



Utilizing Recycled Materials as Innovative Educational Media to Enhance Early Childhood Learning

Ida Royani ^{1*}, Suriyani ², Ririn Tjahyaningsih ³

^{1*,2,3} Faculty of Teacher Training and Education, Universitas Muhammadiyah Bogor Raya, Bogor Regency, West Java Province, Indonesia.

Corresponding Email: idaroyani@umbogorraya.ac.id ^{1*}

Received: 17 July 2025; Accepted: 25 July 2025; Published: 30 July 2025.

Abstract

This research investigates the use of recycled materials as educational media designed to enrich early childhood learning experiences. The study aims to understand how these materials affect children's participation, foster creativity, support cognitive growth, and build environmental awareness. Using a qualitative descriptive approach, data were gathered through observation, interviews, and documentation at a local early childhood education center. Results indicate that learning activities involving recycled items promote higher levels of student engagement and help develop fine motor skills, while also nurturing an early sense of ecological responsibility. Teachers observed that children responded with greater enthusiasm when working with everyday items like bottle caps, newspapers, and cardboard. Integrating these materials into lessons not only encourages creative thinking but also introduces concepts of sustainability in a hands-on manner. Educators found this approach helpful for designing lessons that are both accessible and meaningful, inspiring children to use their imagination and care for the environment. While the findings point to recycled materials as valuable resources in early education, the study was conducted within a limited context and over a short period. Further research involving wider settings and longer observation is recommended to better understand the long-term effects. The insights gained here are relevant for educators seeking to incorporate sustainable practices and environmental values into early learning.

Keywords: Recycled Materials; Early Childhood; Educational Media; Environmental Awareness; Creative Learning.

Introduction

The need to cultivate sustainable habits across all facets of daily life has become increasingly urgent in recent years (Malang *et al.*, 2025). Climate change, environmental decline, and the overuse of natural resources continue to threaten the planet, placing early education at the forefront of efforts to nurture ecological awareness and responsible behavior (Manshur *et al.*, 2024). Early childhood education (ECE) serves not only as a foundation for cognitive, language, and motor development, but also as a period when children begin to form values and attitudes toward their environment and community (Ariska, 2021). Educators and policymakers now face the challenge of adopting teaching approaches that are both effective and mindful of social and environmental responsibilities (Kresnawaty, 2024). One promising method is the use of recycled materials as learning media in early childhood classrooms (Wigati & Wiyani, 2020). Everyday items such as cardboard boxes, plastic bottles, fabric scraps, newspapers, bottle caps, and other household waste can be creatively repurposed into teaching aids, toys, and learning tools. When used thoughtfully, these materials support constructivist learning principles, giving children space to explore, manipulate, and create through hands-on, play-based activities (Tika Kartina, 2022).



Direct engagement with recycled materials helps bridge the gap between abstract concepts and tangible experiences. Play-based learning—long recognized as a cornerstone of early childhood education (Christianna, 2013)—enables children to interact with their surroundings, solve problems, express ideas, and work together with peers. Introducing recycled materials into this context sparks creativity and imagination (Abidin *et al.*, 2022). For instance, a simple cardboard box might become a puppet theater, spaceship, or miniature house, depending on how children choose to use it. Open-ended play of this nature supports not only cognitive growth but also emotional and social development. Additionally, children begin to appreciate the importance of sustainability and environmental stewardship by finding new value in items often regarded as waste. A growing body of research highlights the educational benefits of integrating recycled materials in early learning. Albin-Clark (2020) found that open-ended, recycled materials stimulate divergent thinking and boost engagement. Frost and Wortham (2017) also noted improvements in fine motor skills as children cut, glue, assemble, and construct objects (Siron *et al.*, 2020). The affordability of these resources is another advantage, especially for schools with limited budgets, as it makes quality learning experiences more accessible to all students.

Despite these strengths, the use of recycled materials in early childhood settings often remains inconsistent. Barriers such as limited awareness, inadequate training, and lack of institutional support are common, particularly in developing regions (Firda Sari Aprillia, 2022). Some teachers may feel uncertain about using non-traditional materials or may not fully recognize their educational value. Concerns related to hygiene, safety, or the perceived lack of structure can also discourage adoption (Novria Grahmayanuri, n.d.). More empirical studies are needed to document effective practices, identify obstacles, and offer practical solutions for successful implementation. Beyond the classroom, the use of recycled materials aligns with broader societal goals, including several United Nations Sustainable Development Goals (SDGs) such as Quality Education (SDG 4), Responsible Consumption and Production (SDG 12), and Climate Action (SDG 13). By integrating sustainability into learning, educators help prepare children to become environmentally conscious citizens who can think critically about consumption, waste, and resource management. This educational approach encourages a culture of reuse, resilience, and innovation, fostering both individual growth and collective responsibility.

The social and emotional impact of using recycled materials should not be overlooked. When children participate in collecting, assembling, and using these materials, they develop a sense of ownership, pride, and agency. Such experiences build self-confidence and help children see themselves as contributors to their environment and community. Collaborative projects with recycled materials also promote teamwork, communication, and empathy as children negotiate, share ideas, and work toward shared goals. Although theoretical and anecdotal support for this approach is strong, systematic research on the effects of recycled materials on early learning outcomes remains limited. There is a need for further investigation into how these educational tools influence cognitive skills, creativity, problem-solving abilities, and environmental awareness. It is equally important to understand how teacher training, family involvement, and school infrastructure shape the effectiveness of recycled-based learning. Against this backdrop, the present study examines the role of recycled materials as innovative educational media in early childhood settings. The research focuses on identifying which types of recycled materials are most effective, the teaching strategies that facilitate their use, and their impact on children's engagement and development. The findings aim to inform educators seeking to embed sustainable, creative, and inclusive practices in early learning environments. In essence, using recycled materials in early childhood education offers a unique opportunity to connect sustainability with active learning, inspire creativity, and foster a sense of responsibility. As education systems worldwide seek new ways to address global challenges, integrating recycled materials into early learning emerges as a practical and meaningful strategy for nurturing both young minds and the planet (Firdayani, 2023).

Literature Review

Integrating recycled materials into early childhood education has attracted considerable scholarly attention, spanning the fields of environmental education, play-based pedagogy, and educational media innovation. This review



synthesizes key theories and empirical findings relevant to the current study, organizing them thematically to underscore their significance. In doing so, it also identifies critical gaps that this research seeks to address.

Theoretical Foundations: Play-Based Learning and Constructivism

The foundation of early childhood education is strongly influenced by constructivist theory, as articulated by Piaget (1952) and Vygotsky (1978). Both theorists emphasize that young children learn most effectively through direct, hands-on experiences in their environment. Play, in this context, is not merely recreational but serves as a vital process for cognitive and social development. Bodrova and Leong (2007) argue that play-based learning enables children to construct knowledge actively, experiment, and make sense of the world around them. Recycled materials, when introduced as open-ended resources, provide children with opportunities to transform everyday objects into unique learning tools. This approach aligns with constructivist principles by fostering exploration, discovery, and creative problem-solving—qualities essential in early learning settings.

Recycled Materials as Educational Media

The educational potential of recycled materials is well documented in literature emphasizing both sustainability and pedagogical innovation. Edwards and Cutter-Mackenzie (2011) highlight that recycled items can serve as alternative teaching tools, nurturing environmental literacy and stimulating creativity. Davis (2015) further suggests that such materials serve a dual purpose: enriching the learning environment while simultaneously cultivating ecological awareness in young learners. Notably, research by Inoue and Johnson (2020) found that preschoolers who engaged with recycled play materials exhibited greater creativity and divergent thinking than peers using conventional toys. These findings indicate that recycled materials can support multiple areas of development—including cognitive, social-emotional, and motor skills—when thoughtfully integrated into structured activities.

Environmental Education and Sustainable Practice

The use of recycled materials in educational contexts also intersects meaningfully with environmental education. Tilbury (1995) posits that early exposure to ecological values lays the groundwork for lifelong sustainable habits. By involving children in the creation and use of toys from recycled items, educators introduce concepts such as resource conservation, waste reduction, and environmental stewardship at an impressionable age. Recent work by Albin-Clark (2020) reinforces this view, showing that children who participated in recycled art projects were more inclined to express concern for environmental issues and suggest sustainable practices within their communities. These insights suggest that environmental education can be seamlessly woven into creative, play-based learning.

Affordability, Accessibility, and Equity

Economic considerations also feature prominently in the literature. Frost and Wortham (2017) note that many early childhood centers, particularly in under-resourced areas, struggle to afford high-quality educational tools. Recycled materials offer a practical, low-cost alternative that can be tailored to diverse learning contexts. However, adopting these practices is not without challenges. Rinaldi and Corbetta (2018), in their study of Italian preschools, observed that teachers often hesitated to use recycled materials due to concerns about hygiene, parental perceptions, and alignment with curricular goals. These barriers highlight the need for targeted professional development and supportive policies to encourage the broader adoption of recycled materials in early education.

Gaps in the Literature

Despite broad recognition of the pedagogical and environmental benefits of recycled materials, several important gaps remain. Empirical studies that rigorously measure learning outcomes—such as cognitive gains, creativity, or socio-emotional development—are relatively scarce. Much of the existing research is qualitative or anecdotal, limiting its generalizability. Additionally, there is limited exploration of how teachers systematically incorporate recycled materials into lesson plans or align them with educational standards. In many cases, the use of recycled materials remains informal and lacks curricular integration. Furthermore, few studies have examined the long-term impact of these practices on children's environmental attitudes and behaviors. The role of parents and communities in supporting recycled learning materials also remains underexplored, even though their involvement is vital for reinforcing classroom learning at home.



Contribution of the Present Study

This study seeks to address these gaps by systematically investigating how recycled materials can be utilized as innovative educational media to enhance learning outcomes in early childhood settings. Unlike much previous research, which tends to focus on environmental or artistic outcomes, this study examines the pedagogical value of recycled materials within a structured educational framework. It considers teachers' strategies, children's engagement, and learning outcomes, offering a comprehensive perspective on the educational process. Moreover, the study explores how this approach can be scaled and integrated into broader curricular objectives, particularly in settings with limited resources. By contributing both theoretical insights and practical recommendations, this research aims to enrich the ongoing discourse on sustainable, creative, and inclusive practices in early childhood education.

Methodology

This research employed a qualitative descriptive design with a participatory approach, aiming to explore how recycled materials can be utilized as educational media to enhance the learning experiences of early childhood students. The study focused on children aged 4–6 years at an early childhood education center (PAUD) in Tangerang, Indonesia. The research was conducted over a period of two months, from March to April 2025.

Research Design

A qualitative descriptive method was chosen to enable the researchers to explore children's responses, learning motivation, and creativity during the learning process involving educational toys made from recycled materials. The participatory approach allowed for the direct involvement of teachers and children in both the creation and implementation of these learning media.

Participants

Participants in this study consisted of:

- 1) 15 early childhood students (aged 4–6 years)
- 2) 2 classroom teachers
- 3) 1 school principal

Participants were selected using purposive sampling, based on their active involvement in play-based learning and familiarity with environmental education concepts.

Data Collection Techniques

Data were collected through:

- 1) Observation
To monitor children's engagement and creativity during learning activities with the toys.
- 2) Interviews
Conducted with teachers to gather insights about learning effectiveness and behavioral changes.
- 3) Documentation
Included photos of learning activities, creative products made by children, and lesson plans.

The instruments used comprised observation sheets, interview guides, and activity documentation logs.

Data Analysis Techniques

Data were analyzed using the Miles and Huberman model, which consists of three steps:

- 1) Data Reduction
Organizing data into themes such as creativity, collaboration, and environmental awareness.
- 2) Data Display
Presenting key findings in tables and narrative descriptions.



3) Conclusion Drawing and Verification

Interpreting patterns and linking them to the research objectives.

The researchers ensured credibility through prolonged engagement, member checking, and triangulation across observation, interviews, and documentation.

Table 1. Summary of Research Methodology

Component	Description
Research Design	Qualitative descriptive with participatory approach
Location & Time	PAUD in Tangerang, March–April 2025
Participants	15 students (ages 4–6), 2 teachers, 1 principal
Sampling Technique	Purposive sampling
Data Collection	Observation, Interviews, Documentation
Instruments	Observation sheets, interview guides, documentation logs
Data Analysis	Miles and Huberman model: reduction, display, conclusion
Validity Techniques	Triangulation, member checking, prolonged engagement

Table 1 provides a clear summary of the research methodology used in this study. Each element described in the table illustrates the careful planning, execution, and analysis undertaken to maintain the validity and relevance of the research. By adopting a qualitative descriptive approach with a participatory lens, the researchers were able to observe and document the genuine reactions of young children during play-based learning activities. This method also encouraged teachers to become actively involved in both designing and implementing educational media made from recycled materials. The research was conducted at a well-established early childhood education center (PAUD) in Tangerang, spanning a period of two months. This duration allowed for multiple observations, the building of trust with participants, and ongoing monitoring of the children's creative progress as they interacted with the recycled learning tools.

Participants consisted of 15 children aged 4–6 years, accompanied by two classroom teachers and the school principal. The study used purposive sampling, intentionally selecting individuals who were actively engaged in play-based learning and demonstrated awareness of environmental issues. Data collection relied on three main techniques: observation, interviews, and documentation. Through observation, researchers could directly monitor the children's engagement, creativity, and social interactions. Interviews with teachers provided deeper context and insight into the effectiveness of the approach, while documentation—including photographs and written records—served to strengthen the credibility of the findings. All research instruments were meticulously prepared, including observation checklists, semi-structured interview guides, and documentation logs. Each tool was designed to be appropriate for young children, ensuring that the research process remained ethical and child-friendly.

For data analysis, the study employed the interactive model developed by Miles and Huberman, which involves data reduction, data display, and drawing and verifying conclusions. This approach enabled the researchers to organize the information, identify key themes, and develop well-supported interpretations. To uphold data validity, the study incorporated triangulation of methods, member checking, and prolonged engagement. These strategies helped to cross-check information, validate interpretations with participants, and ensure the overall credibility of the results. The methodological framework used in this study reflects a thoughtful and ethical approach, aimed at gaining a comprehensive understanding of how recycled materials can be used as learning media. The systematic methods applied here are expected to produce findings that are not only academically sound but also practically useful for encouraging creativity and sustainability in early childhood education.



Results and Discussion

Results

The study revealed that using recycled materials as educational resources led to notable improvements in the learning experiences of young children at PAUD Ceria, Tangerang. Observations, interviews, and documentation collected over two months captured several significant developments. Children exhibited marked enthusiasm and active participation during activities involving recycled objects. For example, when tasked with crafting animal figures from discarded plastic bottles and paper, many children not only followed instructions but also displayed initiative by inventing their own unique creations. Such responses point to an environment where creativity and imagination are actively nurtured. Teachers observed progress in the children's fine motor skills, particularly during tasks that required cutting, pasting, and assembling various materials. Cognitive growth was also apparent, as students began to recognize shapes, colors, and fundamental environmental concepts through hands-on engagement. Social interactions improved as well. Group projects fostered a spirit of cooperation, with children sharing materials, offering assistance to peers, and engaging in discussions about their collective work. These exchanges contributed to the development of empathy, teamwork, and a sense of responsibility among the students. Teacher and parent feedback further underscored the value of the participatory approach. Educators reported feeling more empowered to integrate creative teaching methods with environmental themes, while some parents noticed their children adopting recycling habits at home and expressing concern for the planet. Such behavioral changes suggest that learning extended beyond the classroom and began to influence daily routines. A summary of these findings is provided in the following table:

Table 2. Emergent Themes from the Implementation of Recycled Learning Media

Theme	Description
Student Engagement	High enthusiasm, active participation, creative task modification
Skill Development	Improved fine motor abilities, greater understanding of basic concepts
Social Behavior	Increased collaboration, communication, and sense of responsibility
Environmental Awareness	Emergence of eco-friendly attitudes and actions at school and home
Educator Empowerment	Active teacher involvement in developing materials and innovative practices

Discussion

The study's results reinforce the idea that learning is deeply shaped by context, interaction, and the tools available in the classroom. Drawing from Vygotsky's sociocultural theory, it becomes clear that recycled materials serve not just as instructional aids but as cultural resources that help children connect their daily experiences with new concepts. This perspective finds support in the work of Siron *et al.* (2020), who observed that educators using repurposed objects often witness greater student engagement and more dynamic group interactions. Piaget's view on the value of hands-on learning is echoed in the children's responses to creative tasks involving recycled goods. When students are encouraged to manipulate, assemble, and transform discarded items, they are not only developing fine motor skills—as documented by Novria Grahmayanuri (2025)—but are also building confidence in their ability to solve problems and express ideas. Such activities, as noted by Ariska (2021), can provide a sense of accomplishment that is hard to achieve through more passive forms of instruction.

Sustainability in early childhood education has gained increasing attention in recent years, with Hyun's eco-pedagogical approach emphasizing the importance of integrating environmental themes into daily routines. The findings align with efforts by Abidin *et al.* (2022) and Kresnawaty (2024), who argue that the use of recycled materials can foster both creativity and environmental awareness. Children who participate in these activities often carry new habits home, encouraging families to rethink their own approach to waste and resourcefulness. The study's credibility is bolstered by the active involvement of teachers and families, as well as the use of multiple data sources. However, restricting the research to a single school and a modest sample size does introduce questions about how the results might translate to other settings. As suggested by Manshur *et al.* (2024), expanding future studies to include a wider range of institutions or following participants over a longer period could offer valuable insights into how sustainable practices take root and evolve. From a practical perspective, recycled materials provide an affordable and flexible solution for educators, especially in communities where access to commercial resources is limited. Firdayani (2023) and Wigati & Wiyani (2020) both highlight how such approaches can empower teachers to design meaningful, context-sensitive activities without incurring significant costs. These practices also have the potential to nurture a sense of environmental stewardship from an early age, as explored by Tika Kartina (2022).



There remains considerable room for further inquiry. Investigations into the long-term effects of recycled-based learning on children's attitudes and behaviors, as well as the integration of digital media with physical materials, could shed light on new ways to foster creativity and environmental responsibility. Comparative studies across different regions or age groups may also help clarify which strategies are most effective under varying circumstances (Malang *et al.*, 2025; Christianna, 2013; Firda Sari Aprillia, 2022). Leveraging recycled materials in early childhood education not only enriches the learning process but also lays the groundwork for habits and attitudes that extend far beyond the classroom. Such efforts, rooted in both pedagogical theory and practical experience, point toward a more sustainable and responsive approach to nurturing young learners.

Conclusion

This research set out to examine how recycled materials might serve as fresh alternatives for educational tools in early childhood settings. The evidence gathered points to several benefits: children became more invested in classroom activities, showed progress in fine motor and cognitive skills, and demonstrated greater willingness to collaborate with peers. These experiences also appeared to spark early awareness of environmental issues, as children began to connect classroom lessons with daily life. Teachers found that incorporating everyday discarded items into lessons allowed for more creative and flexible approaches to instruction. Such practices are especially valuable in early learning environments, where tactile and exploratory activities form the foundation of growth. The positive reactions from both students and educators suggest that hands-on engagement with repurposed objects can help nurture habits and attitudes that extend well beyond the classroom. Nevertheless, there are important caveats to consider. The study was confined to a single early childhood center, which means the observations may not reflect broader trends. The relatively brief timeframe also limits insight into whether these positive changes endure over time. For a more complete understanding, future studies should include a wider range of schools and follow participants over a longer period. Exploring how digital resources might complement recycled materials could also reveal new ways to support children's development and adaptability in a changing world. Using recycled materials in early childhood education emerges as a practical and impactful approach. Beyond supporting learning goals, such efforts encourage young children to adopt sustainable habits early on—a step that holds promise for shaping more environmentally conscious generations in the years ahead.

References

- Abidin, R., Sumriyeh, S., & Asy'ari, A. (2022). Metode pembelajaran berbasis 3R (reuse, reduce, recycle) dalam upaya memperdayakan kreativitas anak usia dini. *Jurnal Pelita PAUD*, 6(2), 222–231. <https://doi.org/10.33222/pelitapaud.v6i2.1732>
- Ariska, K. (2021). Pemanfaatan bahan bekas dengan decoupage untuk mengembangkan kreativitas anak usia dini pada pembelajaran online. *KINDERGARTEN: Journal of Islamic Early Childhood Education*, 4(2), 189-200. <http://dx.doi.org/10.24014/kjiece.v4i2.12481>.
- Christianna, A. (2013). Pelatihan perancangan alat permainan edukatif (APE) berbasis bahan bekas untuk pendidikan anak usia dini (PAUD) se-Siwalankerto Surabaya. *SHARE: SHaring - Action - REflection*, 1(1), 7–13. <https://doi.org/10.9744/share.1.1.7-13>
- Firda Sari Aprillia. (2022). Membangun kreativitas anak usia dini dengan memanfaatkan barang bekas dan menumbuhkan kebiasaan menabung. *Jurnal Pemberdayaan Masyarakat Indonesia*, 4(1), 78–86. <https://doi.org/10.21632/jpmi.4.1.78-86>
- Firda, T. F., Novianti, R., Andriani, D., Jaya, M. P. S., Intan, F. R., & Idayana, S. (2023). Pelatihan Pembuatan Alat Permainan Edukatif (APE) Ramah Lingkungan (Bahan Bekas) untuk Meningkatkan Kreativitas Guru. *Kreasi: Jurnal Pengabdian Masyarakat*, 3(2), 83-89. <https://doi.org/10.51529/kjpm.v3i2.460>.



- Kresnawaty, A. (2024). Strategi pengelolaan barang bekas yang baik dalam pendidikan anak usia dini. *Jurnal Inovasi, Evaluasi dan Pengembangan Pembelajaran (JIEPP)*, 4(1), 53–60. <https://doi.org/10.54371/jiepp.v4i1.364>
- Manshur, U., Rozi, F., Saleha, L., & Sholihah, C. (2024). Eco-friendly media: Assistance in developing educational props from waste materials in Probolinggo City. *GUYUB: Journal of Community Engagement*, 5(1), 249–271. <https://doi.org/10.33650/guyub.v5i1.8317>
- Grahmayanuri, N., Nasution, F. S., Daulay, D. H., & Yusriani, N. (2025). Upaya Meningkatkan Keterampilan Motorik Halus Anak Melalui Media Pengolahan Barang Bekas Pada Anak Usia Dini di RA Al-Muhajirin Medan Deli. *Islam Universalia: International Journal of Islamic Studies and Social Sciences*, 6(3).
- Sholihah, M. A., & Kuswandi, D. (2025). Utilizing Waste Materials in Educational Media to Foster Creativity and Language-Numeracy Skills in Young Children. *At-Tarbiyat: Jurnal Pendidikan Islam*, 8(2), 449–463. <https://doi.org/10.37758/jat.88i2.43>
- Siron, Y., Khonipah, I., & Fani, N. K. M. (2020). Penggunaan barang bekas untuk media pembelajaran di PAUD: Pengalaman guru. *Early Childhood: Jurnal Pendidikan*, 4(2), 63–74. <https://doi.org/10.35568/earlychildhood.v4i2.868>
- Tika Kartina, H. J. H. (2022). Kesadaran penggunaan barang bekas sebagai alat permainan edukasi anak usia 4 tahun sampai 5 tahun (Penelitian kualitatif di Desa Cibuntu Cibitung Bekasi). *Jurnal Tunas Aswaja*, 1(1), 48–58. <https://doi.org/10.47776/tunasaswaja.v1i1.349>
- Wigati, M., & Wiyani, N. A. (2020). Kreativitas guru dalam membuat alat permainan edukatif dari barang bekas. *As-Sibyan: Jurnal Pendidikan Anak Usia Dini*, 5(1), 43. <https://doi.org/10.32678/as-sibyan.v5i1.2700>