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Community Knowledge Enhancement in Waste Management for a Healthy Environment Through the "Benderang Sentosa" Program

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Abstract Waste management remains a critical issue related to environmental health. Insufficient knowledge in waste management contributes to environmental degradation, including soil, water, and air pollution, and serves as a potential source of diseases. This community service initiative aimed to implement the "Benderang Sentosa" Waste Management Program to enhance community knowledge of waste management practices. The program involved health education and training sessions conducted three times over three weeks. A total of 60 school-age children and 50 health cadres participated. Community knowledge was assessed using a pre-developed questionnaire. Descriptive data were analyzed to compare pre- and post-intervention results. The main result shows that the knowledge level of health cadres about waste management increased by 76%. Similarly, 75% of school-age children demonstrated a significant improvement in their understanding of waste management. The "Benderang Sentosa" Waste Management Program effectively increased community knowledge, contributing to better waste management practices and supporting the goal of a healthier environment.

1. INTRODUCTION

Waste management is a vital component of efforts to achieve the Sustainable Development Goals (SDGs) by 2030, representing a cross-sectoral challenge. Even small-scale waste management actions play a significant role in mitigating various negative environmental, economic, and social impacts while delivering substantial benefits (Elsheekh et al., 2021). Environmental cleanliness and health are critical issues, as they directly influence future quality of life. Among the contributors to waste, household waste is particularly significant, as it substantially increases waste volumes in Indonesia. Bedayu Talang, with its relatively large population, faces a heightened risk of generating significant amounts of waste. As the population grows, so does waste production (Asih et al., 2022).

Waste is generally categorized into two types: organic waste and inorganic waste. The size of a community's population significantly influences the volume of waste generated in the environment. One major contributor to waste in Indonesia is household waste (Apriliana et al., 2022). Household waste plays a substantial role in increasing the overall waste volume in the country. Improper disposal of household waste, such as littering, poses significant challenges to the surrounding environment. The issues arising from unmanaged waste include both physical and social health problems. Studies indicate that individuals living within 5 kilometers of waste disposal sites face a significantly higher risk of developing health conditions such as asthma, tuberculosis, diabetes, and depression, even after accounting for various socio-economic factors (Tomita et al., 2020).

Bedayu Talang Village, located in Senduro District, Lumajang Regency, spans an area of 2.92 km² and is home to 8,723 residents (https://sid.kemendesa.go.id/profile). Preliminary observations in the Krajan and

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Sumbersari areas have revealed a significant issue: ditches are frequently filled with rubbish. Interviews with community leaders and residents highlighted an urgent need for education on effective waste management. Currently, residents predominantly dispose of both organic and inorganic waste using unsustainable methods, such as the cover-dig technique or open burning near their homes. A substantial amount of plastic waste is also discarded without any meaningful recycling or reuse efforts. Furthermore, the available infrastructure for waste collection, particularly garbage bins, is severely inadequate. Data from Dinas Lingkungan Hidup Lumajang (2023) indicates that household waste is the largest contributor to the region's total waste, accounting for 40.25%. This significant volume is driven by various human activities tied to modern consumption needs, such as food packaging and discarded household items. The accumulation of household waste reflects current lifestyle and consumption patterns, emphasizing the urgent need for effective waste management systems and the adoption of sustainable practices.

To effectively address the waste problem, several key solutions can be implemented: (1) enhance Public Awareness: Launch educational campaigns to emphasize the importance of proper waste management and its environmental, social, and health impacts, (2) implement Supportive Policies: Develop and enforce policies that promote sustainable waste management practices, including waste reduction, recycling, and reuse, (3) Invest in Infrastructure: Build and improve facilities such as designated waste disposal sites, recycling centers, and eco-friendly waste processing systems to support proper waste management, (4) promote Community Engagement: Encourage active participation in waste management initiatives, such as organized waste separation and recycling programs, to foster collective responsibility, and (5) incorporate Waste Management Education: Include waste management topics in school curriculums, ensuring that literacy and reading components are integrated to build awareness from an early age. By adopting these strategies, meaningful progress can be made in tackling the waste problem effectively and sustainably.

2. METHOD

This community service, part of The 182 KKN UMD group activity, carried out a program under the tagline "Benderang Sentosa" (an acronym for Bangun Desa Peduli Lingkungan, Bedayutalang Bebas Sampah). The activity was conducted in several stages, as illustrated in Figure 1. These stages consisted of the following.

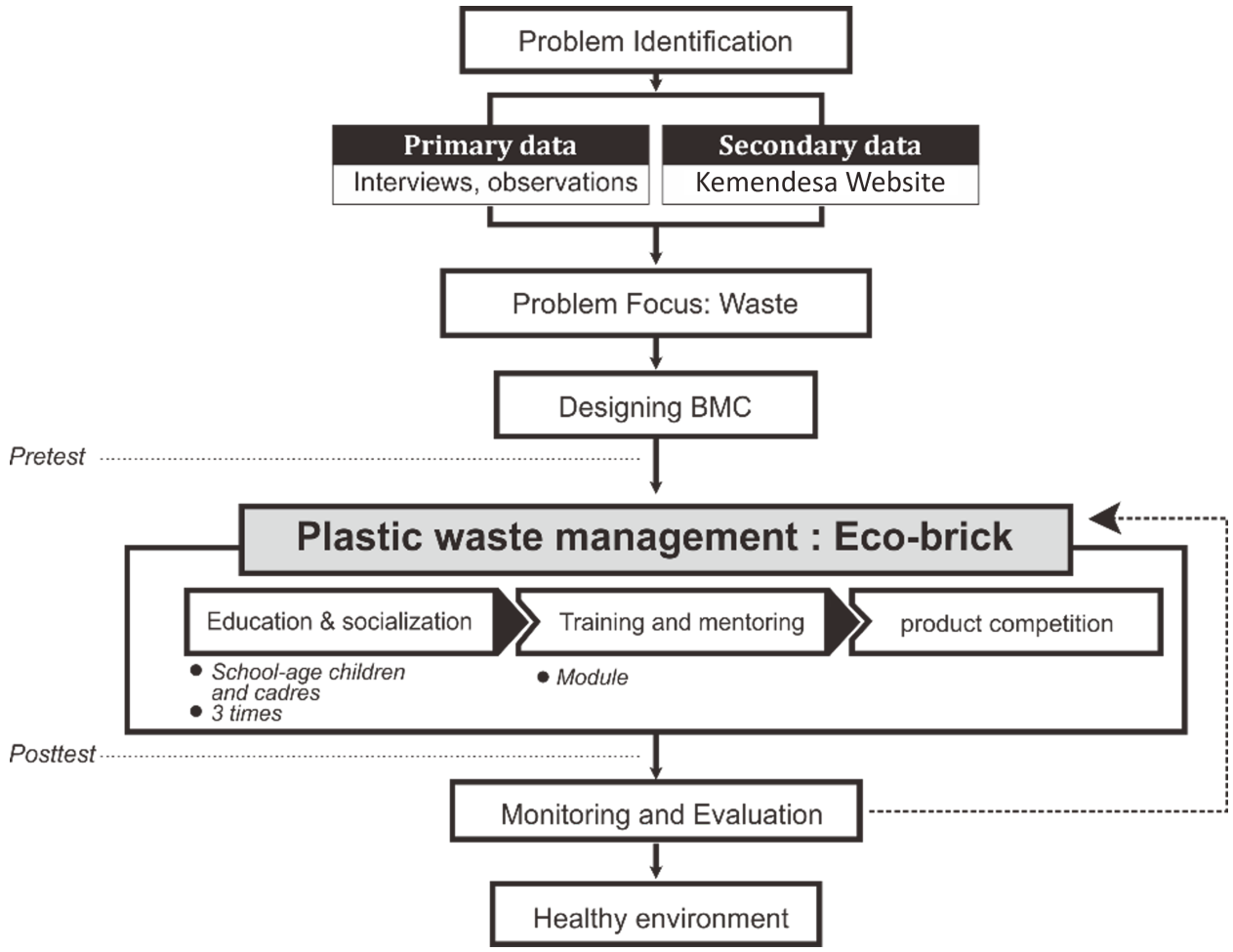

Figure 1 . The stage of community services process

2.1 Survey for problem identification

The survey was conducted through interviews and observations with the village head. Observations revealed significant garbage accumulation in various areas, along with a lack of waste sorting, resulting in a mixture of organic and non-organic waste. The interview with the village head indicated that the community lacked sufficient understanding of the waste management process. These findings highlighted two key issues as priorities: waste management and cardamom processing.

2.2 Focus group discussion for planning the community services activity

The Community Service Team, consisting of nursing lecturers, students engaged in KKN, two health cadres, the village head, and four residents, conducted a Focus Group Discussion (FGD). The outcomes of the FGD identified several initiatives to address the waste management issues within the village.

a. Targets of community service activities
   The target groups for the community service activities were health cadres and school-age children. This selection was intentional, as health cadres were expected to educate community members in their respective neighborhoods (RTs) about effective waste management practices. Additionally, involving school-age children in the training aimed to instill early education on waste management, enabling them to adopt these practices effectively from a young age.

b. Community service material topics
   The focus group discussion concluded that the materials for the cadre group consisted of waste management policies, the waste management process, Ecobricks, eco-enzymes, maggot farming, waste banks, and opportunities for entrepreneurship in the waste sector. In contrast, the materials for the schoolchildren's group comprised a simpler selection, focusing on an introduction to waste management and a practical example of effective waste management practices.

2.3 The community service activity

Our activity spanned three weeks and targeted two distinct groups: a cadre group comprising 50 committed members from Bedayu Talang Village and a cohort of schoolchildren from grades 4, 5, and 6 at Bedayu Talang Elementary School. During this period, the cadre group attended three meetings, which included collaborative projects aimed at fostering community engagement. Simultaneously, the schoolchildren participated in five interactive sessions featuring hands-on activities designed to encourage teamwork and instill a sense of responsibility. The health cadres were drawn from various community segments, including youth organizations, Banser (Barisan Ansor Serbaguna), religious leaders, community leaders, and waste cadres. To support the learning process, the community service team actively distributed informative leaflets. Among these was the BMC (Business Model Canvas) leaflet, which stood out as a comprehensive guide to the waste management training. It provided participants with an overview of the training, including engaging activities and a detailed schedule to ensure a structured and effective learning experience.

The educational component for the cadre group was conducted over three sessions. The first meeting, held during the first week, featured a 60-minute presentation on waste management policies in Lumajang, delivered by the Head of Lumajang Regency. This was followed by a 60-minute discussion on the Village Sustainable Development Goals (SDGs) and waste management, led by the Healthy Lumajang Forum (FLS). In the second week, participants were introduced to Ecobricks, eco-enzymes, maggots, and waste banks in a 40-minute session, followed by a 20-minute demonstration. The third week focused on entrepreneurship opportunities within the waste sector, with a 60-minute presentation facilitated by nursing lecturers and students. All activities were held in the village meeting hall, providing an accessible and collaborative environment for learning and discussion.

Three meetings were conducted for school-age children. In the first meeting, the Healthy Lumajang Forum (FLS) facilitated a 40-minute session on the 3R principles of waste management (Reduce, Reuse, Recycle). The second meeting, also lasting 40 minutes, focused on environmental health and waste management, presented by health center officers with expertise in public health and waste management. The third meeting involved nursing lecturers and students, who provided material and conducted a demonstration on making Eco-bricks. Additionally, community service activities tailored to each class of school-age children were organized to reinforce the learning objectives.

2.4 Evaluation

Evaluation activities were conducted before and after the waste management training. The community service team developed a questionnaire to assess participants' knowledge. The questionnaire included questions designed to evaluate understanding of waste management concepts, ensuring a comprehensive measure of the program's impact.

3. RESULT AND DISCUSSION

Most of the cadres were female, accounting for 84% of the total. Over half (52%) possessed a senior high school education, and the average age was 38 years. The youngest cadre was 28 years old, while the oldest was 55. Among the school-age children, the average age was approximately 11 years, with females comprising the majority at 55% (Table 1).

After three weeks of the education intervention and training, the knowledge of cadres and school-age children improved significantly. Before the intervention, 50% of the cadres had a sufficient understanding of waste management, which increased to 76% at a reasonable level after the

Table 1 . Characteristic demography of respondents

Parameter	f (frequency)	% (percentage)	Mean
Cadres age (years)			38.06
Cadres gender			
Female	42	84	
Male	8	16	
Cadres education Level			
Junior high school	24	48	
Senior high School	26	52	
School-age children age (years)			10.9
School-age children gender			
Female	33	55	
Male	27	45	

training (Figure 2). Similarly, most school-age children initially displayed poor knowledge of waste management, with 68% falling into this category. Following the education and training, their knowledge improved remarkably, with 75% now demonstrating a good understanding of the subject (Figure 3).

Before receiving education and training on waste management, most cadres and school-age children were unfamiliar with the different waste types, proper sorting methods, and effective waste management practices. However, after the training was implemented, the majority demonstrated significant improvement in their understanding. Despite this progress, a small percentage—4% of cadres and 3% of school-age children—still exhibited a limited grasp of the concepts.

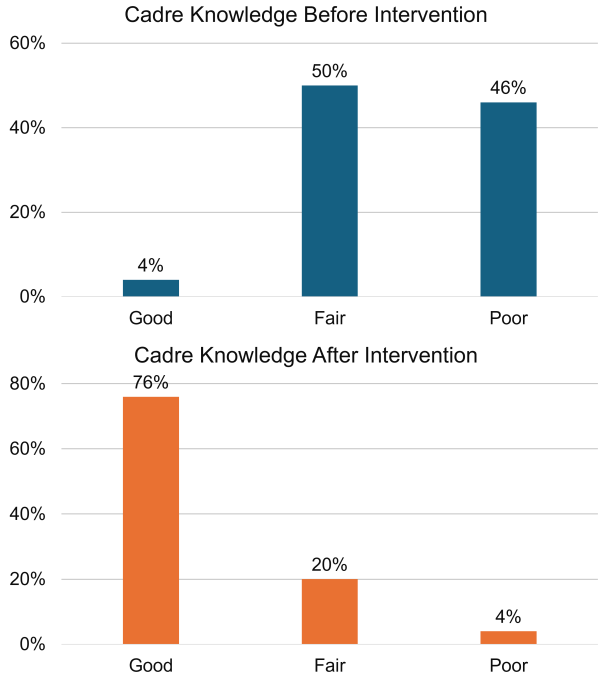

Figure 2 . The changes in the knowledge levels of cadres before and after the three-week waste management education and training program

Communities, particularly in rural areas, often lack sufficient information about environmental literacy. Environmental literacy encompasses individual knowledge and understanding of environmental components, principles of ecological processes, and the ability to take action to preserve environmental quality in daily life. To foster environmental literacy, environmental education must cultivate an understanding of ecological systems, highlight the cause-and-effect relationship between human behavior and environmental health, and promote responsible actions toward the environment (Riyanto, 2020).

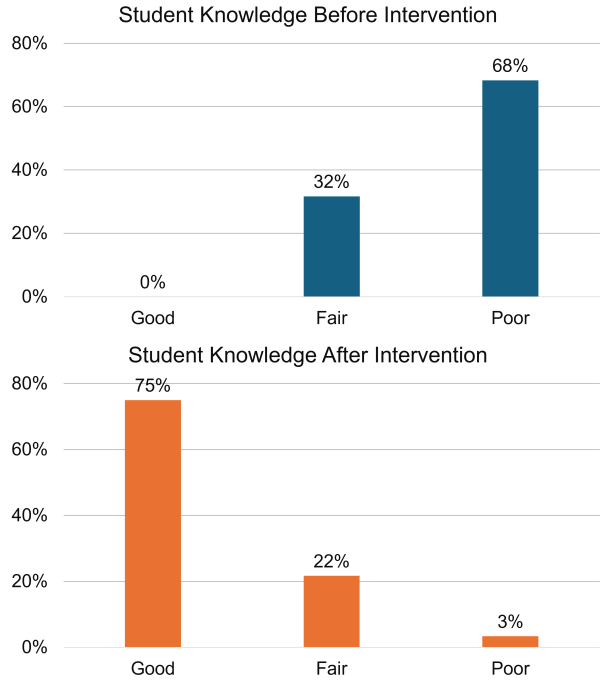

Figure 3 . The changes in the knowledge levels of school-age children before and after a three-week waste management education and training program

Health education and socialization efforts often target school students to raise awareness and encourage behavioral changes within the community, particularly regarding the health impacts of exposure to hazardous waste (World Health Organization, 2021). Schoolchildren are a key target for health education as they represent a vulnerable group with significant potential to develop healthy habits that can positively influence their health throughout their lives. Children are generally more receptive to new information and habit formation.

Educating them helps instill the importance of health and encourages the development of healthy living practices from an early age. During their period of rapid growth and development, health education can support them in understanding essential aspects such as balanced nutrition, physical activity, personal hygiene, and proper sleep patterns for optimal growth.

Additionally, children are often more susceptible to infections and other illnesses. Health education can equip them with the knowledge to prevent diseases, such as effective handwashing, maintaining a clean environment, and minimizing exposure to sick individuals. Moreover, children have the unique potential to become agents of change within their families and communities. By understanding health principles, they can share their knowledge and encourage healthy practices among those around them.

Providing health education to schoolchildren is a long-term investment in the future. Equipping them with the necessary knowledge and skills prepares them to become a health-conscious generation capable of making informed health decisions and contributing to the development of healthier societies.

The topics presented were aligned with programs developed by the Lumajang district, including Eco-brick, Eco-enzyme, and maggot farming. Eco-enzyme is a liquid extract derived from fermenting leftover vegetables and fruit with sugar (Septiani et al., 2021). This method is particularly suitable for application in Bedayu Talang, considering that a significant portion of the household waste produced in the area consists of vegetable waste. Another waste processing initiative is Eco-brick production. Eco-bricks are made by filling used plastic bottles with waste materials such as plastic bags, Styrofoam, and other plastic items. These Eco-bricks can then be repurposed into valuable items like cupboards, trash cans, tables, and more. This recycling effort effectively reduces the volume of plastic waste, contributing to waste management and environmental conservation (Palupi et al., 2020).

Meanwhile, the education sessions also covered the use of maggots in waste management. Maggots are considered highly effective in degrading organic waste compared to other insects. They produce a byproduct known as cassava, which can be used as compost to support vegetable cultivation. Additionally, maggots offer significant benefits as a source of animal feed due to their high nutritional content. They contain 43.42% protein, 17.24% fat, 18.82% crude fiber, 8.70% ash, and 10.79% water, making them a valuable resource for sustainable agriculture and animal husbandry (Siswanto et al., 2022).

Health education has led to a significant increase in knowledge levels among both school-age children and adults. These findings align with research conducted by Isni & MustanginahA (2023), which demonstrated that health education effectively enhances understanding of waste management practices.

Community service participants showed great enthusiasm and creativity in creating items from waste materials. School students were also taught composting techniques, which provide a practical solution to waste management challenges while fostering a sense of environmental responsibility (Mpuangnan et al., 2023). The community has yet to fully experience the benefits of eco-enzyme assistance, as the production process is still ongoing. However, the implementation of eco-bricks has already yielded tangible results, with the production of items such as trash cans, bookcases, tables, and flower pots.

Our dedicated team launched an innovative fundraising campaign to ensure the long-term sustainability and continuity of our community service initiative. Over two weeks, we actively engaged the public through dynamic social media platforms such as Instagram and WhatsApp chain messages. This outreach effort successfully collected 102 reading books, encompassing a variety of genres and interests. In our mission, we collaborated closely with the school and the Lumajang Regional Library (Perpusda), fostering a strong partnership that significantly enriched the project. Together, we aimed to promote literacy and provide valuable reading resources for the community. This collaboration was further strengthened by Perpusda's contributions, which included training for library managers and teachers. Additionally, Perpusda provided books on a loan basis to schools for a set period (three months), after which the books could be exchanged for other collections of reading materials.

Providing education as early as possible is essential. Beyond its critical importance, education shapes character, broadens horizons, instills an understanding of ethics, and equips individuals with career skills. Non-formal education for children should be implemented progressively to complement and enhance formal education. One such focus is fostering children's interest in reading. A lack of interest in reading is a significant factor contributing to low environmental awareness among children (Aulia et al., 2021). In the context of literacy and reading among school-age children, waste management presents a relevant and practical topic to introduce. By learning about waste management, children can develop a sense of responsibility for maintaining a clean environment and understand how their actions can reduce the negative impact of waste on the ecosystem. This approach not only promotes literacy but also encourages sustainable behavior from an early age.

4. CONCLUSION

The "Benderang Sentosa" program in Bedayu Talang Village has successfully enhanced knowledge about waste management among school children and community leaders. Children have shown increased interest in reading about waste in local libraries, and the community has become more proactive in practicing the principles of reducing, reusing, and recycling waste. As a result, there has been a noticeable decline in littering and waste burning, contributing to improved environmental health.

To sustain and expand these positive outcomes, government support is essential for scaling the program to other villages facing similar environmental challenges.

Collaboration among health cadres, the Environmental Service, the Healthy Lumajang Forum, digital cadres, and BUMDes (village-owned enterprises) will be key to furthering community entrepreneurship and ensuring the long-term success of the initiative.

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CONFLICT OF INTERESTS

The authors of this manuscript declare that there are no conflicts of interest.

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