

Small Caps, Big Impact: Sustainable Waste Management Through Creative Recycling

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Abstract: Plastic waste management needs to be introduced at an early age through concrete and enjoyable activities so that environmental awareness can be developed through direct experience. Although education about waste management and the use of plastic waste has been widely carried out, creative activities that connect knowledge of the 3R principles with the practical use of plastic bottle caps still need to be developed in community learning settings. This community service program was carried out as part of the Community Service Program (KKN) in RW 01, Cisarua Village, Nanggung District, Bogor Regency. The participants were elementary school children who joined a tutoring program. The activity aimed to provide an understanding of plastic waste management, introduce the principles of *reduce, reuse, recycle* (3R), and develop participants' skills and creativity by using plastic bottle caps to make keychains. The method used an educational and participatory approach through education, demonstration, direct practice, assistance, reflection, and evaluation. The results showed that the participants were able to take part directly in the process of turning plastic bottle caps into useful 22 products and gained experience in reusing waste materials. Cognitively 86% students could answer what 3R means and 80% they knew what to do as their attitude toward sustainability, and 100% they could find the solution by making the product as psychomotoric aspect. This activity shows that making keychains from plastic bottle caps can be a contextual, creative, and participatory way to provide environmental education for elementary school children.

Keywords: plastic waste; plastic bottle caps; recycling; environmental education; creativity

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INTRODUCTION

Plastic waste is one of the environmental problems that needs continuous attention and proper management. Waste management is not only the responsibility of the community to keep the environment clean, but it also needs to be introduced to children from an early age. Introducing waste management to children can help build their knowledge and habits in sorting, reusing, and processing waste. At the elementary school level, waste education can be easier to understand when it is delivered through concrete activities that involve children directly. Syamsuddin *et al.* (2022) showed that recycling plastic waste with elementary school students can help improve their creativity and understanding of waste utilization. Similar activities have also shown that plastic waste can be changed into useful and creative products for elementary school students (Ayunis *et al.*, 2024; Zulfar *et al.*, 2024).

Waste management education for children should also use educational and participatory activities. Mislan *et al.* (2025) explained the importance of introducing waste management to elementary school students from an early age through activities that provide knowledge about proper waste management. Pertiwi *et al.* (2025) also showed that waste sorting education can help improve students' awareness and care about waste. In addition, Hakika *et al.* (2024) found that education about sorting and processing plastic waste can support environmental literacy. These findings show that environmental education should not only provide information but also give children direct experiences in understanding and practicing waste management.

The use of plastic waste as craft material is one activity that can connect environmental education with creative activities. Sahrupi *et al.* (2024), for example, conducted an educational activity about the use of plastic waste with elementary school students. Widyastuti *et al.* (2024) also showed that processing plastic waste into handicrafts can be used as an educational activity for elementary school students while encouraging their creativity. Puspitasari *et al.* (2024) further showed that waste processing activities through project-based learning can involve students directly in the process of managing waste. Other activities have also used plastic waste to create useful products and develop students' creativity (Ayunis *et al.*, 2024; Riyanti & Ismiasih, 2025). These activities provide an alternative way to reduce waste while producing useful and creative products.

One type of plastic waste that can be reused is plastic bottle caps. Bottle caps are easy to find in daily life and can be used as basic materials for different craft products. Asari and Firdaus (2021) reported an environmental literacy and plastic waste processing activity at SDN Krawitan Yogyakarta, including the use of used bottle caps to make keychains. This activity showed that used materials can be changed into craft products through simple practical activities. The use of waste packaging materials can also be developed into creative activities in elementary school settings (Dewi *et al.*, 2024). The use of bottle caps to make keychains has also been applied in other community service programs. Ulumudin *et al.* (2026) conducted an activity using bottle caps to make keychains through education and direct practice with elementary school students. Febrianti *et al.* (2025) also conducted training on making keychains from used bottle caps as a creative product activity. Ihsanuddin and Saraswati (2025) similarly used plastic waste recycling activities to produce creative and useful handicrafts with children. These activities show that plastic bottle caps can be developed into attractive craft products through direct participation. Wulandari *et al.* (2023) also showed that used bottle caps can be processed into accessories through practical training.

Although several community service programs have used plastic waste and bottle caps as craft materials, applying this activity in a tutoring program for elementary school children in a community setting remains relevant as a form of contextual environmental education. Waste processing activities should not only focus on the final craft product but also on giving

children an experience of understanding that used materials can still be reused. Therefore, making keychains from plastic bottle caps was selected as an activity that combines waste management education with creative practice suitable for elementary school children. The activity also provides an opportunity for children to learn about the value and use of waste through direct experience.

Based on these considerations, the activity of using plastic bottle cap waste was carried out as part of the Community Service Program (*Kuliah Kerja Nyata* or KKN) in RW 01, Cisarua Village, Nanggung District, Bogor Regency. The activity was held at the KKN post and involved children who participated in an elementary school tutoring program. The activity was designed using an educational and participatory approach through the delivery of material about plastic waste and the principles of *reduce, reuse, recycle* (3R), a demonstration of keychain making, direct practice, assistance, reflection, and evaluation. Through this approach, participants not only received knowledge about waste management but also had the opportunity to process plastic bottle caps into useful products. The community service activity aimed to provide elementary school children with an understanding of the importance of plastic waste management, introduce the principles of *reduce, reuse, recycle* (3R), and provide skills in using plastic bottle caps to make keychains. In addition, the activity aimed to develop participants' creativity through the process of making products from used materials. These objectives were achieved through education, demonstration, direct practice, assistance, reflection, and evaluation. Through these activities, participants could gain direct experience in changing plastic bottle waste into creative and useful products.

METHOD

This community service activity was carried out as part of the Community Service Program (*Kuliah Kerja Nyata* or KKN) on Thursday, August 13, 2026. The activity took place at the KKN post in RW 01, Cisarua Village, Nanggung District, Bogor Regency. The activity involved 22 children who participated in an elementary school tutoring program and lasted for approximately two hours. The activity was designed as an environmental education program through the use of plastic bottle cap waste to make keychains. The activity was selected to give children direct experience in recognizing and reusing plastic waste through creative activities suitable for elementary school students.

The method used an educational and participatory approach. This approach allowed participants not only to receive information but also to take part directly in the practical activity. The activity plan was prepared by the KKN team according to the tutoring activities held at the KKN post. During the activity, the KKN team acted as facilitators who provided education, demonstrations, assistance, and evaluation. Meanwhile, the participants actively joined the material session and made their own keychains. This approach was used to achieve the objectives of introducing plastic waste management, understanding the principles of *reduce, reuse, recycle* (3R), and developing participants' skills and creativity through the use of plastic bottle caps.

The activity was carried out through several stages (**Figure 1**). First, the participants received education about plastic waste and the principles of 3R. They were introduced to the importance of reducing waste, reusing materials that can still be used, and processing waste into useful products. After the material session, the KKN team demonstrated how to make a keychain from used plastic bottle caps step by step using the prepared materials and equipment. The demonstration was conducted to help participants understand the process before they started making their own products. The next stage was direct practice. Each participant made one keychain from a plastic bottle cap and was given the opportunity to choose the shape, color,

and decoration according to their creativity. During the practice, the KKN team provided assistance and guidance to participants who had difficulties following the steps or completing their products. Direct participation in the activity became an important part of the empowerment process because participants gained experience in changing used materials into creative and useful products.

Evaluation was conducted during and after the activity using specific measurement tools to assess knowledge, practical skills, and creativity. The evaluation tools utilized included an observation checklist during the practical session to monitor participant engagement, and a structured oral question-and-answer (Q&A) alongside a product assessment rubric during the reflection phase. To determine the effectiveness of the program, the following operational success indicators were established: (1) Cognitive indicator: achieved if at least 80% of the participants could correctly recall and verbally state the basic 3R principles during the reflection; (2) Psychomotor indicator: achieved if 100% of the participants successfully transformed a plastic bottle cap into a fully assembled keychain; and (3) Affective indicator: measured by the active participation and enthusiasm observed via the checklist. The keychains made by the participants became the main tangible output of the activity, physically representing the successful reuse of plastic bottle cap waste.



Figure 1. The flow chart of Activity

RESULTS AND DISCUSSION

Results

The activity of using plastic bottle cap waste to make keychains was carried out on Thursday, August 13, 2026, at the KKN post located in RW 01, Cisarua Village, Nanggung District, Bogor Regency. The activity was attended by 22 elementary school children who joined the tutoring program and lasted for approximately two hours. The activity was designed as a practice-based environmental education activity by combining information about plastic waste and the principles of *reduce, reuse, recycle* (3R) with the activity of making creative products from used materials. The activity began with education about plastic waste and the 3R principles. The participants were given an understanding of the importance of reducing waste, reusing materials that could still be used, and processing waste into useful products. The material was followed by a demonstration of how to make a keychain using used plastic bottle

caps as the main material. The KKN team demonstrated each step of the process so that the participants could understand the process before doing the activity themselves.

After the demonstration, all participants took part in making the keychains. Each of the 22 participants made one keychain using plastic bottle caps as the main material. The participants were also given the opportunity to decorate and choose the appearance of their products based on their creativity. During the activity, the KKN team provided assistance and guidance to participants who had difficulties following the steps. Therefore, the activity was not only about providing information but also gave participants direct experience in reusing used materials to make useful products. The level of difficulty of the activity was simple and could be completed by the participants with assistance. The steps could be followed after the participants received an example through the demonstration. However, some parts of the process still required guidance from the KKN team so that the participants could complete their products properly. The activity produced a simple but functional product, namely a keychain that could be used by the participants and also served as an example of reusing plastic waste.

The main output of the activity was 22 keychains, with one product made by each participant (Table 1). In addition to the physical products, the activity provided participants with practical experience in processing used plastic bottle caps. This experience became an initial outcome of the activity because the participants directly learned how to reuse materials that were no longer being used through a creative activity.

Table 1. Results of the Activity on the Use of Plastic Bottle Cap Waste

Component	Results
Number of participants	22 children
Product per participant	1 keychain
Total products	22 keychains
Main material	Used plastic bottle caps
Activity duration	±2 hours

At the end of the activity, the participants took part in a simple reflection and evaluation. They were asked to show their products and recall the material about plastic waste and the 3R principles. The evaluation was carried out by observing the participants' involvement during the education and practice sessions, their ability to follow the steps of making the keychain, and their ability to complete the product. Monitoring was conducted throughout the activity to observe the participants' participation and the process of making the products. Based on the observations during the activity, all participants took part in the practice and produced one keychain each. The activity also created changes in the participants' experience and initial awareness. Through the practical activity, the participants learned that used plastic bottle caps could still be reused to make functional products. The awareness developed through this activity is considered initial awareness gained through direct experience, rather than a long-term behavioral change. This is because the activity was conducted in only one meeting and did not include further measurement to determine whether the participants continued the behavior after the activity.

Documentation of the activity was also part of the program results to show the process and products produced. The documentation included the delivery of education about plastic waste and the 3R principles, the demonstration of keychain making, participants' practice, assistance provided by the KKN team, and the finished keychains. Each documentation item was accompanied by a caption explaining the activity or product shown (Figure 2).



Figure 2. Cutting the bottle caps as the first step in making keychains from plastic waste.



Figure 3. Ironing the cut bottle caps to form a plastic sheet as the base material for the keychain.



Figure 4. Molding the plastic sheet made from bottle caps using a mold to create the keychain design.



Figure 5. The final keychain made from reused plastic bottle caps.

The evaluation results demonstrated significant achievements across the three established indicators, proving that the activity went beyond mere product creation to facilitate genuine learning outcomes and participant empowerment. Cognitively, the structured oral question-and-answer session during the reflection phase revealed that 86% (19 out of 22) of the participants were able to correctly recall and articulate the basic principles of Reduce, Reuse,

and Recycle (3R), successfully surpassing the 80% target. Psychomotorically, the activity reached a 100% success rate; all 22 children effectively transformed their plastic bottle caps into fully assembled and decorated keychains. This outcome highlighted their practical understanding of waste repurposing and their newly acquired fine motor skills. Furthermore, the affective indicator was successfully met, with the observation checklist recording high enthusiasm, focus, and active engagement from the children throughout the session. This positive emotional response indicated a shifting attitude, demonstrating that the children began to value used plastics as materials for creative empowerment rather than mere trash.

Discussion

The results show that using plastic bottle cap waste to make keychains can be used as an environmental education activity that combines knowledge with practical experience. The participants received information about plastic waste management and then directly applied it by reusing bottle caps. This approach is in line with Syamsuddin *et al.* (2022), who showed that plastic waste recycling activities for elementary school students can introduce waste utilization while also developing students' creativity. The direct involvement of the participants also shows that waste management education can be developed through participatory activities. In this activity, the participants did not only listen to the explanation, but also observed the demonstration, practiced making the product, decorated the keychains, and completed the products with assistance. This is in line with Mislani *et al.* (2025), who emphasized the importance of introducing waste management to elementary school children from an early age through educational activities. Pertiwi *et al.* (2025) also showed that waste management education can help develop students' awareness of waste problems.

The use of plastic bottle caps as the main material is also relevant to previous community service activities. Asari & Firdaus (2021) reported the use of plastic waste for craft activities in elementary schools, including making keychains from used bottle caps. The KKN activity applied a similar concept in a tutoring program in the community. The main difference was the setting of the activity, which was held at the KKN post and involved children who joined the tutoring program. The results are also in line with Ulumudin *et al.* (2026), who used bottle caps to make keychains through education and practical activities. This supports the idea that making keychains can connect waste management education with product-making skills. Febrianti *et al.* (2025) also showed the use of used bottle caps in training to make keychains as creative products. In this KKN activity, the keychains were mainly used as a medium for environmental education and as a way to provide creative experiences for children.

The use of plastic waste to make craft products is also in line with Sahrupi *et al.* (2024) and Widyastuti *et al.* (2024). Both studies showed that education and practical activities for processing plastic waste can be applied to elementary school students through creative activities. Meanwhile, Wulandari *et al.* (2023) showed that used bottle caps can be used to make accessory products. These findings support the use of waste-based craft activities as an alternative way to introduce waste management to children through concrete experiences. In terms of suitability to the needs of the activity, using bottle caps to make keychains has several strengths. The activity used bottle cap waste as the main material and produced a useful product. The making process also gave participants an opportunity to be creative by decorating their products. In addition, the results of the activity could be seen directly through the 22 keychains made by 22 participants. This made the concept of reusing waste more concrete because the participants could see the change from used materials into functional products.

However, the activity also had some limitations. The activity lasted for only about two hours, so the education, demonstration, practice, and assistance had to be completed within a limited time. In addition, the activity was conducted in only one meeting, so the outcomes that

could be observed were still at the level of initial experience and awareness. There was no specific instrument, such as a pre-test and post-test or long-term monitoring, to measure changes in the participants' knowledge or behavior quantitatively. Therefore, continued activities and further evaluation are needed if similar programs are expected to measure their impact on participants' waste management habits. Overall, the activity of using plastic bottle cap waste to make keychains produced 22 products from 22 participants and provided direct experience in reusing used materials. Environmental education combined with demonstration, practice, and assistance can be an alternative participatory approach to introduce waste management to elementary school children. In addition to producing creative products, the activity helped develop participants' experience and initial awareness that some plastic waste can still be reused to make functional products.

The success of these learning outcomes underlines the effectiveness of using a direct, participatory approach for environmental education among elementary school students. By integrating hands-on practice specifically transforming bottle caps into keychains into 3R education, students transition from passive listeners to active agents in the waste management process. This finding aligns with Rudiyanto *et al.* (2021), who assert that direct practical involvement in 3R activities significantly stimulates children's environmental concern and serves as an effective learning process for shaping positive waste management behavior. Introducing these concepts through engaging and creative means is critical during the foundational phases of learning. Aiko *et al.* (2024) further support this, noting that interactive environmental education focused on plastic waste is a highly practical method to instill sustainable, pro-environmental attitudes from a young age. Therefore, the keychain production in this community service activity functioned not just as a final output, but as a tangible educational tool that successfully translated theoretical 3R concepts into internalized cognitive knowledge, physical skills, and positive environmental behaviors.

CONCLUSION

The activity of using plastic bottle cap waste to make keychains showed that waste-based craft activities can be a concrete and participatory form of environmental education for elementary school children. The activity involved 22 participants and produced 22 keychains, with each participant making one product. Through education, demonstration, direct practice, and assistance, participants gained experience in applying the *reduce, reuse, recycle* (3R) principles and learned that used plastic bottle caps can be turned into useful products. Although the activity was conducted in only one meeting, it provided initial experience and awareness about reusing plastic waste. Future activities are recommended to be conducted continuously with further evaluation and monitoring to see long-term changes in participants' waste management habits.

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