



Education on Waste Management Through Interactive Learning Media for Students of SD Muhammadiyah Sambon, Banyudono, Boyolali

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Abstract

The issue of waste in the school environment, particularly the lack of a waste sorting culture, poses a challenge in fostering environmental literacy from an early age. This community service activity aims to describe the implementation of waste management education for students of SD Muhammadiyah Sambon, Banyudono, Boyolali using interactive learning media. The method of implementing the activity uses a participatory approach with the delivery of material divided into four sessions: introduction to waste, interactive games (Maze and waste guessing), the 3R concept and Waste Bank, and the formation of Environmental Hero character. Interactive media were used to tailor the material to the psychological characteristics of elementary school students. The results of the activity showed that dividing the sessions into short segments (15-25 minutes) and using interactive game media were able to attract active participation from the students throughout the activity. Students showed good engagement during questions and answers sessions and educational games. This education has provided a basic understanding of waste sorting as the first step in forming an environmentally caring character. The success of further implementation requires follow-up in the form of providing sorted trash bins and daily habituation guidance at school.

1. Introduction

The issue of waste is one of the global environmental problems that continues to require serious attention (Anna et al., 2025), including in micro-environments such as schools (Darnetti et al., 2021; Fadhli et al., 2026). Teaching and learning activities and students' daily consumption at school have the potential to generate various types of waste, such as plastic

bottles, food wrappers, and paper (Febriyanto, 2025). If not managed properly, this waste can have a negative impact on the health and comfort of the school environment (Gusti et al., 2022). Poor waste management in educational environments not only pollutes the local ecosystem but also contributes to the macro waste accumulation problem at the city level (Halimah et al., 2020).

The importance of environmental education and waste sorting from elementary school age is not only aimed at addressing the physical waste problem but also at shaping character and long-term habits (Hapni et al., 2024). The elementary school age is a critical period in behavioral formation, making educational interventions during this time the most effective for instilling environmental literacy (Indrawan et al., 2022). Environmental literacy includes awareness, knowledge, attitudes, skills, and active participation in preserving the environment (Kinasih et al., 2025). Thru waste sorting education, students are trained to understand the types of organic and inorganic waste, their impacts, and the importance of sorting from the source as an initial step in sustainable waste management (Lestari et al., 2024).

However, environmental education in elementary schools often faces challenges in terms of delivery methods. The psychological characteristics of elementary school students, who have a short attention span, make conventional lecture methods tend to be less effective (Manurung et al., 2024). Jean Piaget's theory of cognitive development shows that children in the concrete operational stage (ages 7-11) need visual and manipulative media to understand abstract concepts (Manyullei et al., 2022). Therefore, innovative interactive learning media, such as educational games (gamification) and visualization, are needed to bridge theoretical concepts into enjoyable concrete experiences for students (Mislani et al., 2025; Nugraha et al., 2021).

The use of interactive media in environmental education plays a crucial role in stimulating students' interest in learning and active participation (Nur Afifah, 2022). This media not only serves as a teaching aid but also as a facilitator for informally evaluating understanding through activities such as picture guessing or maze games (Purnami, 2020). The contextual approach that links the material to students' daily lives, including the use of role models, has

proven capable of internalizing environmental care character values (Santi dan Anisah, 2019; Sari et al., 2023).

Based on field observations and Focus Group Discussions (FGD), SD Muhammadiyah Sambon, Boyolali Regency, faces similar issues. The school produces an average of 20-30 plastic bottles and 30-40 food wrappers every day. This situation is exacerbated by the lack of a structured waste sorting culture. Waste is generally mixed and disposed of without sorting according to its type. In addition, the school does not yet have a waste management system that is implemented sustainably. The school authorities recognize the need for early educational intervention to cultivate an environmentally caring character, while also implementing the values of Al Islam and Muhammadiyah (AIK) regarding cleanliness as part of faith (Widyasari dan Sari, 2025; Yusra et al., 2024).

To address this issue, this community service activity offers a solution in the form of waste management education thru interactive learning media. This activity focuses on delivering basic material as the initial stage of environmental literacy formation before the implementation of direct practices in the field (Rina dan Angella, 2022). This article aims to describe the implementation of waste management education, illustrate the use of interactive media, and identify student responses and engagement during the activities.

2. Methods of Implementation

This community service activity is carried out with a participatory approach that focuses on delivering waste management education to elementary school students.

2.1 Location and Time of Activity

The activity was conducted at SD Muhammadiyah Sambon, Sambon Village, Banyudono District, Boyolali Regency. The implementation of the activity was carried out through initial coordination with the school before the educational phase was conducted.

2.2 Targets and Participants

The main target of this activity is the 4th and 5th-grade students of SD Muhammadiyah Sambon. The selection of these classes is based on the consideration of the students'

cognitive levels, which are beginning to understand the concept of different types of waste and their environmental impacts. Teachers are also involved as companions during the activities.

2.3 Preparation Stage

The preparation stage begins with coordination with the school to schedule activities and identify the existing conditions of waste management. The service team prepared an educational module divided into four different presentation sessions, with visual media and interactive games tailored to the learning focus range of elementary school students.

2.4 Educational Materials and Media

The educational materials cover basic concepts to waste management applications. The materials are divided into four sessions: (1) Introduction to waste, types, colors of trash bins, and how to sort; (2) Interactive games such as Maze and guessing waste types and their impacts; (3) The 3R concept (Reduce, Reuse, Recycle), examples of crafts, and how a Waste Bank operates; and (4) Character building as Environmental Heroes thru a good habits checklist. The learning media used include visual presentation slides, Maze games, and checklist sheets.

2.5 Delivery and Interaction Methods

The delivery methods are conducted thru interactive lectures, question and answer sessions, and educational games. The activities are divided into four sessions with a duration of 15–25 minutes per session to prevent participant boredom. The service team acts as facilitators who encourage students to actively answer questions and interact directly with the displayed media.

2.6 Data Collection Techniques

Data in this article were obtained thru field observations during the activities and photo documentation. Observations focused on participant engagement and responses to interactive media. Quantitative measurements regarding knowledge improvement (pre-test and post-test) were not used in the reporting of this article.

3. Results and Discussion

3.1 Initial Condition of the Partner

Based on the observation results, it was found that SD Muhammadiyah Sambon is facing issues related to waste management in the school environment. Students' daily activities generate various types of waste, such as plastic bottles, snack wrappers, plastic cups, and paper waste. This situation is exacerbated by the lack of a structured waste sorting culture. Waste is generally mixed and disposed of directly without sorting according to its type. This existing condition shows that environmental literacy has not yet become a culture ingrained among the school community.



Figure 1. Condition of Mixed Waste in SD Muhammadiyah Sambon Before Activity.

3.2 Preparation and Development of Educational Materials

Before the implementation of education, the service team coordinated with the school authorities. The educational material is designed by dividing the presentation into four different sessions, facilitated by four speakers in turn. The division of these sessions aims to maintain the relatively short attention span of elementary school students. The team also

prepared supporting media in the form of educational games and checklists to enhance interaction.

3.3 Implementation of Waste Management Education

The educational activities are conducted using interactive lectures and educational games. The activities are divided into four stages:

- 1) Session 1: Basic material was presented regarding the definition of waste, the importance of sorting, types of waste, introduction to the colors of trash bins, and the procedures for sorting.
- 2) Session 2: Students are invited to play Maze and guess the types of waste, followed by an explanation of the negative impacts if waste is not sorted.
- 3) Session 3: Students are introduced to the concept of 3R, examples of crafts made from inorganic waste, and the operational mechanism of the Waste Bank.
- 4) Session 4: Students are given a checklist of good habits, create a student pledge to protect the environment, and listen to a moral message from the characters "Budi and Siti". The activity concluded with an evaluation and a group photo.



Figure 2. Implementation of the Reduce, Reuse, and Recycle.



Figure 3. Material Presentation about Types of Waste.



Figure 4. Implementation of the Educational Material Presentation on Waste Management by the Service Team

3.4 Utilization of Interactive Learning Media

The service team integrates interactive learning media into the lecture sessions. The use of the Maze game and the "Guess the Type of Trash" activity serves as informal evaluation tools as well as recreational media that lighten the atmosphere. In addition, the use of the characters "Budi & Siti" and the good habits checklist helps students visualize the abstract concept of environmental responsibility into a more easily understandable context of daily life.

3.5 Participant Response and Engagement

This engagement is evident from the participants' enthusiasm in answering questions during the waste type guessing session and their participation while playing Maze. The two-way interaction between the facilitator and the students indicates that the media used was able to capture the participants' attention. The teacher acting as a companion was also seen actively helping to guide the students during the game and discussion.



Figure 5. Interaction Between Students and Facilitators During the Educational Games.

3.6 Discussion

The implementation of waste management education at SD Muhammadiyah Sambon shows that an educational approach for elementary school students requires strategies that align with the child's cognitive development stage. The issue of mixed waste in the school environment reflects low environmental literacy at the micro level. The importance of sorting waste from elementary school age is a strategic step because this age is a critical period in the formation of behavior and habits (Darnetti et al., 2021). Through this education, students are not only introduced to the concepts of organic and inorganic waste, but also trained to understand the negative impacts of poor waste management.

The results of the activity show that delivering material through lectures alone is not effective enough for elementary school students. The use of interactive learning media, such

as the Maze game and "Guess the Type of Waste," plays a crucial role in the knowledge transfer process. Socialization of waste sorting that includes interactive methods will be more easily accepted by participants (Fadhli et al., 2026). Interactive media serves to bridge the abstract concepts of types and impacts of waste into something concrete and enjoyable. The enthusiasm of the participants in the field indicates that game media can stimulate students' interest in learning, so that the more complex 3R and Waste Bank materials can be delivered with fewer obstacles.

The use of the characters "Budi & Siti" and the good habits checklist is a form of contextual learning application. This approach requires the material to be connected with the students' real-life situations. Waste management education for students requires an approach that makes students feel involved and have direct responsibility (Santi dan Anisah, 2019). By creating the "Student Pledge," students are encouraged to internalize environmental care values and make them part of their identity.

The education that has been conducted serves as a cognitive foundation for students. However, the formation of a waste sorting culture cannot be limited to just the delivery of the material. The sustainability of the program requires follow-up actions in the form of providing physical facilities (segregated trash bins) and daily habituation support in schools so that behavioral changes can be realized in the future.

3.7 Reflection on Activity Implementation

The implementation of this education has bridged the school's initial limitation regarding the absence of a structured waste management socialization program. The division of short sessions (15-25 minutes) has proven to maintain the concentration levels of elementary school students. However, this activity is still in the initial stage (learning input). The achievement of a real waste sorting culture in the school environment still requires follow-up actions such as providing sorted waste bins, daily habit formation assistance, and direct practice by students, which are planned to be implemented in the next phase according to the service program roadmap.

4. Conclusion

Based on the implementation of waste management education activities at SD Muhammadiyah Sambon, several conclusions can be drawn as follows:

- 1) Waste management education was successfully implemented thru a participatory approach divided into four material sessions, tailored to the learning focus range of elementary school students.
- 2) The use of interactive learning media, such as Maze games, waste type guessing games, and good habit checklists, supports the delivery of waste sorting material and the 3R concept, making it easier for participants to understand.
- 3) Based on field observations, students showed positive responses and active engagement during the activities, especially in the interactive games and question answer sessions.
- 4) This activity serves as the initial foundation for environmental literacy. The achievement of a tangible waste sorting culture still requires follow-up actions in the form of providing physical facilities and daily habituation support.

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