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Implementation of Ecobricks as a Planting Medium in Early Childhood Education (PAUD) Institutions in Karangploso District

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Abstract

Plastic waste, particularly discarded water containers, is still commonly found unused in early childhood education institutions, where it poses a risk of environmental pollution. This community service program implemented ecobrick activities involving the reuse of plastic gallons and bottles as planting media, at three early childhood education institutions in Karangploso District, namely KB & PAUD Matahari (Tegalgondo Village), KB/RA Al-Qur'an Darussalam (Kepuharjo Village), and KB Permata Hati (Ampeldento Village). The program used a descriptive qualitative approach based on community-based development, carried out through needs analysis, preparation, socialization, technical training, hands-on implementation with children, mentoring, and monitoring and evaluation; data were collected through observation, semi-structured interviews, evaluation sheets, and documentation, then analyzed using the Miles, Huberman, and Saldana interactive model. The results showed that all three institutions successfully transformed used gallons and bottles into plant pots through a learning-by-doing approach, actively involving children in decorating, painting, and planting seedlings, with children's understanding of reusing waste materials varying across locations, reaching 86.7% at KB & PAUD Matahari, 100% at KB/RA Al-Qur'an Darussalam, and 62.5% at KB Permata Hati. The program consistently contributed to SDGs 4 and 12, with additional emphasis on SDGs 15, 13, and 17 at each institution, and demonstrated potential for sustainability through integration with other environmental programs such as eco-enzyme.

Keywords: ecobrick; planting media; early childhood education; waste management; community service

1. Introduction

Plastic waste is an environmental issue requiring increasing attention, including in early childhood education institutions. Because plastic is difficult to decompose, it can accumulate and pollute the environment if not properly managed. Waste management should therefore go beyond disposing of waste in designated bins to include sorting, reuse, and processing waste into useful products. In early childhood education, waste-related issues can also serve as tangible learning resources because children interact directly with their immediate surroundings. Siregar et al. (2021) emphasized that ecoliteracy should be introduced from an early age so that children can recognize environmental problems, develop environmental awareness, and understand the importance of maintaining ecological balance. Similarly, Adawiyah et al. (2023) showed that waste found around early childhood education institutions can be developed into learning materials through recycling activities. Thus, waste management can support not only environmental cleanliness but also young children's learning.

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One educational approach to plastic waste management is the ecobrick, in which used plastic containers are densely filled with non-organic plastic waste to create reusable materials for various purposes. In educational practice, ecobrick activities can integrate waste management with authentic, collaborative, and contextual learning experiences. Community service initiatives involving ecobricks have shown that sorting, cleaning, and reusing plastic waste can raise students' awareness of environmental issues while introducing alternative uses for discarded materials (Farahdiansari et al., 2025). Moreover, converting plastic waste into ecobricks at the kindergarten level has been recognized as a form of education for sustainable development because it connects environmental issues with children's direct learning experiences (Asih et al., 2025). Environment-based learning also allows children to learn from objects and situations in their immediate surroundings. Kurniyah et al. (2019) explained that the environment can serve as a learning resource by providing experiences directly related to children's everyday lives. Accordingly, transforming plastic waste into useful materials, including repurposing used water containers as plant pots, offers contextual learning that combines environmental awareness, creativity, responsibility, and hands-on experience. The use of ecobricks as learning materials in early childhood education has also been shown to improve teachers' knowledge and skills in transforming plastic waste into educational play materials (Palupi et al., 2020), while supporting children's motor skills through direct demonstrations of plastic recycling (Ichsan & Mulyani, 2018).

Based on field conditions identified during the ecobrick program, this community service initiative was implemented at three early childhood education institutions in Karangploso District: KB & PAUD Matahari in Tegalgondo Village, KB/RA Al-Qur'an Darussalam in Kepuharjo Village, and KB Permata Hati in Ampeldento Village. The program focused on processing and repurposing used water containers as plant pots and environmental education materials for members of these institutions. It arose from the need to transform discarded materials that might otherwise become waste into functional objects with educational value. Implementation at the three institutions also demonstrated that waste management can form part of children's learning through observing, identifying, using, and caring for plant pots made from reused materials. This approach is consistent with early childhood learning, which emphasizes concrete experiences and interaction with the environment. Handayani and Srinahyanti (2018) explained that scientific literacy in early childhood can be developed through authentic experiences that allow children to observe, recognize, and care for their surroundings. Therefore, the ecobrick program at these three institutions was designed not only to reuse waste but also to foster environmentally responsible habits from an early age through concrete, simple activities relevant to children's daily lives. The program is expected to provide a model of good practice that combines waste management with environment-based learning in early childhood education.

2. Methods

This community service initiative was part of Universitas Negeri Malang's Thematic Belajar Bersama Masyarakat (UMBBM) program, which focused on repurposing used water containers, referred to in the program as ecobricks, as planting containers in early childhood education settings. It employed a descriptive qualitative approach within a community-based development model. This design was chosen because qualitative research positions researchers as key instruments and emphasizes a contextual understanding of field phenomena (Fadli, 2021). It enabled UMBBM Thematic students to work directly and continuously with educational institutions, teachers, parents, and children in planning,

implementing, and evaluating activities. It also enabled the issue of discarded water containers at early childhood education institutions in Karangploso District to be understood in context, with solutions adapted to each institution's circumstances. Activities were conducted in stages at three institutions in Karangploso District, Malang Regency: KB PAUD Matahari in Tegalgondo Village, KB Permata Hati in Ampeldento Village, and KB/RA Alquran Darussalam in Kepuharjo Village. The primary participants were children aged 2–6 years. Teachers and educational staff at each institution served as partners who were expected to continue and develop the ecobrick program independently after the community service activities ended. The technical training and direct mentoring approach was also consistent with previous community service initiatives involving ecobrick-making training for community groups as a means of managing plastic waste (Istirokhatun & Nugraha, 2019).

Before the main activities, UMBBM Thematic students conducted a needs assessment through field observations and discussions with institutional heads and teachers. The assessment covered required materials and equipment, including used 19-liter water containers, utility knives and scissors, acrylic paint and brushes, planting materials consisting of soil, rice husks, and compost, and ornamental plant or simple vegetable seedlings. It also identified the stakeholders involved: UMBBM Thematic students as facilitators; institutional heads and teachers as primary partners; children as the main participants in hands-on activities; and parents or guardians as supporters who helped provide materials. Two issues were observed across the three institutions: the management of used water containers had not been optimized, and environmental learning materials were limited. Based on this assessment, the program proceeded through preparation; orientation for teachers, parents, and children; technical training for teachers; hands-on activities with children to make pots from used water containers and plant seedlings in them; periodic follow-up mentoring; and monitoring and evaluation of program sustainability. Data were collected through observations from preparation to follow-up mentoring, semi-structured interviews with institutional heads and teachers, evaluation forms, and photographic and video documentation. These techniques are commonly used in qualitative community service initiatives to obtain in-depth, contextual data (Thalib, 2022). UMBBM Thematic students served as the primary research instruments, supported by observation and interview guides, cameras, and audio recorders.

The collected data were analyzed using the interactive data analysis model of Miles, Huberman, and Saldaña, with analysis continuing until data saturation was reached (Sugiyono, 2020). The process comprised data collection; data condensation through summarizing and simplifying field notes; data display through descriptive narratives, photographs, and tables of program progress; and conclusion drawing and verification through triangulation of observations, interviews, and documentation. These four processes were iterative and cyclical.

This interactive analysis model has been widely applied in community-based service and training initiatives because it can organize complex field data into systematic and accountable conclusions (Thalib, 2022), including in educational community service activities involving students, teachers, and community leaders working collaboratively (Jamil et al., 2026). Program success was assessed according to the extent to which ecobrick activities became sustainable learning practices integrated into environmental learning themes at the three institutions; children gained direct experience of repurposing discarded water containers as plant pots; children demonstrated responsibility for protecting and preserving their surroundings; and teachers improved their ability to design and facilitate environment-based

learning using recycled materials. All these outcomes were evaluated periodically through follow-up observations and interviews with teachers after the main activities had ended.

3. Results and Discussion

3.1 Results

The ecobrick program, implemented as part of the 2026 Thematic Belajar Bersama Masyarakat (BBM) Program for Early Childhood Education at Universitas Negeri Malang (UM), was conducted at three early childhood education institutions in Karangploso District: KB & PAUD Matahari in Tegalgondo Village, KB/RA Al-Qur'an Darussalam in Kepuharjo Village, and KB Permata Hati in Ampeldento Village. The program was initiated in response to household plastic waste, particularly discarded water containers, which are often disposed of without being reused and may adversely affect the surrounding environment. Activities at all three sites were broadly similar: used plastic water containers or bottles were transformed into plant pots through a learning-by-doing approach. However, each institution placed a slightly different emphasis on its activities to reflect its specific conditions and needs.

KB & PAUD Matahari, Desa Tegalgondo

The ecobrick activity at KB & PAUD Matahari was conducted on Thursday, July 23, 2026, involving all 15 children enrolled at the institution. It began with an introduction to plastic recycling through storytelling and a simple discussion. This was followed by the collection of 15 used water containers, which university students cleaned and shaped into plant pots while ensuring child safety. The children then decorated the pots and planted seedlings in them. They showed considerable enthusiasm throughout the decorating and planting stages and began to understand that discarded materials could be repurposed into useful items. Of the 15 children, 13 (86.7%) demonstrated an understanding of the recycling concept introduced during the activity. In addition to fostering environmental awareness, the activity supported fine motor skills, creativity, and cooperation among children.

KB/RA Al-Qur'an Darussalam, Desa Kepuharjo

The activity at KB/RA Al-Qur'an Darussalam was conducted on Wednesday, July 22, 2026, with children in the RA class as its target participants. It began with the collection of used plastic water containers as the main material for the pots, followed by cutting and shaping the pots by university students. The children then actively participated in creative activities, including painting the pots in various colors and attaching decorative ornaments. The materials used included discarded water containers, paint, brushes, and child-safe decorative materials. All children in class RA B actively participated, and dozens of discarded water containers were recycled into ready-to-use ornamental plant pots. The reported level of understanding of how discarded materials can be reused reached 100%, alongside the development of concern for environmental cleanliness from an early age.

KB Permata Hati, Desa Ampeldento

The activity at KB Permata Hati was conducted on Wednesday, July 22, 2026, involving 16 children. It followed up on an earlier eco-enzyme program. University students first cut and

decorated 16 discarded water containers and bottles to create attractive, child-safe planting containers. They then directly guided the children in planting seedlings in these recycled containers, allowing the children to participate actively in learning by doing. The activity generated considerable enthusiasm. Children gained hands-on experience of reusing discarded materials as planting containers and learned how this practice relates to environmental protection. Of the 16 children, 10 (62.5%) demonstrated an understanding of the activity. The program also strengthened the continuity of the eco-enzyme initiative because the natural fertilizer produced through that program was used directly to care for plants grown in the recycled containers, creating a continuous cycle of environmental learning.

Table 1. Summary of Ecobrick Program Outcomes

Location	Number of Children Involved	Number of Water Containers Recycled	Children Understanding the Recycling Concept (%)
KB & PAUD Matahari	15 children	15 containers	13 of 15 children (86.7%)
KB/RA Al-Qur'an Darussalam	RA class	24 containers	100% of students
KB Permata Hati	16 children	16 containers	10 of 16 children (62.5%)

The data above show that although all three sites successfully involved their children in hands-on recycling activities, the levels of conceptual understanding varied from 62.5% to 100%. This variation suggests that young children's conceptual understanding of recycling does not necessarily correspond directly to their level of physical participation. It may also be influenced by differences in mentoring intensity, instructional methods, and children's age ranges across institutions.

The ecobrick program at all three sites consistently contributed to several Sustainable Development Goals (SDGs), with different emphases as follows.

Table 2. Alignment of the Program with the SDGs

Location	SDG 4 (Quality Education)	SDG 12 (Responsible Consumption and Production)	SDG 15 (Life on Land)	Other SDGs
KB & PAUD Matahari	Contextual, hands-on learning (storytelling, discussion, and recycling activities)	Application of Reduce, Reuse, Recycle (3R) principles by reducing single-use plastics	Planting and caring for plants at school	–
KB/RA Al-Qur'an Darussalam	Access to contextual learning for young children	Waste reduction by recycling water containers into decorative plant pots	–	SDG 13 (climate education); SDG 17 (partnership between UM and partner institutions)

KB Permata Hati	Contextual learning through hands-on experience	Recycling practices and use of eco-enzyme as a natural fertilizer	Planting and developing habits of caring for plants in recycled containers	–

All three sites addressed SDGs 4 and 12 as their core objectives, while their emphasis on SDGs 15, 13, and 17 varied according to the additional focus developed by each student team. Examples included the link to the eco-enzyme program at KB Permata Hati and the emphasis on institutional partnerships at KB/RA Al-Qur'an Darussalam.

3.2 Discussion

Findings from the three implementation sites support the view that experiential learning, or learning by doing, is an effective approach to fostering environmental awareness in young children. At all three institutions, children did not merely observe the processing of discarded water containers; they actively participated in stages appropriate to their motor abilities, such as decorating pots, painting, attaching ornaments, and planting seedlings. Such active involvement is consistent with young children's natural curiosity about concrete objects in their surroundings. Simple recycling concepts may therefore be easier to understand when introduced through enjoyable activities. This finding is consistent with Wulandari et al. (2020), who demonstrated that creative ecobrick activities significantly affected the fine motor development of children aged 5–6 years, particularly their cutting, pasting, and exploration skills across different materials.

Although the three sites carried out the same core activity—turning discarded water containers or bottles into plant pots—they differed in emphasis. KB & PAUD Matahari emphasized introducing recycling concepts through storytelling and discussion before practical activities. KB/RA Al-Qur'an Darussalam highlighted aesthetic creativity through painting and decorating. Meanwhile, KB Permata Hati integrated ecobrick activities with its existing eco-enzyme program to establish a continuous cycle of environmental learning. These differences suggest that program success depends not only on a uniform activity design but also on the ability of student facilitators to adapt mentoring intensity and activities to each institution's local context. This is consistent with the principle of scaffolding in early childhood education, according to which children's developmental achievements depend substantially on the quality of adult guidance in bridging their current and potential abilities.

In terms of outcomes, all three sites reported high levels of enthusiasm among children and improved understanding of how discarded materials can be reused, although the reported percentages varied: 100% among RA B children at KB/RA Al-Qur'an Darussalam, 86.7% (13 of 15 children) at KB & PAUD Matahari, and 62.5% (10 of 16 children) at KB Permata Hati. This variation may have been influenced by the different emphases at each site. KB/RA Al-Qur'an Darussalam prioritized conceptual understanding through more structured creative sessions, whereas university students at KB Permata Hati were relatively more involved in constructing the planting containers than in introducing concepts to children. As a result, understanding was less widespread there than at the other two sites. Beyond cognitive outcomes related to recycling concepts, all three activities consistently reported improvements in fine motor skills,

creativity, and cooperation among children. Thus, the program supported not only environmental knowledge but also broader aspects of early childhood skill development.

Regarding contributions to the SDGs, the consistent alignment with SDGs 4 and 12 across all three sites indicates that the ecobrick program combined two objectives: providing contextual and meaningful learning experiences for young children and introducing responsible consumption and production practices through the Reduce, Reuse, Recycle (3R) principles from an early age. Additional emphasis on SDG 15 at KB & PAUD Matahari and KB Permata Hati, through planting and plant-care activities, demonstrated the program's role in developing ecological responsibility and concern for terrestrial ecosystems, potentially laying a foundation for environmentally responsible behavior at later educational stages. At KB/RA Al-Qur'an Darussalam, the link to SDG 13 reflected an effort to extend the program beyond waste management to climate education for younger generations. Its contribution to SDG 17 also highlighted the importance of partnerships between university students and partner educational institutions in sustaining such initiatives.

Program sustainability was another important aspect observed across the three sites. At KB Permata Hati, the link between ecobrick activities and the eco-enzyme initiative created a continuous environmental learning cycle in which the outcomes of one initiative supported the next. Such integration has the potential to strengthen the acceptability and sustainability of environmentally friendly practices in early childhood education institutions. Rather than ending after a single student visit, activities can become part of routine school practices, such as caring for plants grown in recycled pots.

Overall, the ecobrick program implemented at three early childhood education institutions in Karangploso District illustrates how integrating simple recycling activities into early childhood education can serve several purposes simultaneously: developing children's motor skills and creativity, introducing responsible consumption and production, fostering concern for terrestrial ecosystems, and strengthening partnerships between universities and community-based early childhood education institutions.

4. Conclusion

Overall, the ecobrick program at three early childhood education institutions in Karangploso District, KB & PAUD Matahari, KB/RA Al-Qur'an Darussalam, and KB Permata Hati, successfully transformed discarded water containers and plastic bottles into planting containers through a learning-by-doing approach that actively involved children. The activities also fostered environmental awareness, fine motor skills, creativity, and cooperation among children from an early age. Children's reported understanding of recycling varied across the sites: 86.7% at KB & PAUD Matahari, 100% at KB/RA Al-Qur'an Darussalam, and 62.5% at KB Permata Hati. These findings suggest that conceptual understanding does not necessarily correspond directly to physical participation but may also be influenced by mentoring intensity and instructional methods at each institution. The outcomes consistently supported SDGs 4 and 12 across the three sites, with additional contributions to SDGs 15, 13, and 17 according to each institution's context. The program also showed potential for sustainability through integration with other environmental initiatives, such as eco-enzyme. Nevertheless, the program was limited to three institutions and depended on university student mentoring during the community service period. Uneven levels of understanding across sites also indicate a need for more consistent instructional methods. Future sustainability should therefore be

supported by strengthening the capacity of teachers and parents to continue ecobrick activities independently. Further program development should expand the number of participating institutions, standardize mentoring methods to promote more consistent learning outcomes, integrate ecobrick activities more systematically into early childhood environmental education curricula, and establish sustained mentoring mechanisms with institutional partners to support long-term impact.

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