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Raising Students' Awareness of Their Role in Environmental Cleanliness and Management Through the Use of Recycled Waste at School

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ABSTRACT

Limited waste-management literacy and inconsistent waste-sorting habits remain challenges in elementary schools. This community service program aimed to strengthen students' knowledge, participation, and environmentally responsible behavior through hands-on projects using recycled materials. Conducted at SDN Panaikang 1 Makassar from April to May 2026, the program involved 60 students in grades 4-6. A Participatory Action Research approach was applied through three stages: education on environmental cleanliness and the reduce, reuse, and recycle principles; demonstrations and group practice in producing flowerpots and relief maps from discarded materials; and evaluation and follow-up. Data were collected using a 10-item pre-test and post-test, facilitator observation sheets, and interviews with five classroom teachers. The data were analyzed descriptively using mean scores, percentages, and normalized gain. The results showed a 92% attendance rate and 90% active participation. The mean test score increased from 42.3 to 78.6, with an N-gain of 0.63 in the moderate category, while 80% of students achieved the minimum mastery score of 70. During the two-week follow-up, 62% of students voluntarily collected litter and 35% independently separated plastic from organic waste. The resulting flowerpots were used for school landscaping, while the relief maps served as instructional media. These findings indicate that integrating environmental education with hands-on recycling projects can improve students' short-term knowledge and participation in school waste management. Longer-term monitoring and continued teacher guidance are required to determine whether these behavioral changes are sustained.

INTRODUCTION

Environmental issues in Indonesia's urban areas are becoming increasingly alarming, and the city of Makassar is one of the regions directly affected by these problems. The volume of waste generated by the community across various sectors continues to rise in tandem with population growth and the intensity of economic activity. In the context of education, the school environment plays a significant role as a space for shaping character and fostering environmentally conscious

habits in children from an early age. However, based on the findings of [Nisa et al. \(2025\)](#), waste management literacy in Indonesian schools still requires serious strengthening, particularly in terms of students' knowledge, attitudes, and behaviors. A similar situation was highlighted by [Latifah \(2023\)](#), who pointed out the uneven integration of environmental education into the elementary school curriculum.

At the elementary school level, introducing students to the environment is a crucial foundation. The 3R concept which encompasses reduce, reuse, and recycle has long been recognized as an approach that is relatively easy to implement in school settings. The study [Rudiyanto et al. \(2021\)](#) shows that involving elementary school students in 3R activities can improve their understanding of their responsibility regarding waste. Meanwhile, the study [Endartiwi et al. \(2024\)](#) explains that school-based waste management is a strategic step toward realizing a green school. It is precisely at this point that efforts are made to shift students' mindset from the habit of littering to a more responsible way of thinking.

SDN Panaikang 1 Makassar was one of the schools selected by the community service team as a partner. When the team conducted an initial observation in March 2026, it became apparent that issues regarding cleanliness and environmental management at this school remained quite concerning. A brief mapping exercise conducted by the team at five key locations the front yard, the hallways of grades IV through VI, the cafeteria, the parking area, and the back yard identified 47 trash accumulation sites, with the dominant components being plastic packaging (53%), used paper (24%), and other inorganic materials such as bottles and cans (23%). Documentary photos taken during the observation showed piles of trash scattered around uncovered temporary dumping sites, as well as discarded plastic pots lying along the path to the cafeteria. To confirm that students' understanding of waste sorting and recycling was indeed still limited, the team did not rely solely on visual observations. The team also conducted brief interviews with ten students randomly selected from grades 4 through 6 and administered a pre-test consisting of ten multiple-choice questions to 60 upper-grade students. The pre-test results showed that the average student score was only 42.3 out of 100, with eight out of ten interviewed students stating they did not know the difference between organic and inorganic waste. This situation is not unique. [Fatmawati \(2025\)](#) notes that many educational institutions in Indonesia have not yet fully integrated environmental education into their daily learning routines. This is where the need arises for a tangible intervention that directly impacts changes in student behavior.

Community service, as one of the pillars of the Tri Dharma of Higher Education, provides a platform for students to apply their knowledge for the benefit of the wider community. Such activities serve as a bridge between the theory learned in the classroom and the realities encountered in the field. In the context of waste management in schools, [Shofiatin & Iqbal \(2025\)](#) demonstrates that inorganic waste recycling activities at the elementary school level can foster environmental awareness among students. On the other hand, [Ihsanuddin & Saraswati \(2025\)](#) emphasizes that education through crafts made from plastic waste can strengthen children's understanding of the importance of protecting the environment.

Based on these findings, a team of interns from the Elementary School Teacher Education Program at the Islamic University of Makassar designed a community service program focused on raising awareness among students at SDN Panaikang 1 Makassar regarding environmental cleanliness and management through the use of recycled waste. This program combines formal education, hands-on skills training, and practical exercises in processing discarded items. The goal is clear: to instill ecological awareness while providing students with firsthand experience that items commonly considered useless can actually be transformed into something functional and appealing. This overarching concept aligns with the views of [Karomah \(2025\)](#) regarding environment-based character education, as well as the zero-waste management concept developed by [Buana & Zamaludi \(2023\)](#) to create a cleaner and healthier school environment. The importance of environmental education starting in elementary school is also reaffirmed by [Adnyana et al. \(2024\)](#), which views green education as the foundation for lifelong ecological character development.

METHOD

The design of this community service activity adopts the Participatory Action Research (PAR) approach, in which all parties involved from the implementation team and school officials to the students play an active role in every stage of the program. The primary collaboration took place between the student internship team from the Elementary School Teacher Education Program at Makassar Islamic University and SDN Panaikang 1 Makassar as the partner school. The participatory approach was chosen because, as noted by [Winoto & Septian \(2024\)](#), this model provides space for students not merely to receive information but also to engage in decision-making processes and take concrete action. Broadly speaking, the implementation method was divided into three phases: (1) outreach and education, (2) training and practice, and (3) evaluation and follow-up.

The participants consisted of 60 students, comprising 20 fourth-graders, 20 fifth-graders, and 20 sixth-graders. The selection of these grade levels was based on considerations of the students' cognitive development and motor skills, which were deemed sufficient to participate in practical activities such as cutting, painting, and shaping paper dough. In addition to the main participants, the activity also involved five classroom teachers as supervisors, one principal as the institutional coordinator, and six internship team members serving as facilitators and documenters. Thus, a total of 72 people were actively involved in the entire program series. This participant profile served as the basis for designing the work group assignments, with each group consisting of four to five students and one facilitator.

The first phase focused on outreach and education. The team delivered interactive presentations on environmental cleanliness and the 3R concept to students in the school auditorium. The sessions were designed to avoid a lecturing tone, instead encouraging students to discuss and think critically about the connection between their daily habits and the condition of their surrounding environment. The material covered included the impact of waste on ecosystems, simple methods for sorting organic and inorganic waste, and various examples of handicrafts made from discarded items. This outreach model draws on the transformative environmental education approach proposed by the [Goldman & Aram \(2021\)](#), in which students are encouraged to reflect on the consequences of their consumption patterns.

The second phase is the core of the entire program. At this stage, students are directly involved in two hands-on activities. The first activity involves making flower pots from used plastic water jugs. Students are guided in cutting, painting, and arranging ornamental plants into the pots they have created. The second activity involves creating a relief map using simple materials such as used cardboard, pulped newspaper, plywood, and glue. Newspaper, soaked until it becomes a soft paste, is then used as a reinforcing material to form the relief on the map. The entire process is carried out in groups, allowing students to help one another and exchange ideas. This type of project-based learning aligns with the recommendations of the [Yuningsih & Jaizul \(2025\)](#), which indicate that craft training using recycled materials can hone creativity while fostering environmental awareness.

The third phase consisted of an evaluation conducted through direct observation of changes in student behavior, accompanied by brief interviews with teachers. In addition, the team also administered a post-test using an instrument equivalent to the pre-test to quantitatively measure changes in students' understanding. The aspects measured included students' understanding of recycling, changes in their attitudes toward waste, and their level of participation in school environmental management activities. The evaluation framework used was based on the KAP (knowledge, attitude, and practice) model, as applied by the [Anua et al. \(2022\)](#) to assess the effectiveness of environmental awareness programs. A similar approach was also used by [Owojori & Mulaudzi \(2022\)](#), which emphasizes the interrelationship between knowledge, attitude, and practice in waste management. The entire implementation took place from April to May 2026 at SDN Panaikang 1 in Makassar, with fourth-, fifth-, and sixth-grade students as the primary participants.

RESULTS AND DISCUSSION

The community service program conducted at SDN Panaikang 1 in Makassar yielded a number of changes that could be measured both qualitatively and quantitatively. Of the 60 participating students, the average attendance rate throughout the series of activities reached 92% (55–58 students per session), while 54 students (90%) were recorded as actively participating in discussions and practical activities based on observation sheets filled out by the facilitators. In terms of comprehension, students' average pre-test score of 42.3 rose to 78.6 on the post-test, representing an increase of 36.3 points with an average N-gain of 0.63, which falls into the moderate category. The following outlines the results and discussion for each phase of the program's implementation.

In the initial stage, the team held an awareness session in the school auditorium attended by students in grades 4 through 6. The session began by showing several photos of environments polluted by trash, followed by a discussion on what students could do to reduce waste in their surroundings. The students' response was quite positive; many of them asked spontaneous questions and shared personal experiences regarding their habits of disposing of trash at home and at school. The team noted that prior to the outreach, the majority of students did not understand that the used items they discarded could actually be reused. This observation aligns with the findings of the [Nizaar & Mas'ad \(2020\)](#), which indicate that the routine application of the 3R principles in the school environment has a positive impact on students' ecological awareness.



Figure 1. Waste-recycling awareness session for students at SDN Panaikang 1 Makassar (left); cutting and preparation of discarded plastic water containers for use as flowerpots (right); and students painting and decorating the flowerpots (bottom).

After the awareness session ended, the activity continued with a hands-on session on making flower pots. Used plastic jugs were collected from the area around the school and residents' homes. The team then divided the students into small groups, each consisting of four to five students. Each group received a used jug with the top cut off. The students' task was to design and paint the

surface of the jug using colors and patterns of their own choosing. The atmosphere became quite lively as students scrambled for paint and brushes, offering each other advice on the best designs. After the painting was finished and the paint had dried, the students planted ornamental plants in the pots. According to [Widiyono et al. \(2022\)](#), activities that combine arts and crafts with waste management can improve children's fine motor skills while broadening their understanding of how to repurpose used items. The resulting pots were then placed in the schoolyard as part of an environmental beautification effort.

The next activity involved the process of making relief maps, which took longer than making flower pots. The materials used were relatively easy to obtain: used cardboard as the base layer, plywood as the main frame, used newspapers soaked and pulped into a reinforcing mixture, as well as glue and paint for finishing. The choice of a relief map as a recycled product is not without reason this medium has high educational value, particularly for supporting the teaching of geography and social studies in elementary school. Initially, students were tasked with soaking the newspapers in water for several hours until the fibers softened. Afterward, the softened newspapers were crumpled and mixed with glue to form a paste resembling paper pulp. This mixture is then applied over the map outline that has been drawn on the plywood surface. [Laius & Kont \(2024\)](#) states that hands-on experience in processing recycled materials provides students with a deeper understanding compared to traditional lecture methods.



Figure 2. Construction of a relief map using recycled cardboard and pulped newspaper (left); detailed work and finishing of the relief map by the project team and students (right).

The detailed work phase requires a high degree of precision. Students are guided to smooth the map's surface texture using a newspaper paste applied in gradual layers. This process takes a considerable amount of time because students must wait for each layer to dry before adding the next one. Once the map's relief is properly formed, students begin adding visual elements such as coloring based on regional characteristics, writing the names of areas, and adding geographic symbols. The used cardboard serving as the base layer provides additional strength to the structure, while the plywood acts as a framework supporting the entire construction. This finding reinforces the results of the study [Meilani & Rasman \(2021\)](#), which shows that the use of waste as a learning material provides students with a more comprehensive understanding of environmental management.

Based on data from the pre-test and post-test administered to the 60 participating students, there was a significant improvement in their understanding of the concepts of recycling and waste sorting. The average pre-test score of 42.3 increased to 78.6 on the post-test, with an average gain score of 0.63, which falls into the moderate category. A total of 48 students (80%) met the passing criteria with a minimum score of 70, while 12 students (20%) still fell below this threshold and required further support. Students' understanding of the difference between organic and in -organic waste which only 31% of students answered correctly on the pre-test increased to 78% on the post-test. These quantitative data were supported by the results of interviews with five classroom

teachers conducted at the end of the program. Four out of five teachers reported changes in students' waste disposal habits, particularly regarding sorting waste before disposing of it in the designated bins. One fifth-grade teacher noted, Now there are some children who, before throwing away a plastic water bottle, will first ask if it can be reused for crafts. However, one fourth-grade teacher observed that the behavioral changes were not yet uniform; some students still needed to be repeatedly reminded to dispose of their trash properly, especially during recess.

Before the program began, students' trash disposal habits tended to be haphazard; they rarely considered whether the items they discarded still had potential for reuse. After participating in a series of activities ranging from awareness sessions to hands-on practice, a fairly noticeable shift occurred. The team's observations over the two weeks following the program showed that 37 students (62%) were seen voluntarily picking up trash scattered around the school grounds, and 21 students (35%) took the initiative to separate plastic waste from organic waste without being asked by a teacher. [Ramdani et al. \(2025\)](#) In their study, stated that 3R-based awareness programs can foster ecological awareness among adolescents, and the teams's observations at SDN Panaikang 1 revealed a similar pattern, albeit in the context of a younger age group. The experience of directly handling and processing used items apparently leaves a stronger impression than simply listening to a lecture, as also emphasized by [Šorytė & Pakalniškienė \(2021\)](#).

The team acknowledges that the results reported here must be viewed in light of several limitations. First, the post-program observation period spanned only two weeks, so it remains uncertain whether these behavioral changes will be sustained in the long term. Second, the test used was limited to ten multiple-choice questions, which may not have fully captured the dimensions of attitudes and skills. Third, the positive results may be partly influenced by the novelty effect, as this type of activity was implemented for the first time at the school. Therefore, claims of the program's success must be understood within this context, and periodic follow-ups are needed to ensure the sustainability of its impact. This aligns with the observations in [Prasetyo et al. \(2020\)](#) regarding the importance of continuous evaluation in the Adiwiyata program, as well as the perspective in [Maryuni \(2024\)](#) that fostering an environmentally conscious character requires a long-term commitment from all school stakeholders.

The program's impact extends beyond the individual level. Flower pots made from recycled plastic jugs, which now adorn the school grounds, make a tangible contribution to the design of the outdoor spaces. Meanwhile, the relief maps created by the students have been utilized by teachers as teaching aids in the classroom, particularly in Social Studies and Arts, Culture, and Crafts. The principal welcomed the entire program series positively and expressed interest in making recycling activities a regular part of the school's routine. This idea aligns with the concept of the circular economy in education as highlighted by the [Wardani & Indira \(2025\)](#), where schools serve not only as places for the transfer of knowledge but also as concrete examples of responsible waste management practices. It is hoped that the partnership between the school and the university, established during the implementation of this program, can be sustained to ensure the continuity of similar initiatives in the future.

CONCLUSION

Overall, the community service program implemented at SDN Panaikang 1 Makassar successfully had a positive impact on students' awareness as well as on the cleanliness and organization of the school environment. This improvement was evident both in the written test results (average score increased from 42.3 to 78.6) and in the results of behavioral observations of students during the two-weeks following the program. Through a combination of outreach, training, and hands-on practice in crafting items from recycled materials, students not only gained theoretical knowledge about the 3R concept but also experienced firsthand the process of transforming items that were initially worthless into functional and aesthetically pleasing products. The flower pots made from used plastic jugs and the relief maps made from cardboard, newspapers, and plywood produced during the activity are now part of the school's assets that can be utilized to support environmental design as well as the learning process in the classroom.

Although the results were quite encouraging, the team recognized that this program had several limitations. The relatively short duration of the program, limited equipment and materials, and a post-program observation period that spanned only two weeks were the main challenges. For the next phase, it is recommended that the school consider establishing a mini-waste bank, conducting regular recycling training, and integrating environmental education into extracurricular activities. Ongoing collaboration between the school, the surrounding community, and universities is a key factor in ensuring the long-term sustainability of this program's impact.

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