

Jurnal Pemberdayaan Masyarakat *Media Pemikiran dan Dakwah Pembangunan*

ISSN: (Print) (Online) Journal homepage:
<https://ejournal.uin-suka.ac.id/dakwah/JPMI/index>

Pesantren Responses to Climate Change: Digital Eco-Literacy and Da'wah Communication among for Gen-Z in Lombok

Athik Hidayatul Ummah, Zaenudin Amrulloh, & Muhamad Aldi

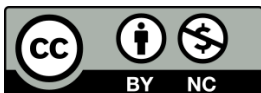
To cite this article: Athik Hidayatul Ummah, Zaenudin Amrulloh, & Muhamad Aldi (2026): Pesantren Responses to Climate Change: Digital Eco-Literacy and Da'wah Communication among for Gen-Z in Lombok, Jurnal Pemberdayaan Masyarakat: Media Pemikiran dan Dakwah Pembangunan, DOI:10.14421/jpm.2026.101-06

Type of paper: Research article

To link to this article: <https://doi.org/10.14421/jpm.2026.101-06>

Follow this and additional works at: <https://ejournal.uin-suka.ac.id/dakwah/JPMI>

Creative Commons License



© 2024 The Authors. This work is licensed under a [Attribution-Non Commercial 4.0 International \(CC BY-NC 4.0\)](https://creativecommons.org/licenses/by-nc/4.0/), which permits non-commercial use, reproduction, and distribution of the work without further permission provided the original work is attributed as specified on the Jurnal Pemberdayaan Masyarakat: Media Pemikiran dan Dakwah Pembangunan.

Pesantren Responses to Climate Change: Digital Eco-Literacy and Da'wah Communication among for Gen-Z in Lombok

Athik Hidayatul Ummah^(a), Zaenudin Amrulloh^(a), & Muhamad Aldi^(b)

^(a) Universitas Islam Negeri Mataram, Indonesia, ^(b)University of Tabuk, Saudi Arabia

Abstract

This study examines how pesantren in Lombok develop climate literacy among Gen Z santri through da'wah communication and participatory digital eco-literacy media. Climate change calls for greater involvement of religious educational institutions in strengthening ecological awareness and climate literacy among younger generations. Using a qualitative case study, the research involved 20 santri as the main participants purposively, with pesantren leaders and *mudabbir* as informants. Data were gathered through interviews, focus group discussions, observation, documentation, and an evaluation questionnaire. Qualitative data were analyzed thematically, while questionnaire responses were analyzed descriptively. The results indicate that greening, waste management, environmental cleanliness, and agriculture were already practiced in pesantren, but santri's understanding of climate change, particularly adaptation and mitigation, remained limited. This gap informed the development of the Environmentally Friendly Islamic Digital Comic (*Komik Digital Islam Ramah Lingkungan*, KODIR), which integrates climate knowledge, santri's ecological experiences, Islamic values, and visual communication. Through its participatory production, santri were involved in constructing and communicating ecological messages rather than merely receiving information. The study concludes that pesantren-based eco-literacy can develop toward digital eco-literacy by connecting climate knowledge, religious values, and participatory media production, offering a contextual form of ecological da'wah for younger generations.

ARTICLE HISTORY

Received 13 June 2026

Accepted 26 September 2026

KEYWORDS

Pesantren; Climate Change;
Da'wah Communication; Eco-literacy; Gen Z

Introduction

Climate change has become one of the most pressing global challenges, with increasingly tangible impacts on various aspects of human life. Rising global temperatures and changing climate patterns affect not only the physical environment through droughts,

floods, and sea-level rise but also food security, water availability, economic conditions, health, and education (IPCC, 2022; Word-Bank, 2024). This urgency has positioned climate change responses as an important part of the Sustainable Development Goals (SDGs), particularly SDG 13 on Climate Action, while also intersecting with other development goals. Given this complexity, climate change mitigation cannot rely solely on scientific approaches and government policy interventions but requires the involvement of diverse social actors, including religious communities and institutions.

Religion has considerable potential to shape how people understand and respond to environmental problems. Jenkins et al., (2018) argue that climate change cannot be adequately understood solely through scientific, economic, social, and political dimensions, as religion can also influence human values, experiences, and actions toward the environment. In Islam, ecological responsibility is closely related to how humans establish their relationship with nature and exercise their moral responsibility for sustaining life. Religious communities can therefore become strategic actors in translating climate change, which is often perceived as a scientific and global issue, into a moral concern embedded in everyday practices.

In Indonesia, pesantren represent religious institutions with considerable potential to perform this role. Pesantren function not only as institutions of Islamic education but also as social communities with distinctive value systems, religious leadership, and communal ways of life. The presence of kyai (pesantren leader), santri (pesantren student), mosques, residential facilities, and Islamic learning traditions provides a setting in which ecological values can be internalized through education and religious practices. Several studies have demonstrated the capacity of pesantren to integrate Islamic teachings with environmental conservation. Quddus (2020) shows that Nurul Haramain NW Pesantren in Lombok has developed sustainable living practices grounded in the ecological values of the Qur'an and Hadith, with the tuan guru (kyai) playing an important role in environmental conservation leadership. Other research on eco-pesantren has similarly demonstrated the integration of sustainable development values into pesantren education and everyday life (Anabarja & Safril Mubah, 2021).

This potential has become increasingly significant as many santri today belong to a younger generation growing up within a digital ecosystem. Gen Z will not only experience the long-term consequences of climate change but also engages intensively with information through digital media. This condition creates opportunities for pesantren to extend environmental education beyond conventional learning models toward forms of religious communication that are more responsive to the characteristics of digital media and younger audiences. Pesantren can therefore function not only as sites of religious education but also as agents of environmental communication that connect Islamic values, climate change knowledge, and ecological action.

However, this normative and institutional potential does not always correspond with the level of environmental literacy among santri. Husamah et al., (2020), in their study of the environmental literacy of pesantren students, found varying levels of ecological knowledge among santri. The study also identified a gap between the tendency

to express support for pro-environmental actions and participation in actions requiring broader engagement. These findings indicate that a religious educational environment does not automatically produce uniform levels of ecological literacy and action. In other words, a gap remains between the potential of pesantren as agents of ecological transformation and santri's environmental literacy capacity to critically understand and practically respond to ecological problems.

This gap becomes more complex in the context of climate change because the challenge concerns not only the availability of information but also how such information is communicated and interpreted. Within the digital ecosystem, young people encounter extensive flows of information, including inaccurate information about climate change. Religious narratives can also become part of this meaning-making process. Findings from the Center for Digital Society at Universitas Gadjah Mada indicate that some respondents associated the climate crisis with sinful behavior and human disobedience to religious teachings (CfDS, 2024). This suggests that religion is indeed present in the ways people interpret the climate crisis, but such interpretations require forms of literacy capable of critically and contextually connecting environmental knowledge with religious understanding.

Literacy is therefore an important means of strengthening public awareness and capacity to address climate change. For Gen Z, who have grown up with digital media, such literacy needs to move beyond the provision of environmental information toward digital eco-literacy, understood as the use of digital resources and media to develop knowledge, critical awareness, and the capacity to respond to ecological problems. Visual media such as comics have particular potential in this process because they can combine narrative, imagery, and knowledge in forms of communication that are more accessible to younger audiences. Chakravarty (2021) demonstrate how comics can be used to communicate climate change issues, while visual metaphors enable social and cultural knowledge, as well as particular values, to be communicated through more accessible forms of representation.

This study was conducted in the context of pesantren in Lombok, West Nusa Tenggara. Indonesia's disaster risk data indicate that West Nusa Tenggara faces multiple hazards, including drought, water scarcity, floods, extreme waves, and coastal abrasion (BNPB, 2026). This context makes pesantren relevant not only as institutions of religious education but also as part of communities directly exposed to ecological risks. Accordingly, this study aims to analyze the role of pesantren in developing climate literacy among Gen Z santri and to explore the development of digital eco-literacy through da'wah communication as a strategy for strengthening santri awareness and engagement with environmental and climate change issues.

Studies on Islam, pesantren, and environmental issues have developed across several interconnected perspectives. First, eco-pesantren studies have demonstrated how Islamic values are integrated into environmental education and ecological practices, ranging from sustainable lifestyles grounded in the Qur'an and Hadith (Quddus, 2020)

and Islamic environmentalism in pesantren education (Anabarja & Safril Mubah, 2021) to ecopedagogy through environmental conservation practices (Maslani et al., 2023). Environmental education has also been developed through the integration of environmental issues into pesantren curricula to support sustainable development (Lutfauziah et al., 2023). Taken together, these studies demonstrate the capacity of pesantren to connect religious values, education, and ecological practices. However, their primary emphasis remains on environmental education, conservation, and sustainability practices, providing limited explanation of how such ecological practices relate to the more specific development of climate literacy among santri.

Second, studies of digital da'wah communication have shown that the development of digital media has expanded the forms and strategies through which religious messages are communicated, including the use of increasingly diverse communication formats adapted to the characteristics of younger audiences (Ummah, 2023a, 2023b). This body of scholarship is important because it demonstrates that da'wah is no longer confined to conventional forms of religious communication but also involves the production and circulation of messages in digital spaces. Nevertheless, studies of digital da'wah communication have predominantly focused on transformations in media, communication strategies, and the dissemination of religious messages, while its use for communicating ecological concerns, particularly climate change, remains relatively underexplored.

Third, studies of climate change communication have demonstrated the growing use of digital and visual media to translate complex climate issues into forms of communication that are more accessible to audiences. Digital games have been employed as a medium for climate change communication (Foltz et al., 2019), while comics enable climate change experiences and issues to be communicated through the combination of narrative and visual representation (Sou, 2023). The experimental study by Guo et al., (2026) further demonstrates the potential of comics storytelling in climate change mitigation communication, although its effects are influenced by audience characteristics and engagement processes. This body of literature highlights the potential of visual communication to bridge the complexity of climate knowledge and audience experience. However, much of this scholarship has developed outside religious educational contexts and has yet to explain how visual climate communication can be integrated with religious values and da'wah practices.

A synthesis of these three strands of scholarship reveals a more specific research gap. Eco-pesantren studies have explained the relationship between Islamic values, education, and ecological practices; digital da'wah communication studies have demonstrated the transformation of religious communication within digital media environments; and climate change communication studies have highlighted the potential of digital and visual media for communicating climate issues. However, the intersection of these three areas remains insufficiently explored, particularly regarding how pesantren connect climate change knowledge with Islamic values through digital da'wah communication while simultaneously involving Gen Z santri in the production of

ecological messages. This intersection constitutes the specific research gap addressed in this study.

Building on this gap, this study proposes a digital eco-literacy approach grounded in da'wah communication through the development of digital visual media that integrate climate change knowledge with Islamic values. Unlike previous eco-pesantren studies that have predominantly emphasized environmental education and ecological practices, this study positions pesantren as agents of ecological communication that translate religious values and climate change knowledge into digital messages relevant to Gen Z santri. The novelty of this study lies in integrating da'wah communication, digital eco-literacy, and participatory visual media production through the Environmentally Friendly Islamic Digital Comic (*Komik Digital Islam Ramah Lingkungan*, KODIR) as a medium for climate literacy within pesantren.

This study was conducted in the context of pesantren in Lombok, West Nusa Tenggara. Indonesia's disaster risk data indicate that West Nusa Tenggara faces multiple hazards, including drought, water scarcity, floods, extreme waves, and coastal abrasion (BNPB, 2026). This context makes pesantren relevant not only as institutions of religious education but also as part of communities directly exposed to ecological risks. Accordingly, this study aims to analyze the role of pesantren in developing climate literacy among Gen Z santri and to explore the development of digital eco-literacy through da'wah communication as a strategy for strengthening santri awareness and engagement with environmental and climate change issues.

Literature Review

The literature on pesantren and environmental sustainability shows that Islamic boarding schools can embed ecological responsibility in religious teaching, institutional routines, and community practices. Quddus (2020) describes how Qur'anic and Hadith-based values, together with religious leadership, support sustainable living in a Lombok pesantren. Anabarja and Safril Mubah (2021) similarly frame eco-pesantren as an institutional model that connects Islamic environmentalism with sustainable development, while Maslani et al. (2023) emphasize ecopedagogy expressed through conservation practices. Curriculum-oriented research further demonstrates that environmental issues can be incorporated into pesantren education to strengthen sustainability-oriented learning (Lutfauziah et al., 2023).

This study was conducted in the context of pesantren in Lombok, West Nusa Tenggara. Indonesia's disaster risk data indicate that West Nusa Tenggara faces multiple hazards, including drought, water scarcity, floods, extreme waves, and coastal abrasion (BNPB, 2026). This context makes pesantren relevant not only as institutions of religious education but also as part of communities directly exposed to ecological risks. Accordingly, this study aims to analyze the role of pesantren in developing climate literacy among Gen Z santri and to explore the development of digital eco-literacy

through da'wah communication as a strategy for strengthening santri awareness and engagement with environmental and climate change issues.

These studies establish pesantren as potentially important sites of ecological education, but environmental practice should not be treated as equivalent to climate literacy. Environmental literacy encompasses knowledge, attitudes, competencies, and participation concerning environmental problems; its levels may vary even among students living in institutions that promote pro-environmental values (Husamah et al., 2020). Eco-literacy likewise involves understanding relationships between human and natural systems and developing capacities for sustainable living (Goleman et al., 2012). Climate literacy is more specific because it requires an understanding of climatic processes, causes and impacts, adaptation and mitigation, as well as the capacity to evaluate information and make informed responses. Consequently, greening, cleanliness, waste management, or agricultural activities may provide an experiential foundation for climate literacy, but they require explicit conceptual connections to the climate crisis.

Digital media have expanded da'wah beyond sermons and face-to-face religious instruction into networked, visual, and participatory communication. Ummah (2023a, 2023b) shows that digital da'wah involves adapting message formats and communication strategies to the media habits of younger audiences. For Gen Z santri, this adaptation concerns not only the choice of platform but also narrative form, visual language, interactivity, and opportunities to participate in producing messages. The audience is therefore not simply a recipient of religious instruction but can become an interpreter and creator of da'wah content.

Climate change is not interpreted only through scientific evidence or policy discourse; it is also mediated by values, identities, worldviews, and moral traditions. Jenkins et al. (2018) argue that religion influences how communities understand climate risks and formulate responses. Salter and Wilkinson (2024), in their review of 50 faith actors, further show that faith-based organizations commonly frame climate change as a moral, religious, socio-political, and justice issue while remaining connected to its practical effects. Within Islam, concepts concerning stewardship, responsibility, balance, and the human relationship with creation can provide an ethical vocabulary for environmental action. In pesantren, this vocabulary is especially significant because religious authority, communal learning, and everyday practice are closely interconnected. Religious communication can therefore translate climate knowledge into locally meaningful moral narratives rather than merely adding scriptural references to scientific information.

This interpretive role also creates a need for critical literacy. Religious explanations may make climate issues more culturally intelligible, but they can oversimplify causal processes when detached from scientific knowledge. Recent research likewise cautions against assuming a uniformly positive relationship between religion and climate action: patterns vary by religious exposure, climate outcome, and generation (Major-Smith et al., 2025), while the organizational potential of religion may remain only partly realized in practice (Hearn et al., 2024). The CfDS (2024) findings concerning

religious interpretations of the climate crisis therefore illustrate the importance of communication that connects faith-based meaning with accurate climate information. From this perspective, ecological da'wah should operate as knowledge translation: it should retain the scientific dimensions of climate change while articulating their ethical significance in language and experiences familiar to religious audiences.

Research on climate communication reinforces the importance of audience-sensitive framing. Ariestya et al. (2022) demonstrate that frames and terminology in online news can influence Gen Z climate awareness. This suggests that communicating climate change to young people requires more than simplifying technical information. Messages must connect scientific concepts with recognizable experiences, culturally meaningful values, and forms of expression suited to the audience. In pesantren, digital da'wah offers a framework for joining these dimensions by linking climate knowledge to Islamic ethics and the everyday ecological experiences of santri.

Visual and interactive media can make climate change more accessible by connecting abstract processes with stories, places, and lived experiences. Foltz et al. (2019) show how digital games can communicate climate issues, while Sou (2023) demonstrates that comics combine narrative and imagery to represent lived experiences beyond apocalyptic framings. Ray et al. (2022) provide further evidence that climate-oriented comics and data narratives can direct readers toward ideas of collective responsibility and future-oriented thinking. Comparative research also indicates that comics can support climate learning when narrative and visual information are designed coherently (Keller et al., 2023). Chakravarty (2021) further illustrates the communicative potential of comics for environmental themes. Experimental evidence indicates that comics storytelling can support engagement with climate mitigation messages, although its effects vary according to audience characteristics and engagement processes (Guo et al., 2026). These findings support the use of comics as a climate-communication medium but do not establish that exposure alone produces durable behavioral change.

The concept of digital eco-literacy provides a broader framework for understanding this media use. Building on eco-literacy, digital eco-literacy connects ecological knowledge and critical awareness with the capacities needed to access, assess, create, and communicate environmental meanings in digital environments (Zuhriyah, 2023). Research on youth-produced climate media shows that young people can use videos, digital images, social media, digital stories, and online writing to articulate climate concerns and participate in public communication (Beach & Smith, 2023). A recent systematic review likewise concludes that youth storytelling can connect scientific knowledge with lived experience, identity, emotional processing, cultural knowledge, and civic engagement, while noting continuing gaps in longitudinal research and equitable digital design (Sezen-Barrie & Huang, 2026). A participatory approach is therefore especially relevant because it moves learners from consuming environmental information to selecting issues, evaluating claims, contextualizing knowledge, and producing messages.

In a pesantren setting, this process may also include interpreting ecological concerns through Islamic sources and communicating them in forms meaningful to peers.

Taken together, the literature identifies four complementary foundations: pesantren can institutionalize ecological values and practices; religion can provide moral and interpretive frames for climate action; digital da‘wah can adapt religious communication to younger audiences; and visual media can translate complex climate issues through narrative and participation. Yet these strands have largely developed separately. Eco-pesantren research has paid limited attention to the distinction between environmental practice and climate literacy. Digital da‘wah scholarship has focused primarily on changing media and communication strategies rather than ecological issues. Climate-communication studies, meanwhile, have rarely examined participatory visual production within Islamic educational institutions.

This study addresses that intersection by examining how pesantren can connect existing ecological practices with climate knowledge and by exploring KODIR as a participatory form of digital eco-literacy and da‘wah communication. Its analytical contribution lies in treating santri not merely as recipients of environmental education but as producers of ecological messages who interpret local experiences, climate knowledge, Islamic values, and audience needs through digital visual media.

Methods

This study employed a qualitative approach using a case study design to analyze the role of pesantren in developing climate literacy and digital eco-literacy through da‘wah communication. The development of KODIR was situated within the participatory process of the cases under study, enabling the researchers to examine how climate change knowledge, santri’s ecological experiences, Islamic values, and digital communication skills were brought together in the production of da‘wah media. The study was conducted from September 2024 to January 2025 in Lombok, West Nusa Tenggara. The initial stage involved mapping several pesantren that had demonstrated engagement with environmental issues. Based on this mapping, Al-Islahuddiny Pesantren in West Lombok and Sirajul Huda Pesantren in Central Lombok were selected as the main cases because both had developed environmental practices but had not yet established specific programs or da‘wah media that connected environmental and climate change issues with Islamic perspectives.

Data were collected through interviews, Focus Group Discussions (FGDs), observation, documentation, and an evaluation questionnaire. The FGDs and interviews were used to explore santri’s understanding of climate change, their ecological experiences, and their needs for literacy media. The subsequent research process involved santri in participatory activities designed to strengthen climate literacy and to develop KODIR. The main informants and participants were 20 santri purposively selected in coordination with pesantren leaders and *mudabbir* or senior *ustadz*. The participants were Madrasah Aliyah-level *tahfiz* santri who were engaged in Qur’an memorization and the study of *kitab kuning* (yellow book or classical Islamic book). Several participants also had

skills in story writing, drawing, and graphic design. Additional data were obtained from leaders and *mudabbir* at each pesantren to provide further information on educational, religious, and environmental practices within the pesantren.

Qualitative data were analyzed thematically through data organization, coding, category development, and the identification of themes related to climate literacy, Islamic values, digital da‘wah communication, and the development of KODIR. Questionnaire data were analyzed descriptively using frequencies and percentages as supplementary evidence to the qualitative findings. The trustworthiness of the findings was strengthened through source and method triangulation by comparing data obtained from santri, pesantren leaders, and pesantren administrators across interviews, FGDs, observations, documentation, and evaluation data.

Results

Pesantren and Environmental Practices: Research Context

The initial mapping indicated that several pesantren in Lombok had developed various environmental practices that have received limited scholarly attention. Two pesantren particularly relevant to the focus of this study were Al-Islahuddiny Pesantren in West Lombok and Sirajul Huda Pesantren in Central Lombok. Despite their different characteristics, both pesantren had integrated environmental concerns into their educational activities and everyday life.

Al-Islahuddiny Pesantren developed environmental awareness through greening initiatives, environmental cleanliness, and religious education. Its greening movement, carrying the tagline “Hijau Pesantrenku, Lestari Desaku” (“Green My Pesantren, Sustainable My Village”), was implemented not only within the pesantren but also through Al-Islahuddiny’s network and branches across Lombok and Sumbawa. In everyday life, santri were encouraged to dispose of and sort waste properly and maintain environmental cleanliness, while environmental values also intersected with the study of *kitab kuning*, particularly in discussions of *thaharah* (the book of purification).

For pesantren administrators, these practices also formed part of moral and religious education. Ustaz Sulhan Muchlis explained:

“The best way to teach the younger generation to care for nature is through pesantren, which play an important role in religious and moral education. The greening movement initiated by the pesantren is not merely about planting trees. It is also about cultivating values of goodness and responsibility. The greening movement is a long-term investment in the future of the Earth.”

Meanwhile, Sirajul Huda Pesantren developed the concept of eco-pesantren through agribusiness education adapted to the agricultural characteristics of the surrounding community. Environmental education was integrated into the curriculum and extracurricular activities, including through its Islamic Vocational High School program in Food Crop and Horticultural Agribusiness, *diniyah* education, greening activities, nature conservation, and sustainable agricultural practices. Santri

were trained to cultivate and manage the pesantren's agricultural land, with the produce used to meet the needs of santri and partly marketed.

These practices illustrate how religious education and agricultural skills intersect with environmental management in everyday pesantren life. Agricultural activities were not positioned merely as economic practices but were also connected to educational and religious values. Interviews with pesantren leaders indicated that environmental awareness and the responsible use of natural resources had long been introduced through *majelis taklim*. Tuan Guru Abdullah explained:

"The idea of food security practiced in this pesantren has existed for a long time and began through the majelis taklim as a way to teach both santri and congregants how God encourages humans to utilize the vast natural resources that have been provided."

This statement indicates that ecological practices at Sirajul Huda were developed not only through agribusiness education but also grounded in religious teachings delivered through *majelis taklim*. The use of natural resources was situated within the framework of human responsibility as *khalifah* (a leader), making agricultural activities a point of convergence between religious education, agribusiness skills, and environmental awareness. Overall, the two pesantren demonstrate different patterns of ecological practice. Al-Islahuddiny Pesantren emphasizes greening, environmental cleanliness, and religious education, whereas Sirajul Huda Pesantren places greater emphasis on integrating environmental concerns into education and agricultural practices.

The Gap between Environmental Practices and Climate Literacy

The FGD findings revealed a distinction between santri's understanding of environmental issues and their understanding of climate change. Santri were familiar with environmental issues and had participated in practices such as greening, maintaining environmental cleanliness, and waste management. However, when the discussion focused specifically on climate change, most santri did not yet have a comprehensive understanding of the concept, including climate change adaptation and mitigation. During the FGD, climate change was even perceived as a relatively new issue for many of them. Thus, although environmental management practices were already embedded in pesantren life, santri had not yet connected these practices with broader knowledge of climate change.

The initial interviews reinforced the FGD findings by identifying challenges at both the institutional and communication levels. Interviews with pesantren leaders indicated that the pesantren had not previously organized activities specifically addressing climate change. Religious learning had intersected with environmental concerns, for example through discussions of *thaharah* in *kitab kuning*, but these discussions had not been specifically directed toward climate change. The pesantren also lacked da'wah media specifically designed to educate santri about environmental and climate change issues from an Islamic perspective. These conditions suggest that limitations in climate literacy were related not only to santri's knowledge but also to the absence of dedicated learning spaces and communication media addressing these issues.

The FGDs subsequently identified two interrelated needs. First, santri needed stronger knowledge of climate change, particularly its causes, impacts, adaptation, and mitigation. Second, there was a need for educational and creative literacy media capable of connecting climate change with religion while also corresponding to the communication characteristics of Gen Z. The FGDs also identified climate change misinformation as an additional concern, further reinforcing the need for literacy media that could provide contextualized and accessible information.

Based on these findings, the identified gap concerned not only knowledge but also communication. Ecological practices were already present in pesantren life, but they had not yet been fully connected to an understanding of climate change. At the same time, there was no specific medium connecting climate change knowledge with religious perspectives and the communication characteristics of Gen Z santri. These findings subsequently provided the basis for developing digital eco-literacy through da'wah communication media.

From Climate Literacy to Digital Da'wah Communication

Based on the needs identified through the FGDs and interviews, 20 santri participated in activities designed to strengthen environmental and climate literacy, followed by the development of digital da'wah media. This process was supported by networks with expertise in environmental issues, literacy, and digital da'wah, and was designed to connect climate change knowledge with santri's experiences and the context of pesantren life.

Participant mapping showed that several santri already possessed skills in story writing, drawing, and graphic design. These existing capacities were subsequently utilized to develop climate change communication through media suited to the characteristics of Gen Z. Santri therefore not only received knowledge about climate change but were also involved in translating this knowledge into da'wah messages that could be communicated to their peers.

This process broadened santri's understanding of da'wah and the forms of media through which religious messages could be communicated. In a reflection following the activities, one of the santri, M. Irsyadul Ibad, stated:

"I learned something new from participating in these activities. I met the facilitators, and the experience opened my mind to the fact that da'wah content can take many different forms, including comics."

This statement indicates that da'wah began to be understood as extending beyond conventional forms of communication and as something that could also be developed through digital visual media. At the same time, reflections from other participants indicated that the literacy activities provided them with new knowledge about climate change. Ahmad Abiva N. stated:

“I learned about climate change, what causes it, and what its impacts are. It turns out that it has serious consequences for us as young people. After this, I intend to pay more attention to the issue.”

These reflections reveal two developments occurring simultaneously: climate change began to be understood as an issue relevant to the lives of younger generations, while digital media began to be recognized as a means of communicating da‘wah messages about the issue. The intersection of climate literacy, santri’s creative skills, and da‘wah communication subsequently provided the foundation for the development of KODIR.

KODIR as a Da‘wah-Based Digital Eco-Literacy

The strengthening of climate literacy was subsequently translated into the development of KODIR. The 20 santri were divided into two groups of ten participants each. The comics were developed through a participatory process consisting of several stages, from generating ideas and developing storylines and storyboards to sketching and producing the digital comics. This process enabled santri to transform the knowledge acquired during the literacy activities into visual messages about environmental issues and climate change.

During the idea-generation stage, santri drew on environmental experiences and issues close to their everyday lives as sources for their stories. They identified the intended audience, genre, and moral message before developing the storyline. This process was not always straightforward. L. Yuda Rinaldi, one of the participants, explained:

“Of all the activities, the most difficult part for me was finding an idea or da‘wah content about climate change. But with the patient guidance of the facilitators, I felt that I was being guided through the process.”

This experience demonstrates that producing KODIR involved more than acquiring the technical skills required to create comics. Santri also engaged in the process of determining how climate change issues could be constructed as da‘wah messages relevant to younger audiences.

The religious dimension was integrated as santri developed their storyboards by identifying Qur’anic verses and Hadith relevant to their stories. Once the storyboards had been completed, four santri with visual communication design skills participated in creating the digital sketches, while the other participants provided input throughout the production process. Islamic values were therefore not positioned as messages separate from ecological issues but were incorporated into the narratives constructed by the santri.

The process resulted in two digital comics, *“Pulau Kecil yang Terancam Tenggelam”* (A Small Island Threatened by Submersion) and *“Karena Sampah Jadi Masalah”* (When Waste Becomes a Problem). The first comic tells the story of Lia, a santri living on a small island who observes changes in the coastal area where she lives. The story communicates changing coastal conditions, including coastal erosion and sea-level rise, as experienced

in Lombok, and connects these issues with Qur'anic references at the end of the comic. The second comic is set within pesantren life and addresses waste accumulation that obstructs drainage systems and is associated with flooding.

The development of these two comics demonstrates a pattern of message translation within KODIR: environmental issues grounded in santri's experiences were transformed into narratives, connected with ecological knowledge and Islamic values, and subsequently constructed as digital visual messages for younger audiences. Through this process, KODIR functioned not merely as the final product of the activities but as a medium of digital eco-literacy that brought together ecological experiences, climate change knowledge, visual communication, and da'wah.

The evaluation of the 20 participants showed positive responses to the climate literacy activities and the development of digital comics. Twelve santri reported that they strongly agreed and eight agreed that the digital comic development materials were relevant to their needs. In addition, 13 santri strongly agreed and seven agreed that the materials were presented clearly and were easy to understand. No participants selected disagree or strongly disagree for either indicator.

Responses directly related to climate literacy and da'wah communication showed a similar pattern. Fifteen santri (75%) strongly agreed and five (25%) agreed that the activities increased their awareness of environmental and climate change issues. The same proportions were found for the statement that the activities increased participants' understanding of digital comics as a medium of da'wah. Thus, all participants provided positive assessments of both aspects.

The qualitative evaluation also indicated that the activities represented a new experience for some participants. Thoriq Abdul Ghoni, one of the santri, reflected:

“This was the first activity of this kind that I had participated in during my time as a santri here. I was very happy to be involved, and I hope that what I learned will be useful.”

This reflection complements the questionnaire findings by illustrating participants' experiences during the digital eco-literacy process. While the questionnaire indicated positive perceptions of the materials, climate literacy activities, and digital comics as a medium of da'wah, participants' reflections suggest that involvement in this type of activity represented an experience they had not previously encountered within the pesantren environment.

These findings should be interpreted as participants' perceptions following the activities rather than as causal evidence of increased knowledge or behavioral change, as the evaluation did not employ pre-test and post-test measurements. Nevertheless, the consistency between the questionnaire responses and qualitative reflections indicates that participants perceived digital comics as a relevant medium for connecting environmental and climate change issues with da'wah communication among Gen Z santri.

Discussion

From Ecological Practices to Climate Literacy in Pesantren

The findings indicate that ecological awareness in pesantren does not emerge in a vacuum. Practices such as greening, waste management, environmental cleanliness, agriculture, and the teaching of Islamic values concerning human relationships with nature have already become part of pesantren life. This finding is consistent with Quddus (2020), who demonstrates that sustainability practices in pesantren can develop from the ecological values of the Qur'an and Hadith as well as religious leadership. It also reinforces the findings of Anabarja & Safril Mubah (2021) and Maslani et al. (2023) regarding the capacity of pesantren to integrate Islamic values, education, and environmental conservation practices.

However, this study finds that the presence of such ecological practices does not in itself produce adequate climate literacy. The santri in this study were already familiar with greening, environmental cleanliness, and waste management, yet climate change, including the concepts of adaptation and mitigation, remained relatively new knowledge for some participants. This finding is consistent with Husamah et al. (2020), who show that environmental literacy among pesantren students is not uniform and that a distinction exists between a tendency to support pro-environmental actions and engagement in broader forms of action. Thus, the present study demonstrates that ecological practices, environmental literacy, and climate literacy are interrelated but distinct domains.

These findings also provide a more nuanced understanding of eco-literacy. Goleman et al. (2012) conceptualize eco-literacy as the capacity to understand the interconnectedness between humans and natural systems and to develop the capacities necessary to respond to ecological challenges. In the pesantren examined in this study, ecological understanding is shaped not only through knowledge of environmental systems but also through everyday practices, religious education, and moral values governing human relationships with nature. However, the findings indicate that these values and practices still require a conceptual bridge to connect them explicitly with the causes and impacts of climate change as well as adaptation and mitigation.

It is in this respect that the findings extend existing eco-pesantren scholarship. Previous studies have demonstrated how Islamic values can be integrated into pesantren education and ecological practices. However, these studies have largely explained how environmental concerns are institutionalized through religious values, education, curricula, and ecological practices, while the relationship between these practices and santri's climate literacy has received less attention. The present study identifies a further issue, the existence of pro-environmental practices is insufficient when santri lack a literacy framework that enables them to understand these practices within the broader context of the climate crisis. Strengthening the role of pesantren in climate change mitigation therefore requires stronger connections among religious values, existing ecological practices, and climate change knowledge.

Da'wah Communication for Climate Change Literacy

The gap between ecological practices and climate literacy indicates that the challenge facing pesantren is not merely a lack of information but also a matter of communication. Climate change is a complex scientific issue, while Gen Z santri require forms of communication that can connect such knowledge with their experiences, religious values, and everyday lives. In this context, da'wah communication can function as a process of knowledge translation, transforming climate change from relatively abstract scientific knowledge into messages with moral and religious relevance.

This finding reinforces the view that religion can shape how people understand and respond to climate change. Jenkins et al. (2018) explain that religion interacts with human values, identities, experiences, and actions in responding to climate change. In the pesantren context, this relationship is evident when ecological knowledge is communicated not separately from religion but in connection with the Qur'an, Hadith, values of responsibility toward nature, and santri's everyday practices. Religion thus functions not merely as a source of normative legitimacy for environmental stewardship but also as a communication framework through which climate change knowledge can be interpreted within the religious lifeworld of santri.

The findings also extend the understanding of da'wah communication in the context of ecological issues. Previous studies have shown that the development of digital media has transformed da'wah strategies through the use of increasingly diverse formats and media adapted to the characteristics of younger audiences (Ummah, 2023a, 2023b). In this study, da'wah was not limited to the verbal transmission of religious teachings through sermons or religious gatherings but involved issue selection, narrative construction, the integration of Islamic references, and the use of digital visual media. Participants' reflections that da'wah could be communicated through comics indicate an expansion of religious communication from conventional modes of delivery toward the production of multimodal messages oriented to audience characteristics.

The audience dimension is particularly important because climate change communication requires not only accurate information but also communicative relevance. Ariestya et al., (2022) show that the ways in which climate change is framed in online media can influence Gen Z's awareness of climate change. In this study, such communicative relevance was evident when santri considered the intended audience, genre, everyday experiences, moral messages, and visual forms in developing KODIR. Ecological da'wah communication, as demonstrated in this study, can therefore be understood as a process that brings together climate knowledge, Islamic values, the lived context of santri, audience characteristics, and media choices. This distinguishes it from environmental education oriented primarily toward knowledge transfer.

The development of KODIR demonstrates that ecological literacy in digital environments extends beyond the ability to understand environmental issues. Santri participated in selecting issues, developing storylines and storyboards, identifying relevant Qur'anic verses and Hadith, and translating these ideas into digital visual messages. In

this sense, digital eco-literacy moves from understanding ecological issues toward the capacity to interpret, contextualize, produce, and communicate ecological knowledge through digital media.

This finding extends the concept of eco-literacy, which emphasizes understanding ecological principles and developing the capacities required for sustainable ways of living (Goleman et al., 2012). The development of digital technologies further creates opportunities for digital eco-literacy, connecting ecological learning with the use of technology and digital environments (Zuhriyah, 2023). In the context of Gen Z santri, the findings demonstrate that digital eco-literacy involves not only using digital technologies to access environmental knowledge but also developing the capacity to interpret and communicate that knowledge through digital media.

The use of comics also highlights the importance of multimodal communication in the digital eco-literacy process. This finding is consistent with Sou (2023), who demonstrates that comics, as a multimodal medium, can communicate lived experiences of climate change through the combination of narrative and visual representation. The experimental study by Guo et al. (2026) likewise demonstrates the potential of comics storytelling to foster audience engagement with climate change mitigation. However, unlike Guo et al. (2026), the present study does not examine the effects of comics on mitigation intentions or behavior. The contribution of KODIR lies instead in its participatory production process, through which santri connect climate change knowledge with local experiences, religious references, and digital visual communication.

The production of KODIR positioned santri not merely as recipients of literacy activities but also as participants in the production of ecological knowledge and messages. This is significant because digital literacy concerns not only the ability to consume information but also the capacity to produce and communicate meaning. In this study, such participation was evident when santri's ecological experiences became sources for narratives that were subsequently connected with climate change knowledge and Islamic values. Through this creative process, these elements were constructed into digital visual messages intended for their peers. Thus, digital eco-literacy in the pesantren context operates through a process that connects ecological experiences, climate change knowledge, religious interpretation, and the production of messages through digital media.

These findings constitute the principal contribution of this study to scholarship on pesantren and eco-literacy. While previous eco-pesantren research has primarily demonstrated how pesantren integrate Islamic values with environmental education and ecological practices, this study shows that pesantren can also function as spaces for the production of digital ecological communication. The contribution does not lie in claiming that digital comics automatically transform santri's ecological behavior. Rather, the findings demonstrate that integrating climate literacy, da'wah communication, and digital media production provides a mechanism through which Gen Z santri can understand and articulate ecological issues using religious and media forms that are relevant to their generation.

Conclusion

This study finds that pesantren have important potential in developing climate literacy through the integration of ecological practices, Islamic values, and digital da‘wah communication. Although practices such as greening, waste management, environmental cleanliness, and agriculture have developed within pesantren life, these practices do not automatically result in adequate climate literacy. The development of KODIR shows how climate change knowledge can be connected with santri’s ecological experiences, Islamic values, and digital visual communication. In this process, santri are not only recipients of information but are also involved in constructing and communicating ecological messages through media that are relevant to the characteristics of Gen Z.

Theoretically, this study extends the discussion of eco-literacy by showing that ecological practices, environmental literacy, and climate literacy are interrelated but not identical domains. In the pesantren context, eco-literacy can also be developed through da‘wah communication and digital media production, which enable ecological knowledge to be interpreted and communicated within a framework of religious values. Practically, the findings point to the importance of pesantren administrators, government institutions, and environmental organizations in developing climate literacy programs that do not stop at environmentally friendly practices but also integrate climate change knowledge, religious values, and communication media relevant to younger generations.

This study is limited to participants’ responses after the activities and did not employ pre-test and post-test measurements. Therefore, the findings are not intended to demonstrate the effectiveness of KODIR in changing santri’s knowledge, attitudes, or ecological behavior. Future research could examine the effectiveness of such digital da‘wah media through a more systematic evaluation design, involve a broader range of participants, and measure changes in knowledge, attitudes, and behavior related to climate change

Acknowledgement

The authors would like to thank Al-Islahuddiny Pesantren in West Lombok and Sirajul Huda Pesantren in Central Lombok for their support and involvement in this research. Appreciation is also extended to the Islamic Communication and Broadcasting Study Program and the Islamic Community Development Study Program at UIN Mataram, as well as Sekolah Literasi Rinjani and UAC Creative Studio, for their contributions to the implementation of the research activities.

Author’s declaration

The authors declare that this article has been approved for submission to *Jurnal Pemberdayaan Masyarakat: Media Pemikiran dan Dakwah Pembangunan*. All data sources used in this article are accurate and have been appropriately reported.

Authors' contributions and responsibilities.

Both authors, Athik Hidayatul Ummah (Author 1) and Zaenudin Amrulloh (Author 2), collaboratively conducted the research-based community engagement activities. Both authors contributed to data collection, data analysis, and the preparation of the manuscript.

Funding

This article is based on a research-based community engagement project funded by the Ministry of Religious Affairs of the Republic of Indonesia through the Litapdimas Research and Community Engagement Program in 2024.

Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

Additional information

No additional information related to this research.

References

- Anabarja, S., & Safril Mubah, A. (2021). The Islamic Environmentalism in Eco-Pesantren Initiatives: Integrating the Sustainable Development Values in Islamic Boarding School. *Journal of International Studies on Energy Affairs*, 2(1), 75–90. <https://doi.org/10.51413/jisea.Vol2.Iss1.2021.75-90>
- Ariestya, A., Paramitha, G., & Elmada, M. A. G. (2022). Climate change awareness of gen z: The influence of frame and jargon on online news. *Jurnal Studi Komunikasi (Indonesian Journal of Communications Studies)*, 6(3), 753–770. <https://doi.org/10.25139/jsk.v6i3.5287>
- Beach, R., & Smith, B. E. (2023). Youth production of digital media to address the climate crisis. *Climate Literacy in Education*, 1(2). <https://doi.org/10.24926/cle.v1i2.5349>
- BNPB. (2026). *Indeks Risiko Bencana Indonesia 2025 Vol 4 No.4*. Badan Nasional Penanggulangan Bencana. <https://inarisk.bnpb.go.id/IRBI-2025/files/basic-html/page1.html>
- CfDS. (2024). *Menangkal Misinformasi Krisis Iklim di Indonesia* (pp. 1–6) [Kertas Kebijakan]. Center for Digital Society.
- Chakravarty, R. (2021). *Green Humour for a Greying Planet*. Penguin Books, an imprint of Penguin Random House.
- Foltz, A., Williams, C., Gerson, S. A., Reynolds, D. J., Pogoda, S., Begum, T., & Walton, S. P. (2019). Game Developers' Approaches to Communicating Climate Change. *Frontiers in Communication*, 4, 28. <https://doi.org/10.3389/fcomm.2019.00028>
- Goleman, D., Bennett, L., & Barlow, Z. (2012). *Ecoliterate: How Educators Are Cultivating Emotional, Social, and Ecological Intelligence* (1. ed). Jossey-Bass.

- Guo, Y., Wei, D., Xu, S., & Wang, Y. (2026). Employing Comics Storytelling to Promote Climate Change Mitigation: An Experimental Study Grounded on the Situational Theory of Public. *Risk Analysis*, 46(4), e70234. <https://doi.org/10.1111/risa.70234>
- Hearn, A. X., Huber, F., Koehrsen, J., & Buzzi, A.-L. (2024). The perceived potential of religion in mitigating climate change and how this is being realized in Germany and Switzerland. *Journal of Environmental Studies and Sciences*, 14(2), 342–357. <https://doi.org/10.1007/s13412-023-00884-z>
- Husamah, H., Miharja, F. J., & Hidayati, D. A. (2020). Environmental Literacy of Islamic Boarding School Students: Study in MA Bilingual-Sidoarjo, East Java, Indonesia. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 8(1), 57. <https://doi.org/10.33394/j-ps.v8i1.2766>
- IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/wg2/>
- Jenkins, W., Berry, E., & Kreider, L. B. (2018). Religion and Climate Change. *Annual Review of Environment and Resources*, 43(1), 85–108. <https://doi.org/10.1146/annurev-environ-102017-025855>
- Keller, L., Stötter, J., Oberrauch, A., Kuthe, A., Körfggen, A., & Hüfner, K. (2023). Learning about climate change with comics and text: A comparative study. *Sustainability Science*. <https://doi.org/10.1007/s11625-023-01398-x>
- Lutfauziah, A., Al-Muhdhar, M. H. I., Suhadi, & Rohman, F. (2023). Curriculum Development for Environmental Education at an Islamic Boarding School. *Journal of Turkish Science Education*, 20(3), 490–503. <https://doi.org/10.36681/tused.2023.028>
- Major-Smith, D., Halstead, I., Golding, J., & Major-Smith, K. (2025). Associations between religiosity and climate change beliefs and behaviours in the Avon Longitudinal Study of Parents and Children (ALSPAC). *PLOS Climate*, 4(4), e0000469. <https://doi.org/10.1371/journal.pclm.0000469>
- Maslani, M., Hidayat, W., Qadir, A., & Muhyidin, A. (2023). Ecopedagogy in Action: An Ethnographic Exploration of Environmental Preservation Strategies in Pesantren. *Jurnal Pendidikan Islam*, 9(2), 211–222. <https://doi.org/10.15575/jpi.v9i2.29347>
- Quddus, A. (2020). Eco-Pesantren As the Panacea for Global Climate Change: Lessons From Nurul Haramain NW Lombok Islamic Boarding School Indonesia. *Jurnal Tatsqif*, 18(2), 111–121. <https://doi.org/10.20414/jtq.v18i2.2741>
- Ray, L. C., Song, Z., Sun, Y., & Yang, C. (2022). Designing narratives and data visuals in comic form for social influence in climate action. *Frontiers in Psychology*, 13, 893181. <https://doi.org/10.3389/fpsyg.2022.893181>
- Salter, J., & Wilkinson, O. (2024). Faith framing climate: A review of faith actors' definitions and usage of climate change. *Climate and Development*, 16(2), 97–108. <https://doi.org/10.1080/17565529.2023.2183073>

- Sezen-Barrie, A., & Huang, Y. (2026). Youth storytelling in climate change education: A systematic review of research designs, pedagogical scaffolding, and digital tools (2014–2024). *Environmental Education Research*. Advance online publication. <https://doi.org/10.1080/13504622.2026.2671436>
- Sou, G. (2023). Communicating Climate Change With Comics: Life Beyond Apocalyptic Imaginaries. *Geographical Research*, 61(3), 320–332. <https://doi.org/10.1111/1745-5871.12592>
- Ummah, A. H. (2023a). Communication Performance of Millennial Students: Digital Da'wah Strategies of Islamic Boarding Schools In Lombok West Nusa Tenggara. *TASAMUH*, 21(1), 71–100. <https://doi.org/10.20414/tasamuh.v21i1.5775>
- Ummah, A. H. (2023b). *Komunikasi Dakwah Era New Media: Tilikan Teoritis dan Praktis*. (Original work published Sanabil)
- Word-Bank. (2024, September 4). *Choosing Our Future: Education For Climate Action*. <https://www.worldbank.org/en/topic/education/publication/education-forclimate-action>
- Zuhriyah, A. (2023). The Role of Smart Education (SE) in supporting Digital Eco-Literacy (DEL). *Indonesian Journal of Geography*, 55(1), 167. <https://doi.org/10.22146/ijg.74409>