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Innovation in Sustainable Plastic Waste Management through Ecobrick Technology as an Effort to Realize an Environmentally Friendly Village

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Abstract: The problem of plastic waste is still a serious challenge in environmental management, especially at the village level which has limitations in an integrated waste management system. The accumulation of plastic waste that is not managed properly can have a negative impact on the environment and public health. This Community Service Activity (PKM) aims to implement innovations in sustainable plastic waste management through ecobrick technology by involving the community and students as agents of change in realizing environmentally friendly villages. The method of implementing activities uses a participatory-educational approach which includes the preparation stage, socialization, ecobrick making training, collaborative implementation between the community and schools, and monitoring and evaluation. The results of the activity show that there is an increase in public and student knowledge about plastic waste management, an increase in skills in making ecobricks, and the beginning of behavioral changes in reducing and sorting plastic waste at the source. The involvement of students has proven to be effective in expanding the impact of environmental education to families and the surrounding community. However, the sustainability of the program still requires institutional strengthening and sustainable mentoring. In conclusion, ecobrick technology based on community and student participation is an effective strategy in supporting sustainable plastic waste management and realizing environmentally friendly villages.

Keyword: Ecobrick, Plastic Waste, Community Service, Eco-Friendly Village, Circular Economy

INTRODUCTION

The problem of plastic waste is an increasingly urgent global environmental issue along with the increasing consumption activities of modern society. The world's plastic production continues to increase significantly, while the level of management is not optimal so that most of it ends up polluting the environment. Studies show that around 60–80% of marine waste comes from land that is not well managed, with the dominance of plastic materials that are

difficult to decompose naturally (Jambeck et al., 2015; Geyer et al., 2017). This condition confirms that plastic waste management requires an approach that is not only technical, but also based on changes in people's behavior.

At the local level, especially in urban areas, the problem of plastic waste is increasingly complex due to the limited waste management infrastructure, low public awareness in waste sorting, and the still dominant single-use consumption pattern. This condition is exacerbated by the lack of involvement of young age groups in environmental management activities, even though students are agents of change who have great potential in forming a culture of environmental care from an early age. Without appropriate educational interventions, this pattern of behavior has the potential to continue and worsen the environmental conditions of settlements.

One of the innovative approaches that is developing is the use of ecobricks, which is a method of managing plastic waste by putting and compacting plastic waste into used plastic bottles until it becomes a solid material that can be reused. Ecobricks are not only a technical solution for waste reduction, but also a practical learning medium in building environmental awareness. According to Wilson et al. (2015), the success of sustainable waste management is largely determined by the integration between technical aspects and the active participation of the community, including educational groups.

The involvement of students in the ecobrick program is very strategic because school is a space for building long-term character and habits. Through educational activities, training, and direct practice of making ecobricks in the school and community environment, students can be trained to understand the concept of reduce, reuse, and recycle applicatively. In addition, student involvement can also accelerate the spread of environmental innovations to families and surrounding communities, thereby creating a multiplier effect in changing people's behavior.

The concept of ecobricks is also in line with the principle of the circular economy, which emphasizes waste reduction through the reuse of materials. UNEP (2021) emphasizes the importance of the role of communities and educational institutions in accelerating the transition to a sustainable waste management system. Thus, the integration between the community and students in the ecobrick program is a relevant approach in building a more conscious and responsible environmental ecosystem.

However, the implementation of ecobricks still faces challenges, especially in terms of consistency of participation, technical understanding, and program sustainability. Therefore, a community service program is needed that not only focuses on technical education, but also strengthens collaboration between the community and students as a driving force for environmental behavior change.

Thus, ecobrick-based plastic waste management innovations through the involvement of students are expected to be an effective strategy in realizing environmentally friendly villages, through strengthening environmental literacy, increasing the participation of the younger generation, and creating a culture of sustainable waste management at the community level.

METHOD

This Community Service Activity (PKM) is carried out with a community-based participatory-educational approach and student involvement, which aims to optimize the implementation of plastic waste management innovations through ecobrick technology in a sustainable manner at the village level. This participatory approach was chosen because the effectiveness of waste management is highly determined by the active involvement of the community in the process of changing environmental behavior (Wilson et al., 2015).

Preparation Stage

This stage includes initial observation, identification of problems, and mapping of plastic waste management conditions at partner locations. This activity also involves coordination with village officials, schools, and community leaders to obtain program support. According to Creswell (2018), the preparatory stage in community-based research is important to ensure the alignment between field needs and program intervention design.

Socialization and Education Stage

This stage is carried out through counseling on the impact of plastic waste, the concept of 3R (reduce, reuse, recycle), circular economy, and the introduction of ecobrick technology. Students are actively involved through educational activities in schools to strengthen environmental literacy from an early age. School-based environmental education has proven to be effective in shaping environmentally friendly behavior in the younger generation (UNEP, 2021; Hartley et al., 2020).

Ecobrick Training and Practice Stage

At this stage, technical training on making ecobricks is carried out which includes collecting, sorting, cleaning, drying, and compaction of plastic waste into plastic bottles. This hands-on practical activity aims to improve the skills of the community and students. The concept of ecobricks as a method of upcycling plastic waste has been widely used as an educational approach in community-based waste reduction (Wilson et al., 2015).

Implementation Stage and School–Community Collaboration

This stage involves the formation of an ecobrick working group consisting of the community and students. Schools are encouraged to integrate ecobrick activities in environmental education programs or the Pancasila Student Profile Strengthening Project (P5). The involvement of educational institutions in environmental management contributes significantly to long-term ecological behavior change (UNESCO, 2017).

Monitoring and Evaluation Stage

Monitoring is carried out to assess the level of participation, the quality of the ecobricks produced, and changes in the behavior of the community and students. Evaluation is carried out through observation, interviews, and documentation. According to Patton (2017), participatory-based evaluation allows for increased program effectiveness because it involves direct feedback from activity participants.

Program Sustainability Stage

The sustainability of the program is maintained through the formation of village-based environmental care communities and schools. This sustainability approach is in line with the circular economy principle which emphasizes the importance of community-based waste management systems (Geissdoerfer et al., 2017).

RESULTS AND DISCUSSION

The implementation of the Community Service (PKM) program with ecobrick-based plastic waste management innovations shows positive changes both in terms of knowledge, skills, and behavior of the community and students at the activity location. The program focuses not only on the technical aspects of waste management, but also on building collective awareness of the importance of sustainable environmental management.

Increased Environmental Knowledge and Awareness

The results of the socialization activity showed an increase in participants' understanding of the impact of plastic waste on the environment. Prior to the activity, most participants did not understand that plastics take hundreds of years to decompose and can cause long-term pollution (Geyer et al., 2017). After the educational activity, participants including students showed increased awareness of the importance of reducing the use of single-use plastics and the application of the 3R (reduce, reuse, recycle) concept. This is in line with the findings of UNEP (2021) which affirms that community-based environmental education can significantly increase environmental literacy.

At the training stage, the community and students succeeded in practicing ecobrick making directly. The results of the practice showed that participants were able to produce ecobricks with a density level that was in accordance with the standard after receiving assistance. On average, participants showed good ability in the process of sorting, cutting, and compaction of plastic waste into bottles. This shows that ecobrick technology is relatively easy to adopt by the community because it does not require complex technology (Wilson et al., 2015).



Figure 1. Socialization and Training in Making Eco Bricks

Student engagement has a significant impact on the success of the program. Students not only play the role of participants, but also as agents of disseminating environmental information in families and the surrounding environment. This activity strengthens the concept of education for sustainable development, where education is the main instrument in shaping sustainable behavior (UNESCO, 2017). In addition, the involvement of students through hands-on activities has been proven to increase their motivation and concern for environmental issues.

After the program was implemented, there was a change in community behavior in household waste management. Some residents have started sorting plastic waste and collecting it to be used as ecobricks. Although this change is still gradual, early indications indicate a shift from unmanaged waste disposal patterns to source-based management patterns. This is in line with the concept that changing environmental behavior requires a sustainable process and social support (Geissdoerfer et al., 2017).



Figure 2. Program Results

Although the results of the program show a positive impact, there are several challenges faced, including limited community time, consistency in making ecobricks, and the need for sustainable assistance. In addition, it is still necessary to integrate the program with village policies so that activities can run systematically and sustainably.

In general, this ecobrick program implies that community- and student-based plastic waste management is an effective strategy in supporting the creation of environmentally friendly villages. Collaboration between the community and educational institutions has been proven to be able to accelerate the process of transforming environmental behavior and increase collective awareness of sustainability issues.

CONCLUSION

The Community Service Program (PKM) through ecobrick-based plastic waste management innovations has been proven to have a positive impact in increasing awareness, knowledge, and skills of the community and students in sustainable waste management. This activity succeeded in encouraging behavior change from conventional waste management patterns to a more environmentally friendly source-based management pattern.

The involvement of students as agents of change makes an important contribution in expanding the impact of environmental education, both in the school and family environment. This shows that an educational approach based on the participation of the younger generation is effective in accelerating the internalization of environmental concern values.

In addition, the application of ecobrick technology shows that simple innovations can be an alternative solution in reducing plastic waste stockpiles, while supporting the principles of circular economy and sustainable development. However, the sustainability of the program still requires institutional strengthening, consistency of community participation, and policy support at the village level.

Overall, this program contributes to realizing the concept of environmentally friendly villages through collaboration between the community, students, and educational institutions in more effective and sustainable management of plastic waste.

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