MEDIASI Jurnal Kajian dan Terapan Media, Bahasa, Komunikasi
Vol. 7 (3), 2026, 205–219

Digital Media-Based Educational Communication for Sustainable Behavior and Environmental Literacy in Early Childhood Education

Eka Anisa Sari[1*], Dhias Cahya Hakika[2], Anissa Yuwantina[3], Resdika Anggesa Dwi Setiawan[1], Angga Pranata[1]

[1] Department of Communication Science, Ahmad Dahlan University, Yogyakarta, Indonesia.
[2] Department of Chemical Engineering, Ahmad Dahlan University, Yogyakarta, Indonesia.
[3] Postgraduate School, Universitas Negeri Semarang, Semarang, Indonesia.

*Corresponding author: eka.sari@comm.uad.ac.id

DOI: https://doi.org/10.46961/mediasi.v7i3.2025

Article Info

Received: 15/03/2026
Revised: 29/05/2026
Accepted: 31/05/2026
Published: 30/09/2026

e-ISSN: 2721-0995
p-ISSN: 2721-9046

Keywords

Educational Communication;
Early Childhood Education;
Environmental Literacy;
Digital Media;
Sustainable Behavior;

ABSTRACT

Environmental literacy and sustainable behavior should be cultivated from early childhood, yet limited research has examined how educational communication mediates the relationship between digital media and children's behavioral development. This study investigates the role of digital media-supported educational communication in fostering environmental literacy and sustainable behavior among young children. A qualitative action research design was employed, comprising four stages: planning, action implementation, observation, and reflection. Data were collected through classroom observations, semi-structured interviews with teachers, and documentation of learning activities, with credibility strengthened through methodological triangulation. The findings show that Canva-based digital learning media enhanced children's engagement, attention, and understanding of environmental concepts. However, digital media alone did not directly foster sustainable behavior. Instead, behavioral change emerged through teachers' educational communication, including persuasive interaction, role modeling, repeated habituation, and continuous reinforcement supported by parental involvement. Teachers functioned as meaning makers who transformed digital content into meaningful learning experiences and encouraged environmentally responsible behavior. This study proposes the Digital Sustainable Communication Ecosystem for Children (DSCEC), a conceptual framework integrating digital media, educational communication, behavioral habituation, and school-parent collaboration to promote sustainable behavior in early childhood education. The findings shift the emphasis from technology-centered learning toward communication-centered digital pedagogy and offer theoretical and practical implications for environmental education and Education for Sustainable Development (ESD).

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

INTRODUCTION

Environmental degradation, including climate change, pollution, and increasing waste production, has become an increasingly serious global concern. This situation requires greater public awareness of the importance of environmental sustainability. Such awareness should be cultivated from an early age through educational processes that instill environmentally responsible values and behaviors. Early Childhood Education (PAUD) is a crucial phase in the development of children's character, attitudes, and habits, which can influence their future behavior. At this stage, children begin to recognize basic values related to social life and their surrounding environment. Therefore, introducing environmental literacy from an early age is essential to help children understand the relationship between humans and the environment and develop a sense of responsibility for environmental preservation (Kaya & Elster, 2019; Kurniawan & Kusuma, 2021).

In educational practice, environmental literacy in early childhood education is often developed through conventional approaches such as storytelling or the use of simple images. These approaches may not optimally capture children's attention, particularly in the digital age, when children are already familiar with various forms of visual media and technology (Rojo-Ramos et al., 2021). The use of digital technology-based learning media therefore offers an alternative for strengthening interactions between teachers and students during the learning process. Visual and multimedia resources can help students understand information more effectively because they engage more than one cognitive processing pathway in working memory (Mayer & Moreno, 1998; Moreno & Mayer, 1999). Digital media can also increase learning motivation and encourage active student participation in learning activities (Pramadita, 2021; Supriani et al., 2024).

Environmental literacy involves not only an understanding of environmental concepts but also the development of attitudes and behaviors that support environmental sustainability. In early childhood, cultivating simple behaviors such as watering plants, maintaining a clean environment, and sorting waste can serve as an initial step toward fostering sustainable behavior. These habits help children understand the importance of environmental conservation and encourage the development of environmentally conscious dispositions from an early age (Putri, 2022). Previous studies have also shown that creative learning media, including storybooks and visual media, can contribute to the development of environmentally conscious character traits in young children (Masykuroh & Wahyuni, 2023). In addition, environmental literacy activities involving storytelling and interactive experiences have been shown to enhance children's understanding of the importance of environmental protection (Siregar et al., 2020).

Teachers also play a crucial role as communicators in the learning process. Educational communication serves not only to convey learning materials but also to build positive relationships with students. Student-centered learning and dialogic interaction can increase children's engagement in learning activities (Nakato et al., 2025). Therefore, using digital media as a means of educational communication can help teachers convey learning messages in ways that are more engaging and accessible to children.

Against this background, innovations in environmental literacy learning are needed to integrate educational communication with digital technology. One possible approach is the use of visual learning media created through digital design platforms such as Canva. The platform enables teachers to develop various forms of educational content, including visual posters, digital picture stories, and simple campaign materials designed to foster environmentally conscious behavior in early childhood (Nunneley et al., 2021).

This study examines the application of digital media-based educational communication in developing sustainable behavior and environmental literacy in early childhood education. It also investigates how digital media can support communicative interactions between teachers and children during environmental literacy learning. The study employed a qualitative approach with an action research design comprising planning, implementation, observation, and reflection. Data were collected through observations of learning activities, interviews with teachers, and documentation of the use of digital media in learning.

Overall, this study seeks to provide a clearer understanding of how educational communication using digital media supports environmental literacy learning in early childhood. It is also expected to contribute to the development of innovative learning media that align with technological advances and support the development of sustainable behavior in children from an early stage of development.

LITERATURE REVIEW

The increasing integration of digital technology into educational settings has transformed the ways in which communication processes are constructed in early childhood learning environments. Within

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

communication and media studies, digital media are no longer viewed merely as instructional tools but also as communicative environments capable of shaping children's cognitive engagement, behavioral orientation, and patterns of social interaction. In the context of environmental education, this transformation is increasingly relevant because educational institutions are expected not only to transmit knowledge but also to cultivate sustainable behavior and environmental awareness from an early age (Turnure, 1975).

Scholars have emphasized that environmental literacy in early childhood education should be understood as a multidimensional construct encompassing knowledge, awareness, attitudes, and environmentally responsible behavior (Kaya & Elster, 2019). This perspective challenges earlier approaches that positioned environmental learning primarily as a process of cognitive acquisition. Contemporary studies argue that environmental literacy must also involve behavioral internalization through habitual practices and meaningful interaction with the surrounding environment (Setyaningsih et al., 2024). Educational communication therefore becomes central because the success of environmental literacy programs depends substantially on how environmental messages are communicated, interpreted, and practiced by children in everyday learning activities.

Within this discussion, theories of multimedia learning provide an important foundation for understanding how digital media influence children's learning experiences. Mayer and Moreno (1998) argue, through the Cognitive Theory of Multimedia Learning, that individuals process information more effectively when verbal and visual elements are integrated. The theory suggests that multimedia communication enhances comprehension because learners use dual cognitive channels to process information. In early childhood education, where children rely strongly on visual stimulation and experiential learning, multimedia-based communication may increase engagement and message retention more effectively than conventional instructional methods.

However, scholarly debate remains regarding the extent to which digital media contribute to meaningful behavioral transformation rather than merely increasing classroom engagement. Several studies demonstrate that interactive digital media can improve children's motivation and participation in learning activities (Supriani et al., 2024). Similarly, visual storytelling and creative learning media have been shown to support children's environmental awareness and social-emotional development (Garaigordobil et al., 2022; Masykuroh & Wahyuni, 2023; Xu et al., 2017). Nevertheless, much of the existing literature focuses predominantly on the technological effectiveness of media in increasing learning interest, while giving comparatively limited attention to how communication processes mediate the formation of sustainable environmental behavior.

This limitation points to an unresolved issue in current scholarship. Existing research often treats digital media as pedagogical instruments rather than as part of a communicative process involving interaction, meaning-making, and behavioral reinforcement. Consequently, the relationship between digital educational communication and the formation of sustainable behavior in early childhood remains theoretically underexplored. Moreover, many previous studies emphasize isolated educational outcomes, such as motivation, creativity, or literacy acquisition, without critically examining how communicative interactions between teachers and children shape environmental values and habitual ecological practices (Pramono et al., 2024).

Another important debate concerns the role of teachers as communicators within digitally mediated learning environments. Learner-centered educational frameworks emphasize that effective educational communication depends not only on media use but also on dialogic interaction and relational engagement between teachers and students (Nakato et al., 2025). This perspective suggests that technology alone is insufficient to produce meaningful learning outcomes. Digital media become effective when integrated with communicative strategies that encourage participation, emotional connection, and reflective interaction. In this regard, educational communication can be understood as a social process through which teachers actively construct environmental meanings with children through both digital and experiential learning activities (Rosyida et al., 2024).

Several studies on ecoliteracy in early childhood education also show that environmental behavior is developed more effectively through repeated practice and contextual experience than through abstract instruction alone (Putri, 2022; Siregar et al., 2020). Activities such as sorting waste, watering plants, and maintaining classroom cleanliness contribute to sustainable habit formation because children learn environmental responsibility through direct experience. Nevertheless, previous research has rarely integrated these experiential practices with digital communication approaches. Consequently, understanding remains

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

limited regarding how digital educational media can function not only as tools for delivering information but also as communicative bridges between symbolic learning and real-world environmental practices.

This study positions itself within these scholarly tensions by conceptualizing digital educational communication as an integrative communication process that combines multimedia interaction, teacher communication practices, and experiential environmental learning. Rather than viewing digital media solely as technological support for instruction, the study conceptualizes digital communication as a mediating process through which environmental values are translated into sustainable behavioral practices among early childhood learners.

The present study therefore advances previous scholarship in three significant ways. First, it extends multimedia learning perspectives into the domain of environmental communication in early childhood education, an area that remains relatively underdeveloped in communication studies. Second, it integrates educational communication theory with sustainable behavior formation by emphasizing the relational role of teachers as communicators in digitally mediated learning environments. Third, it addresses the empirical gap concerning how digital media-supported communication can facilitate the transition from environmental awareness to environmentally responsible behavior among young children.

Based on this theoretical synthesis, the study proposes that digital educational communication contributes to environmental literacy and sustainable behavior when three interconnected dimensions are integrated: (1) interactive multimedia content, (2) communicative and dialogic teacher-child interaction, and (3) experiential environmental practice embedded in everyday learning activities. Through this framework, the study seeks to contribute to the broader discourse on media, communication, and sustainability education by demonstrating how digital communication practices can support the development of ecological awareness in early childhood education contexts.

METHOD

This study employed a qualitative approach with an action research design. The approach was selected because the study aimed to improve learning practices through the application of educational communication supported by digital media in early childhood education. The action research was conducted through several cycles comprising planning, implementation, observation, and reflection. The research cycles were conducted two to three times, following a principle of continuous improvement to achieve a more effective learning model. The study was conducted at Cahya Mentari Kindergarten and focused on integrating environmental literacy into learning activities through interactive digital media.

The research participants consisted of teachers as primary informants and parents as supporting informants. Teachers implemented the learning activities and acted as communicators in conveying educational messages to children. Parents provided additional information about children's behavior in the home environment and supported the cultivation of environmentally conscious behavior. Informants were selected through purposive sampling based on their level of involvement in the early childhood learning process (Laksana et al., 2021).

Data were collected through participant observation, in-depth interviews, and documentation. Observations were conducted to examine the learning process directly, including communication interactions between teachers and children and children's environmental literacy-related behaviors, such as watering plants and sorting waste. In-depth interviews with teachers and parents were used to obtain a more comprehensive understanding of digital media use in learning and changes in children's behavior after receiving educational messages through digital media. Documentation included photographs of learning activities, notes on the learning process, and examples of digital media used in educational activities.

The research instruments included observation guidelines, interview guides, and a child development assessment rubric related to environmental literacy. The rubric was used to help researchers identify changes in children's behavior following the implementation of digital media in learning activities. The study also used the Canva design platform to create educational visual materials, including environmental posters, digital picture stories, and simple campaign content on environmentally friendly behavior. These materials were combined with other forms of digital educational content, such as educational videos relevant to environmental literacy (Sari et al., 2023).

The research procedure consisted of several stages. The first was the pre-research stage, which aimed to identify the context and learning needs through initial interviews with teachers and parents and preliminary

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

observations of children's environmental literacy-related behavior. The second stage involved planning and designing digital media. At this stage, the researchers developed digital educational media containing messages about sustainable behavior, such as waste sorting and maintaining environmental cleanliness. The media were designed to suit the developmental characteristics of young children and to be readily usable by teachers in learning activities (Fadillah et al., 2022).

The third stage involved implementing digital media directly in classroom learning activities. Teachers used digital visual media and educational video content on waste sorting to communicate learning messages to children. This stage aimed to examine how digital media could capture children's attention and help them understand environmental literacy concepts through an enjoyable learning experience.

The fourth stage consisted of observation and reflection. At this stage, the researchers collected data on the effectiveness of digital media use through observations of children's behavior before and after the lesson, interviews with teachers, and reflective discussions about the learning process. The reflections were then used to evaluate the success of the learning activities and identify aspects requiring improvement.

The final stage involved continuous improvement. The researchers refined the digital media and learning model based on the observation and reflection results. This process aimed to generate recommendations for developing more effective digital educational media and learning communication models to support environmental literacy and sustainable behavior in early childhood.

Data were analyzed using the Miles and Huberman interactive analysis model, which comprises three stages: data reduction, data presentation, and conclusion drawing or verification. Data validity was maintained through source triangulation, technical triangulation, and time triangulation, thereby strengthening the reliability of the data.

Ethical Considerations

This study was conducted in accordance with ethical principles for educational research involving human participants. The research activities were carried out with permission from the management of TK Cahya Mentari, the research site. Before the study was implemented, informed consent was obtained from teachers and from the parents of children who participated in the learning activities and observations. Participation was voluntary, and participants were informed about the objectives, procedures, and educational purposes of the study.

The study involved no medical intervention, psychological risk, or sensitive personal data; therefore, formal ethical board approval was not required under the institution's guidelines for classroom-based educational action research. Nevertheless, the researchers ensured that all procedures complied with ethical standards concerning confidentiality, participant protection, and responsible data management.

To protect participant privacy, the identities of all children, teachers, and parents were anonymized in the research documentation and reporting. Data collected through observations, interviews, and documentation were used solely for academic purposes and were stored securely by the researchers. Throughout the study, learning activities were designed to support children's educational development without causing disruption, discomfort, or harm.

RESULTS AND DISCUSSION

Results

The findings show that the use of digital media-based educational communication in early childhood education had a positive impact on environmental literacy and the development of environmentally conscious behavior among children. The learning process used digital media created with Canva and educational videos that presented examples of environmentally friendly behavior, such as sorting waste and maintaining environmental cleanliness.

Initial observations showed that most children already had a basic understanding of the importance of environmental protection. However, this understanding was not yet optimally reflected in their daily behavior. Simple activities such as disposing of waste properly, watering plants, and maintaining classroom cleanliness still required teacher guidance. This condition indicates that strengthening environmental literacy in early childhood should be supported by more engaging learning methods tailored to children's developmental characteristics. Environmental literacy is an important competency that should be introduced from an early age to develop children's environmental awareness and concern for the future (Kaya & Elster, 2019).

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

In this study, digital visual media were created using Canva in the form of environmental education posters, illustrated visual stories, and simple campaign materials promoting environmentally friendly behavior. These media served as tools for educational communication between teachers and children during the learning process. Children were also introduced to educational videos depicting waste-sorting activities, allowing learning messages to be communicated through a combination of visual and audiovisual media.

The study also included teacher training on assertive communication and the use of digital media in the learning process. These activities include the teacher's training process in designing visual learning media and developing more humanistic educational communication strategies for teacher-child interaction. The training was intended to improve teachers' ability to communicate learning messages clearly, communicatively, and interactively to students.

Observations further indicated that digital media increased children's engagement in learning activities. Children appeared more enthusiastic and active when visual media and educational videos were used as supporting tools. Learning activities involving games and visual media have also been shown to support the development of children's creativity and social skills (Garaigordobil et al., 2022; Ijar et al., 2024).

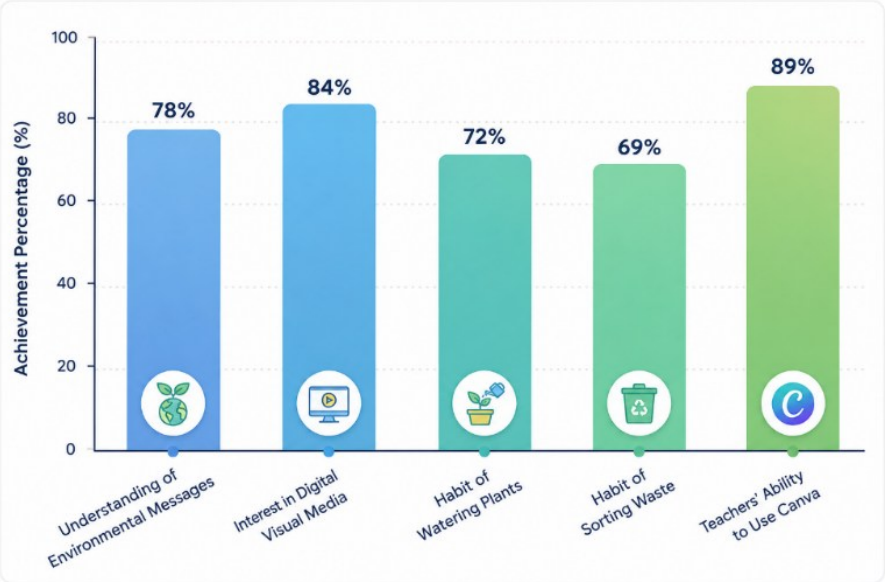


Figure-1. Results of the Implementation of Digital Media-Based Educational Communication in Environmental Literacy Learning in Early Childhood Education

Based on the observation results documented from teacher briefing on assertive communication regarding learning implementation and teacher briefing activities, the researchers obtained an overview of the achievement levels of several indicators in the implementation of digital media-based educational communication in early childhood education. These results are summarized in the bar chart presented in Figure-, which shows the percentage achievement of indicators related to environmental literacy learning.

The observations indicated that children's interest in digital visual media was relatively high, at approximately 85%. This finding suggests that digital visual learning media, such as posters and illustrations designed using Canva, were able to capture children's attention and help them understand learning messages more easily. This result is consistent with the concept of multimedia learning, which explains that combining text and images can improve student understanding by engaging two information-processing pathways in working memory (Mayer & Moreno, 1998).

Children's comprehension of messages related to environmental awareness reached approximately 78%. This finding indicates that the educational communication process conducted by teachers, through a combination of visual media and direct explanation, helped students understand basic concepts concerning the importance of environmental sustainability. Environmental literacy is an important competency that should be introduced from an early age so that children can develop awareness and a sense of responsibility for environmental sustainability in the future (Kaya & Elster, 2019; Zou, 2017).

From a behavioral perspective, observations indicated that approximately 72% of children were accustomed to watering plants, while approximately 69% were beginning to sort waste independently. These

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

results demonstrate that habit formation through simple, routine activities in the school environment can be an effective strategy for instilling environmental values and character in children. Teacher role modeling also plays an important role in fostering environmental awareness in early childhood (Putri, 2022).

In terms of teacher competency, the ability to use Canva-based digital media showed significant improvement after the briefings and training, with a success rate of approximately 88%. Teachers reported that digital media helped them deliver learning materials in a more engaging, communicative, and accessible manner. In addition, humanistic and assertive communication patterns contributed to more positive interactions between teachers and children, thereby increasing student participation and engagement in the learning process (Nakato et al., 2025; Ningrum et al., 2021).

Overall, the findings indicate that educational communication supported by digital media has significant potential to improve environmental literacy and foster sustainable behavior in early childhood. Combining digital media with effective communication approaches and practice-based learning activities, such as watering plants and sorting waste, can create more meaningful learning experiences for children.

The observation instrument used in this study was designed to provide a comprehensive understanding of teachers' educational communication, children's sustainable behavior and environmental literacy, and the effectiveness of digital media integration in the learning process. The observation indicators were developed in accordance with the study objectives, particularly to identify how teachers' educational communication strategies and the use of digital media contribute to environmentally responsible behavior among early childhood learners. The instrument therefore consisted of two complementary forms of assessment: (1) conventional face-to-face classroom observation and (2) observation supported by interview confirmation during digital media-based learning activities.

Conventional Classroom Observation (Face-to-Face)

Conventional classroom observation was conducted to examine the teaching and learning process in a natural classroom setting without digital media intervention. The observation focused on three primary dimensions: teachers' educational communication, children's sustainable behavior, and children's environmental literacy.

The first dimension, teachers' educational communication, assessed teachers' ability to convey environmental messages using simple, concrete, and developmentally appropriate language for young children. The observation also assessed the quality of teacher-child interactions, the provision of positive reinforcement through verbal and nonverbal appreciation, the interactive use of conventional learning materials such as posters and storybooks, and teachers' role modeling of environmentally responsible behavior during classroom activities. These five indicators were selected because educational communication plays a fundamental role in facilitating children's understanding while simultaneously shaping positive environmental habits through daily interaction.

The second dimension focused on children's sustainable behavior and was intended to capture observable behavioral changes in their everyday school activities. The indicators included children's ability to dispose of waste independently in designated bins, awareness of water conservation by turning off taps after use, creativity in reusing recyclable materials during classroom activities, concern for classroom cleanliness, and active participation in environmental conservation activities such as watering plants and caring for the school environment. These indicators were designed to assess the extent to which sustainability values had been internalized and translated into children's daily behavior.

The third dimension examined children's environmental literacy, referring to their understanding of fundamental environmental concepts and their ability to apply this knowledge in everyday situations. The assessment focused on children's ability to distinguish different types of waste, explain the importance of environmental cleanliness, recognize basic environmental symbols, retell the moral messages presented during environmental learning activities, and respond appropriately to environmental problems, such as reminding peers to keep the environment clean or informing teachers when witnessing actions that could damage the environment. These indicators reflect the view that environmental literacy encompasses not only cognitive knowledge but also the ability to interpret, communicate, and apply environmental values in meaningful daily practices.

Digital Observation Assessment and Interview Confirmation

In addition to conventional classroom observations, the study employed a digital observation assessment supported by interview confirmation to evaluate the implementation of digital media-based

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

learning. This complementary approach was used to obtain a more comprehensive understanding of the effectiveness of digital media in enhancing environmental literacy and fostering environmentally responsible behavior among early childhood learners. Combining direct observation with follow-up interviews enabled the researchers to examine not only how digital media were implemented but also how teachers interpreted and facilitated children's learning experiences throughout the instructional process.

The first observation dimension focused on teachers' use of digital media. It assessed teachers' ability to integrate digital learning resources, such as educational videos and Canva-based presentations, into environmental education activities. The assessment also examined teachers' proficiency in operating digital platforms, the extent to which digital media encouraged active child participation, the creativity of visual content designed in accordance with early childhood developmental characteristics, and the appropriate, safe, and age-responsive use of digital technology in classroom settings. Collectively, these indicators were intended to evaluate the quality of digital media implementation as an instrument of educational communication rather than merely as a technological learning aid.

The second dimension examined children's responses to digital media, with particular emphasis on the extent to which digital learning materials attracted their attention, enhanced their understanding of environmental concepts, and encouraged positive behavioral change. Observations included children's visual engagement during digital presentations, comprehension of environmental messages conveyed through digital content, participation in interactive learning activities, ability to recall key messages during subsequent learning sessions, and the emergence of observable sustainable behavior in everyday school activities. Accordingly, this dimension assessed not only children's cognitive understanding but also the effectiveness of digital media in facilitating environmentally responsible behavior through meaningful learning experiences.

To strengthen the credibility of the observational findings, semi-structured interviews were conducted with participating teachers. The interviews explored teachers' experiences in implementing digital media, challenges encountered during classroom instruction, strategies used to encourage children's active participation, and teachers' perceptions of changes in children's environmental awareness and sustainable behavior following the integration of digital learning media. Combining classroom observations with interview data strengthened the trustworthiness of the findings through methodological and data-source triangulation and enabled a richer interpretation of the role of educational communication in digital learning.

Digital Media Development Outcomes

As a follow-up to the professional development program for teachers at PAUD Cahya Mentari, participants developed a digital learning resource in the form of an environmental education poster entitled "From a Sad Earth to a Happy Earth" (Si Bumi Sedih Jadi Ceria). The poster used a digital storytelling approach to present environmental conservation messages through a simple and engaging narrative suited to the cognitive and linguistic characteristics of early childhood learners.

The storyline begins by depicting the Earth in a polluted condition caused by littering and environmental degradation, thereby emphasizing the negative consequences of irresponsible human behavior. The narrative then introduces children as active agents of environmental stewardship who engage in positive actions, including disposing of waste properly, planting flowers, maintaining environmental cleanliness, and sorting recyclable materials. The story concludes with the transformation of the Earth into a clean, green, and cheerful environment, symbolizing the positive effects of environmentally responsible behavior and collective action.

From a pedagogical perspective, the poster incorporates colorful illustrations, expressive cartoon characters, large typography, and concise language appropriate to the developmental characteristics of young children. The anthropomorphized Earth character displays contrasting emotional expressions—sadness at the beginning of the story and happiness at the end—and serves as an emotional communication strategy that helps children understand the relationship between human actions and environmental conditions. The sequential narrative structure also enables children to recognize cause-and-effect relationships while encouraging empathy and environmental responsibility through meaningful visual storytelling.

Rather than serving solely as a visual teaching aid, the digital poster functioned as an educational communication tool that facilitated dialogue between teachers and children. During classroom implementation, teachers used the poster to initiate discussions, encourage children to express their ideas, connect environmental messages with everyday experiences, and reinforce positive behavior through questioning, reflection, and direct practice. Consequently, the digital learning media supported not only children's cognitive

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

understanding of environmental issues but also the internalization of sustainability values through interactive communication and experiential learning.

These findings indicate that the effectiveness of digital learning media extends beyond visual attractiveness or technological features. Their educational value is largely determined by teachers' ability to communicate, contextualize, and reinforce the environmental messages embedded in the media. The digital poster developed through the training program therefore functioned primarily as a learning trigger, while the transformation of children's sustainable behavior occurred through continuous educational communication, repeated habituation, and meaningful teacher-learner interaction. This finding further supports the Digital Sustainable Communication Ecosystem for Children (DSCEC) proposed in this study, which conceptualizes digital media as one component of a broader communication ecosystem integrating educational communication, behavioral habituation, and collaborative learning to promote sustainable behavior in early childhood education.



Figure 2. Educational Posters as Digital Learning Media

Intervention Success Categories

The level of intervention success was analyzed according to the percentage achievement of the observational indicators. An achievement rate of 81%-100% was categorized as highly effective, indicating that the use of digital media consistently fostered children's sustainable behavior. A rate of 61%-80% was classified as effective, suggesting that environmentally responsible behavior had developed well, although periodic reinforcement remained necessary. Achievement rates of 41%-60% were categorized as moderately effective, indicating a need to improve both digital media design and teachers' competencies in using educational technology. An achievement rate of 40% or below was classified as less effective, indicating that the implementation of digital media had not yet produced a substantial impact on the development of environmentally responsible behavior among young children.

Documentation of the Research Implementation

The study was conducted at PAUD Cahya Mentari through a series of interconnected stages, including preliminary data collection, digital media training, instructional implementation, and observation of the educational communication processes occurring throughout classroom activities. Each stage was systematically designed to provide a comprehensive understanding of how teachers used digital media to promote environmental literacy and foster sustainable behavior among early childhood learners.

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

The initial stage involved in-depth interviews with the school principal and teachers from the Playgroup (Kelompok Bermain/KB), Kindergarten B (TK B), and Childcare Center (*Tempat Penitipan Anak*/TPA). The semi-structured interviews explored existing instructional practices, teachers' experiences in using digital media, educational communication strategies employed during classroom instruction, and challenges encountered in integrating environmental education into children's learning activities. In addition to generating factual information, the interviews were used to verify and validate the observational findings, thereby strengthening the credibility of the study through data-source triangulation.

The researchers subsequently conducted a training program on the development of digital learning media for teachers at PAUD Cahya Mentari. The training was designed to strengthen teachers' competencies in creating digital educational media suited to the developmental characteristics of early childhood learners. During the program, teachers received hands-on guidance in designing instructional materials using digital design applications, selecting communicative visual illustrations, developing digital storytelling content, and constructing simple, contextual, and age-appropriate environmental messages that could be readily understood by young children. As an outcome of the training, teachers produced various digital learning media, including an educational poster entitled "From a Sad Earth to a Happy Earth" (*Si Bumi Sedih Jadi Ceria*), which was subsequently used as the primary instructional medium during classroom activities.

The subsequent stage involved implementing the digital learning media in classroom instruction. Teachers incorporated the media they had developed as an integral component of the educational communication process with children. During the learning activities, teachers not only presented digital media using an interactive display but also encouraged two-way communication by inviting children to ask and answer questions, participate in discussions, observe examples of environmentally responsible behavior, and engage in practical activities such as disposing of waste in designated bins, caring for plants, and maintaining classroom cleanliness. These findings indicate that digital media primarily functioned as an initial instructional stimulus, whereas children's understanding and internalization of environmental messages were constructed through direct interaction between teachers and learners.

Classroom observations during the implementation phase showed that the use of digital media significantly enhanced children's attention and active participation in learning activities. Children appeared more focused when visual media were presented, responded actively to teachers' questions, and were able to relate the stories conveyed through digital media to their everyday experiences. Nevertheless, behavioral change did not occur solely as a result of exposure to digital media. Instead, sustainable behavioral development emerged through continuous educational communication by teachers, reinforcement through positive daily habits, and parental involvement in strengthening environmentally responsible behavior in the home environment.

Overall, the research documentation shows that digital media were implemented at PAUD Cahya Mentari within a collaborative learning ecosystem. Interactions among teachers, children, and parents emerged as the primary determinants of the successful use of digital media in promoting environmental literacy and fostering sustainable behavior. These findings reinforce the conclusion that digital media should not be regarded as the sole determinant of behavioral change. Rather, digital media function as supporting instructional tools whose effectiveness depends on the quality of educational communication, the consistency of behavioral habituation, and sustained collaboration between schools and families.

Discussion

The interview and training documentation demonstrated that teachers' competencies form the primary foundation for the successful implementation of digital media in learning activities. In other words, the effectiveness of digital media depends not only on the quality of the technology itself but also on teachers' ability to design, deliver, and communicate instructional messages effectively. These findings highlight teacher capacity building as a prerequisite for maximizing the educational potential of digital media.

During classroom implementation, teachers did not merely function as technology operators; they served as communication mediators who transformed visual content into meaningful learning experiences through dialogue, reflective questioning, role modeling, and positive reinforcement. This finding confirms that educational communication is the central mechanism linking digital media to children's behavioral development. Accordingly, digital media function as an instructional stimulus, while teachers facilitate the cognitive and affective processes through which environmental messages are interpreted and internalized by children.

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

Classroom observations indicated that environmentally responsible behavior emerged when environmental messages delivered through digital media were continuously reinforced through habitual practices at school and sustained parental support at home. Behavioral transformation should therefore be understood as the outcome of an ongoing communication process within a collaborative educational ecosystem rather than as a direct consequence of exposure to digital media alone.

Collectively, these three stages illustrate a transformation process consistent with the findings of the present study, as shown in Figure-6.

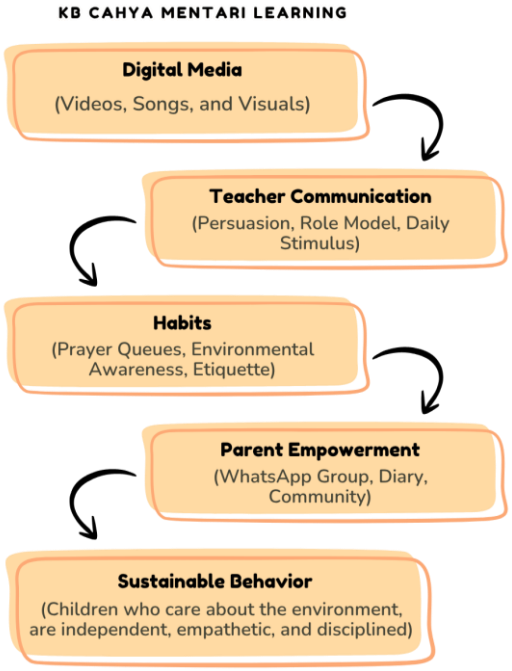


Figure-3. Implementation of the Learning Model at KB Cahya Mentari

This sequential process strengthens the argument that the Digital Sustainable Communication Ecosystem for Children (DSCEC) is not merely a theoretical framework but also an empirically grounded model that accurately represents the educational processes observed throughout the research conducted at PAUD Cahya Mentari. The findings demonstrate that educational communication supported by digital media has significant potential to enhance environmental literacy and foster sustainable behavior among early childhood learners. However, unlike many previous studies that primarily emphasize the effectiveness of digital technology as an instructional tool, the present findings show that digital media alone do not directly transform children's environmental behavior. Their effectiveness instead depends on how teachers translate digital content into meaningful learning experiences through educational communication, repeated habituation, and collaboration with parents. This finding suggests that the success of digital learning lies not merely in the technology itself but in the communication processes accompanying its implementation.

Observations conducted across TK B, Kelompok Bermain (KB), and Tempat Penitipan Anak (TPA) at PAUD Cahya Mentari consistently showed that digital media, including educational videos, visual posters, songs, and Canva-based presentations, successfully attracted children's attention and increased their engagement during classroom activities. Children demonstrated higher levels of concentration, participated actively in discussions, responded enthusiastically to visual stimuli, and were able to recall environmental messages conveyed through digital learning materials. These findings support Muldoon et al. (2019), who reported that visual and audiovisual media enhance children's motivation and participation in classroom learning. Likewise, the Multimedia Learning Theory proposed by Mayer and Moreno (1998) explains that integrating verbal explanations with visual representations facilitates information processing through dual cognitive channels, thereby improving children's comprehension of learning materials.

Nevertheless, the present study extends these theoretical perspectives by demonstrating that improved understanding does not automatically lead to behavioral transformation. Classroom observations showed that children developed environmentally responsible behavior only when digital messages were reinforced through

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

persuasive educational communication delivered by teachers. Teachers consistently contextualized digital content by providing simple explanations, encouraging two-way interaction, modeling environmentally responsible practices, and reinforcing positive behavior through verbal praise and daily classroom routines. Consequently, teachers functioned not only as information transmitters but also as meaning makers who transformed abstract environmental messages into concrete experiences that children could understand and practice in their daily lives.

This finding was particularly evident in the observations conducted in TK B, where teachers integrated environmental videos with storytelling, classroom discussions, and direct demonstrations of environmentally friendly practices such as sorting waste, saving water, and maintaining classroom cleanliness. Rather than allowing children to consume digital content passively, teachers encouraged active participation through questioning, reflection, and immediate practice. Such communication-oriented learning created meaningful interactions that facilitated children's understanding while simultaneously strengthening environmental values through everyday experiences.

A similar pattern emerged in the Kelompok Bermain (KB) classrooms. Although the intervention achieved a very effective category (81%-100%) based on the observation indicators, its effectiveness was attributed not solely to digital media but to the synergy among persuasive teacher communication, repeated habituation, and contextual learning experiences. Teachers consistently linked digital environmental messages with practical classroom activities, enabling children to connect what they observed on screen with real-life environmental actions. This finding indicates that digital media primarily functioned as learning enablers, whereas behavioral change was mediated through continuous interpersonal communication between teachers and children.

Observations conducted in the TPA further reinforced this communication process. The learning sequence consistently followed a communication ecosystem that began with exposure to digital media, followed by persuasive teacher communication, daily habituation, and continuous parental reinforcement through WhatsApp groups, daily communication books, and parent meetings. This collaboration enabled environmental values introduced at school to be consistently reinforced in children's home environments. As a result, children's sustainable behavior emerged not simply from repeated exposure to digital content but from continuous interaction among teachers, parents, and children within a supportive educational environment.

These findings are consistent with learner-centered educational approaches, which emphasize that meaningful learning occurs through active interaction rather than passive information delivery. Nakato et al. (2025) argued that learner-centered communication strengthens children's participation and engagement by fostering reciprocal interaction between teachers and learners. Likewise, early childhood education requires instructional approaches that correspond to children's developmental characteristics, as learning primarily occurs through play, direct experience, and engaging visual stimulation (Garaigordobil et al., 2022; Ijar et al., 2024). The present findings indicate that digital media become substantially more effective when integrated with authentic learning experiences, allowing children to practice environmentally responsible behavior directly through activities such as watering plants, disposing of waste properly, sorting recyclable materials, and maintaining classroom cleanliness.

These findings also support previous studies reporting that creative educational media contribute positively to environmental literacy among young children. Interactive visual media, including picture books, educational videos, and storytelling activities, have been shown to facilitate children's understanding of environmental concepts while increasing their motivation to learn (Siregar et al., 2020). However, the present study advances this body of knowledge by demonstrating that media effectiveness should be understood within a broader communication framework. Rather than viewing digital technology as the primary determinant of behavioral change, the study highlights educational communication as the central mechanism through which digital content is interpreted, contextualized, and transformed into sustainable action.

Based on these findings, the study proposes the Digital Sustainable Communication Ecosystem for Children (DSCEC) as a conceptual model explaining how digital media contribute to the development of sustainable behavior in early childhood. The model positions digital media as an initial trigger that captures children's attention and facilitates environmental understanding. Educational messages are then mediated through persuasive teacher communication, strengthened by repeated habituation in everyday classroom activities, and sustained through continuous collaboration between schools and parents. Within this

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

ecosystem, teachers act as meaning makers who bridge digital information and children's lived experiences, while parents reinforce these values beyond the classroom.

CONCLUSION

This study demonstrates that integrating digital media into educational communication contributes to enhancing environmental literacy and fostering sustainable behavior among young children. However, digital media alone do not directly lead to behavioral transformation. Their effectiveness depends on teachers' ability to translate digital content into meaningful learning experiences through persuasive communication, role modeling, repeated habituation, and continuous reinforcement supported by parental collaboration. In this context, teachers function not merely as facilitators of technology but as meaning makers who connect digital learning resources with children's everyday experiences and environmental practices.

The findings further show that digital media, including Canva-based visual materials and educational videos, effectively increase children's engagement and understanding of environmental concepts when integrated with interactive classroom activities and authentic learning experiences. Sustainable behavior therefore develops through a collaborative educational communication ecosystem rather than through technology alone.

The principal contribution of this study is the proposed Digital Sustainable Communication Ecosystem for Children (DSCEC), a conceptual model that positions digital media as a learning trigger while emphasizing educational communication, behavioral habituation, and school-parent collaboration as key mechanisms for developing sustainable behavior in early childhood education. The model extends the current literature by shifting the perspective from technology-centered learning toward communication-centered digital pedagogy and offers theoretical and practical implications for environmental education and Education for Sustainable Development (ESD).

Future studies are encouraged to validate the DSCEC model across diverse educational settings using mixed-methods or longitudinal research designs. Further research may also explore the integration of more interactive digital technologies, such as gamification or artificial intelligence-supported learning, and examine the long-term influence of family and community involvement on the sustainability of children's environmental behavior.

DECLARATIONS

Author Contributions

Eka Anisa Sari: Conceptualization, Methodology, Investigation, Formal Analysis, Data Curation, Writing-Original Draft, Supervision, Project Administration. Dhias Cahya Hakika, Anissa Yuswantina, and Angga Pranata: Validation, Investigation, Visualization, Writing-Review & Editing, Data Curation, Formal Analysis. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Conflict of Interest

The authors declare no conflict of interest. They affirm that the research was conducted in the absence of any financial, institutional, or personal relationships that could be perceived as influencing the study or the interpretation of its findings.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Because the study involves early childhood education participants, the data are not publicly available due to ethical considerations and the need to protect participant confidentiality. All research data were anonymized and used solely for academic purposes in accordance with ethical research standards.

Funding

The authors gratefully acknowledge financial support from the Institute of Research and Community Service (Lembaga Penelitian dan Pengabdian Masyarakat/LPPM), Universitas Ahmad Dahlan, through the Internal Research Scheme under Research Contract No. [PD-331/SP3/LPPM-UAD/XII/2025].

ACKNOWLEDGEMENT

The authors sincerely thank TK Cahya Mentari for granting permission and providing support throughout the research process. They also extend their appreciation to the teachers, parents, and children who

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

participated in the study and contributed valuable insights during the implementation of the learning activities. The authors further thank Universitas Ahmad Dahlan for supporting the academic development and completion of this research.

REFERENCES

Fadillah, D., Farihanto, M. N., & Setiawan, R. A. D. (2022). "Senggol Bestie" as Media Promotion Among Muhammadiyah Universities. *Komunikator*, *14*(2), 148–158. https://doi.org/10.18196/jkm.15845

Garaigordobil, M., Berrueco, L., & Celume, M.-P. (2022). Developing Children's Creativity and Social-Emotional Competencies through Play: Summary of Twenty Years of Findings of the Evidence-Based Interventions "Game Program." *Journal of Intelligence*, *10*(4), 77. https://doi.org/10.3390/jintelligence10040077

Ijar, S., Lu'lu R., Nur S., Fatimah, Khadijah., & Hairani A. P. (2024). Mengembangkan Sosial Emosional Anak Usia Dini Melalui Bermain. *Ta'rim: Jurnal Pendidikan Dan Anak Usia Dini*, *5*(3), 63–71. https://doi.org/10.59059/tarim.v5i3.1340

Jane, F. Nakato, Chidinma I. Onyeibor, & Chinyere E. Ekanem. (2025). Rethinking learner-centered teaching in early education: Lessons from a global practice perspective. *International Journal of Management & Entrepreneurship Research*, *7*(5), 413–420. https://doi.org/10.51594/ijmer.v7i5.1929

Kaya, V. H., & Elster, D. (2019). A Critical Consideration of Environmental Literacy: Concepts, Contexts, and Competencies. *Sustainability*, *11*(6), 1581. https://doi.org/10.3390/su11061581

Kurniawan, Y. I., & Kusuma, A. F. S. (2021). Aplikasi Augmented Reality untuk Pembelajaran Salat bagi Siswa Sekolah Dasar. *Jurnal Teknologi Informasi Dan Ilmu Komputer*, *8*(1), 7. https://doi.org/10.25126/jtiik.0812182

Laksana, D. J., Budiman, A., & Apriandari, W. (2021). Game Edukasi Pengenalan Alat Musik Tradisional Menggunakan Metode MDLC Berbasis Android. *Jutisi : Jurnal Ilmiah Teknik Informatika Dan Sistem Informasi*, *10*(1), 45. https://doi.org/10.35889/jutisi.v10i1.579

Masykuroh, K., & Wahyuni, T. (2023). Media Pop-Up Book Untuk Meningkatkan Karakter Peduli Lingkungan Pada Anak Usia Dini. *Aulad: Journal on Early Childhood*, *6*(2), 172–181. https://doi.org/10.31004/aulad.v6i2.483

Mayer, R. E., & Moreno, R. (1998). A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory. *Journal of Educational Psychology*, *90*(2), 312–320. https://doi.org/10.1037/0022-0663.90.2.312

Moreno, R., & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology*, *91*(2), 358–368. https://doi.org/10.1037/0022-0663.91.2.358

Muldoon, R., Shelford, T., Holland, O., & Hryciw, D. H. (2019). Environmental Awareness of Primary School Aged Children in Brisbane, Australia. *International Journal of Innovation in Science and Mathematics Education*, *27*(2). https://doi.org/10.30722/IJISME.27.02.003

Ningrum, F. S., Safrina, R., & Sumadi, T. (2021). Peran Pembelajaran Musik melalui Project Based Learning terhadap Perilaku Sosial Anak Usia 5-6 Tahun. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *6*(2), 704–718. https://doi.org/10.31004/obsesi.v6i2.1559

Nunneley, C. E., Fishman, M., Sundheim, K. M., Korus, R. E., Rosen, R. H., Streater, B. A., O'Donnell, K. A., Newman, L. R., & Marcus, C. H. (2021). Leading synchronous virtual teaching sessions. *The Clinical Teacher*, *18*(3), 231–235. https://doi.org/10.1111/tct.13282

Pramadita, S. (2021). Potensi Daur Ulang Sampah Melalui Identifikasi Jenis Dan Karakteristik Sampah Di Panti Asuhan Dan Pesantren Darul Khairat. *Jurnal Teknologi Lingkungan Lahan Basah*, *9*(2), 082–089. https://doi.org/10.26418/jtllb.v9i2.47598

Pramono, R.-, Cendana, W., M. Panjaitan, A., Siahaan, H., & Sekar Syallomitha, D. (2024). Gerakan Literasi Cinta Lingkungan Melalui Pojok Baca Masyarakat. *Prosiding Konferensi Nasional Pengabdian Kepada Masyarakat Dan Corporate Social Responsibility (PKM-CSR)*, *6*, 1–5. https://doi.org/10.37695/pkmcsr.v6i0.2022

Putri, H. R. (2022). Pembentukan Karakter Cinta kepada Tuhan dan Cinta Kepada Lingkungan pada Anak Usia Dini (AUD) melalui Pembiasaan dan Keteladanan. *BIO-CONS : Jurnal Biologi Dan Konservasi*, *4*(2), 151–156. https://doi.org/10.31537/biocons.v4i2.720

Rojo-Ramos, J., Manzano-Redondo, F., Barrios-Fernandez, S., García-Gordillo, M. A., & Adsuar, J. C. (2021). Early Childhood Education Teachers' Perception of Outdoor Learning Activities in the Spanish Region of Extremadura. *Sustainability*, *13*(16), 8986. https://doi.org/10.3390/su13168986

Rosyida, E., Listiyono, H., & Zuliarso, E. (2024). Rancang Bangun Game Edukasi Pembelajaran Huruf Alfabet Pada Anak Usia Dini Menggunakan Metode Multimedia Development Life Cycle. *Jurnal JTIK (Jurnal Teknologi Informasi Dan Komunikasi)*, *8*(3), 549–555. https://doi.org/10.35870/jtik.v8i3.2014

Sari, E. A., Setiawan, R. A. D., & Jandevi, U. (2023). Social Media in Electoral Communication: A Case Study

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

of Strategic Initiatives by Bantul Election Commission for the 2024 Elections. *CHANNEL: Jurnal Komunikasi*, *11*(2), 137–143. https://doi.org/10.12928/channel.v11i2.377

Setyaningsih, D., Handasah, R. R., Mamma, A. T., Krobo, A., Olua, E., & Iryouw, V. (2024). Fostering Eco-literacy and Naturalistic Intelligence through Environmentally Based Education in Coastal Preschool. *JPUD - Jurnal Pendidikan Usia Dini*, *18*(1), 251–269. https://doi.org/10.21009/JPUD.181.18

Siregar, M., Meilanie, S. M., & Purwanto, A. (2020). Pengenalan Ecoliteracy pada Anak Usia Dini melalui Metode Bercerita. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *5*(1), 719. https://doi.org/10.31004/obsesi.v5i1.700

Supriani, Y., Oktaviyanthi, R., & Suherman, S. (2024). Peran Orang Tua dalam Pengenalan Angka di Era Digital Melalui Comic Digital Interaktif. *Jurnal Sosial Dan Sains*, *4*(10), 966–975. https://doi.org/10.59188/jurnalsosains.v4i10.19997

Turnure, C. (1975). Cognitive development and role-taking ability in boys and girls from 7 to 12. *Developmental Psychology*, *11*(2), 202–209. https://doi.org/10.1037/h0076456

Xu, L., Ling, M., Lu, Y., & Shen, M. (2017). Understanding Household Waste Separation Behaviour: Testing the Roles of Moral, Past Experience, and Perceived Policy Effectiveness within the Theory of Planned Behaviour. *Sustainability*, *9*(4), 625. https://doi.org/10.3390/su9040625

Zou, B.-J. (2017). Understanding American Preschool Teachers' Teaching Beliefs About Literacy Instruction. *DEStech Transactions on Social Science, Education and Human Science*, *mess*. https://doi.org/10.12783/dtssehs/mess2017/12153

Copyright © 2026 Published by The Center for Research and Community Service Politeknik Negeri Media Kreatif.
This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)