



The Role of Community Service Students in Transforming Plastic Bottle Waste into Pencil Holders for Children in Ajuen Jeumpet Village

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Abstract

Waste management is a growing global issue driven by population growth and human activities. In Indonesia, waste generation reaches tens of millions of tons annually, dominated by household and plastic waste that is difficult to decompose and poses long-term environmental risks. This problem is also evident in Aceh Province, particularly in Aceh Besar Regency, where increasing waste volumes are not matched by adequate infrastructure or public awareness. Unsustainable practices such as open burning and improper disposal are still common. At the local level, including Jeumpet Ajuen Village, plastic waste accumulation and limited awareness among children regarding waste utilisation remain significant challenges. Therefore, a participatory educational approach through the Community Service Program (CSP) was implemented. This program applied interactive education and hands-on practice by transforming plastic bottles into functional products, such as pencil holders, using the 3R principles (Reduce, Reuse, Recycle). The program involved 25 children and demonstrated positive outcomes, with most participants successfully creating useful products and showing improved awareness. This activity aims to enhance children's knowledge, creativity, and environmental responsibility from an early age, while reducing improper waste disposal practices.

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1. Introduction

Waste management has become a critical global issue driven by rapid population growth and increasing human activities. Globally, approximately 40% of waste is not properly managed, and total waste generation is projected to reach 3.4 billion tons by 2050, highlighting the urgency of sustainable waste management practices [1], [2]. The production of plastic continues to increase annually, while waste management systems often fail to keep pace, resulting in significant environmental challenges [3]. Consequently, plastic waste has emerged as one of the most pressing environmental concerns worldwide, including in developing countries such as Indonesia [4].

At the national level, Indonesia faces serious challenges in waste management, with total waste generation reaching approximately 68.7 million tons annually, dominated by household and organic waste [5], [6]. A significant proportion of this waste, over 65%, is still disposed of in landfills without proper processing, reflecting inefficiencies in the waste management system [6]. In addition, national

waste generation data indicate that plastic waste contributes substantially to environmental degradation due to its persistence in ecosystems [7]. These conditions underscore the need for integrated and sustainable waste management strategies at both national and local levels [8].

Plastic waste is particularly problematic due to its non-biodegradable nature, leading to long-term accumulation in terrestrial and aquatic ecosystems [9]. In rural areas, these issues are often exacerbated by limited infrastructure, lack of waste segregation practices, and low public awareness regarding recycling and reuse [10], [11]. Conventional waste-handling methods, such as open burning and dumping into rivers, remain prevalent, contributing to air pollution and environmental degradation [12], [13]. These practices not only harm ecosystems but also pose serious risks to public health [14].

Similar challenges are evident in Aceh Province, where waste generation continues to increase alongside population and economic growth, while waste management systems remain inadequate [15]. At the district level, Aceh Besar Regency produces approximately 151.88 tons of waste per day, with a significant portion managed through open dumping systems that do not meet environmental standards [16]. Plastic waste accounts for a significant share of total waste, further exacerbating long-term environmental risks if not properly managed [16]. These conditions highlight the urgency of implementing effective waste management interventions at the local level [17].

Higher education institutions play a strategic role in addressing these challenges through community service programs such as Kuliah Kerja Nyata (KKN). University students act as facilitators and agents of change by bridging academic knowledge with practical community needs [18], [19]. Previous studies have shown that student-led participatory and educational approaches can significantly improve community awareness and behaviour regarding waste management [20], [21]. Interactive education and upcycling practices have proven effective in enhancing public understanding and promoting sustainable waste utilisation [9], [22].

Children represent a critical target group for environmental education, as early exposure to sustainable practices can shape long-term behaviour and environmental responsibility [23]. However, environmental education in schools is often theoretical and lacks practical application [24]. Therefore, innovative and engaging approaches are needed to instil environmental awareness among children. Transforming plastic waste into functional products, such as pencil holders, provides a simple yet effective way to introduce the 3R (Reduce, Reuse, Recycle) principles while fostering creativity and practical skills [25], [26].

This study and community service activity aim to enhance children's knowledge, awareness, and skills in managing plastic waste through a participatory and hands-on approach. The novelty of this work lies in integrating environmental education with creative upcycling practices specifically targeted at children in rural areas, combined with the active role of CSP students as facilitators. Unlike previous programs that focus primarily on awareness, this approach emphasises skill-based learning and direct product creation to drive behavioural change. The expected contribution is the development of sustainable environmental behaviour from an early age, the reduction of improper waste disposal practices, and the creation of simple, value-added products from plastic waste.

2. Methodology

This study employed a participatory and educational approach through a community service program integrated with CSP. The method combined interactive learning with practical activities to improve children's awareness and skills in plastic waste management. The approach was chosen to ensure active engagement between facilitators (CSP students) and participants, enabling effective knowledge transfer through both theoretical explanation and hands-on experience.

2.1. Approach

The program used a participatory education model comprising socialisation, interactive lectures, and practical demonstrations. The activities focused on introducing environmental health concepts and the importance of plastic waste recycling using the 3R principles (Reduce, Reuse, Recycle). This approach emphasised two-way communication to enhance participants' understanding and involvement.

2.2. Location and Participants

The community service activity was conducted in Jeumpet Ajuen Village, Darul Imarah District, Aceh Besar Regency. The participants were 25 children selected through purposive sampling based on their relevance to the program objectives, particularly their limited prior knowledge of plastic waste utilisation.

2.3. Implementation Stages

The program was carried out in three main stages:

- 1) **Socialisation Stage:** Participants were introduced to the environmental impacts of plastic waste and the importance of proper waste management through simple and engaging explanations.
- 2) **Demonstration Stage:** CSP students demonstrated safe techniques for cutting, shaping, and decorating plastic bottles into pencil holders. The demonstration included step-by-step guidance to ensure participants understood the process.
- 3) **Practical Stage:** Participants independently created pencil holders from used plastic bottles under the facilitators' supervision. This stage emphasised creativity, skill development, and application of 3R principles.

2.4. Tools and Materials

The materials used in this activity included used plastic bottles (600 ml–1500 ml), decorative materials such as origami paper, gift wrap, or ice cream sticks, and additional accessories like beads and ribbons. Tools included scissors, cutters, glue guns, adhesives, markers, and rulers to ensure precision and safety during production.

2.5. Intervention and Duration

The intervention was conducted in a single session lasting approximately 60–90 minutes. It consisted of a short lecture on environmental health and plastic waste recycling, followed by a question-and-answer session and hands-on practice. This structure was designed to maximise learning efficiency within a limited timeframe.

2.6. Data Collection and Evaluation

Data were collected through direct observation of participant engagement, creativity, and ability to complete the assigned tasks. The evaluation focused on participants' understanding of waste management concepts, their practical skills in creating recycled products, and behavioural changes observed during the activity. Descriptive analysis was used to interpret the program's outcomes.

3. Result & Discussion

The implementation of this community service program demonstrates the important role of participatory education in improving children's awareness and behaviour toward plastic waste management. Through interactive socialisation, demonstrations, and hands-on practice, participants were not only introduced to environmental concepts but also directly involved in transforming plastic waste into useful products. This approach aligns with experiential learning principles, which hold that knowledge is more effectively understood when participants actively engage in practical activities. The involvement of CSP students as facilitators further strengthened the learning process by bridging theoretical knowledge with real-life applications in the community.

Furthermore, this activity's results indicate that combining environmental education with creative recycling practices can significantly enhance children's motivation and skills. The process of converting plastic bottles into pencil holders provided a simple yet meaningful experience, encouraging participants to view waste as a resource rather than a problem. This activity also helped foster environmentally responsible behaviour from an early age, which is essential for long-term sustainability. Therefore, this program not only addresses local waste issues but also fosters community-based environmental awareness through innovative, practical approaches.



Figure 1. Educational Activity on Plastic Waste Recycling into Pencil Holders for Children in Jeumpet Ajuen Village

Figure 1 illustrates an educational session conducted by CSP students to introduce plastic waste management concepts to children in Jeumpet Ajuen Village. In this stage, the facilitators deliver explanations about the environmental impacts of plastic waste and the importance of applying the 3R principles (Reduce, Reuse, Recycle). The interactive nature of the session is evident in the children's active participation, which is facilitated through direct communication, demonstrations, and question-and-answer sessions. The presence of recycled plastic bottle products, such as decorated pencil holders, serves as a visual aid that helps participants better understand the concept of waste utilisation. This approach reflects the effectiveness of experiential learning, where visual and practical examples enhance comprehension among young learners.

Furthermore, the activity shown in **Figure 1** highlights the role of CSP students as facilitators and motivators in fostering environmental awareness at an early age. The learning environment is designed to be informal and supportive, allowing children to feel comfortable and actively participate in the session. The interaction between facilitators and participants indicates a two-way communication process, which is essential in participatory education. This initial stage plays a crucial role in building a foundation of knowledge before moving to practical activities. As a result, children not only gain theoretical understanding but also develop a positive attitude toward environmental responsibility, which is expected to influence their sustainable waste management behaviour.

Figure 2 depicts the demonstration and mentoring session conducted by CSP students to guide children in creating pencil holders from used plastic bottles. At this stage, the facilitators provide step-by-step instructions for safely cutting, shaping, and decorating plastic bottles into functional products. The presence of direct assistance ensures that participants can follow the process correctly while minimising the risks associated with using tools such as scissors and cutters. The interaction between facilitators and children reflects an applied learning approach, where theoretical knowledge introduced in the previous stage is translated into practical skills. This hands-on demonstration is essential for enhancing participants' understanding of recycling processes and reinforcing the concept of utilising plastic waste.



Figure 2. Demonstration and Mentoring Session on Creating Pencil Holders from Plastic Bottles for Children

Furthermore, the mentoring process shown in **Figure 2** highlights the importance of guidance and supervision in skill-based learning activities, especially for children. The close interaction between CSP students and participants creates a supportive learning environment that encourages confidence, creativity, and active participation. Through this guided practice, children can develop fine motor skills, improve their ability to follow instructions, and express their creativity when decorating the products. This stage also strengthens the internalisation of environmental values, as participants directly experience how waste materials can be transformed into useful and aesthetically pleasing items. Consequently, the activity not only builds practical skills but also fosters a positive attitude toward sustainable waste management.

Figure 3 illustrates the hands-on activity where children actively participate in decorating recycled plastic bottles into functional pencil holders. At this stage, participants apply the knowledge and skills obtained from previous sessions by engaging directly in the creative process. The use of colourful materials, such as decorative sticks, paper, and accessories, encourages children to express their creativity while transforming waste into useful products. This activity not only strengthens their understanding of recycling concepts but also promotes fine motor skill development and artistic expression. The close interaction among participants further fosters collaborative learning, allowing them to share ideas and techniques during the decoration process.

Moreover, this practical activity highlights the effectiveness of experiential learning in reinforcing environmental education among children. By directly engaging in the transformation of plastic waste, participants develop a deeper appreciation for the value of reused materials and the importance of sustainable practices. The activity also enhances problem-solving skills as children learn to adapt materials and design their own products. This stage plays a crucial role in shaping positive environmental behaviour by enabling participants to internalise the concept of waste reduction through

meaningful, enjoyable experiences. Ultimately, the hands-on approach helps build long-term awareness and responsibility for environmental conservation.



Figure 3. Children's Hands-on Activity in Decorating Recycled Plastic Bottles into Functional Pencil Holders

Figure 4 illustrates the collaborative learning process among children and CSP students during the plastic waste recycling activity. In this stage, participants are grouped to work collaboratively to transform used plastic bottles into functional products. The group-based approach encourages interaction, communication, and teamwork among participants, allowing them to exchange ideas and support one another throughout the activity. The presence of CSP students as facilitators ensures that each group receives adequate guidance, helping participants overcome challenges during the recycling process. This collaborative setting not only enhances learning effectiveness but also promotes social skills such as cooperation, responsibility, and mutual assistance.

Moreover, the activity shown in **Figure 4** highlights the importance of peer learning in strengthening environmental education outcomes. By working in groups, children are more motivated and engaged, as they can learn from their peers while actively participating in the task. This approach fosters a sense of collective responsibility toward environmental conservation, as participants realise that waste management is a shared concern. The collaborative process also supports creativity and problem-solving, as each group develops unique designs and solutions based on available materials. Ultimately, this stage reinforces both cognitive and social learning, contributing to the development of sustainable environmental behaviour among children.



Figure 4. Collaborative Learning Process of Plastic Waste Recycling into Functional Products among Children

The novelty of this study and community service activity lies in integrating participatory environmental education with creative, hands-on upcycling practices specifically targeted at children in rural areas. Unlike conventional environmental education programs, which are often theoretical, this approach combines interactive learning, direct skill application, and product-based outcomes by transforming plastic waste into functional items, such as pencil holders. Additionally, the active involvement of CSP students as facilitators bridges academic knowledge with community needs, creating a more contextual and impactful learning experience. This study also emphasises the formation of early-age environmental behaviour through experiential learning, which not only enhances knowledge and skills but also fosters long-term environmental responsibility. Therefore, the program provides a practical, innovative model for community-based waste management education that is both sustainable and easily replicable in similar rural settings.

4. Conclusion

This study demonstrates that participatory, hands-on environmental education implemented through a CSP-based community service program is effective in improving children's knowledge, skills, and attitudes toward plastic waste management. The integration of interactive learning with practical upcycling activities, specifically transforming plastic bottles into functional pencil holders, enabled participants to understand and apply 3R principles in a meaningful way. The results indicate high engagement and successful task completion among participants, reflecting the effectiveness of experiential learning in fostering environmental awareness at an early age. Moreover, the involvement

of university students as facilitators played a crucial role in bridging academic concepts with community practices, enhancing both learning outcomes and community participation. This program not only helps reduce improper waste disposal but also promotes sustainable habits and creativity among children. Therefore, this approach offers a scalable, replicable model for community-based environmental education, particularly in rural areas with limited waste-management infrastructure.

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