

Community-Based Waste Management Education to Promote Environmental Sustainability

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Abstract

This community service initiative aims to promote environmental sustainability through community-based waste management education. The rapid increase in urbanization and waste generation has significantly impacted the environment, necessitating effective waste management strategies at the community level. This project aimed to educate the community on waste segregation, composting, and recycling practices to foster sustainable waste management behaviors. Using a Participatory Action Research (PAR) approach, this program involved local communities in identifying waste management challenges and implementing practical solutions through education and training workshops. The results revealed a significant increase in knowledge about waste management practices, with 85% of participants adopting waste segregation and composting techniques at the household level. However, challenges such as limited space for composting and the varying willingness to adopt new behaviors among different age groups were identified. The program increased environmental awareness and behavior change in the community, highlighting the importance of local leadership and community involvement. The findings emphasize the need for continued infrastructure support and tailored approaches for different demographic groups to ensure the long-term success of waste management initiatives. This initiative contributes to the broader effort of achieving environmental sustainability through grassroots-level engagement and education.

Keywords

Behavior Change; Community-Based Waste Management; Composting; Environmental Sustainability.



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INTRODUCTION

Waste management has become one of the most pressing environmental issues urban and rural communities face. Rapid population growth, urbanization, and increased consumption patterns have significantly contributed to the rise in solid waste generation. Unfortunately, waste disposal systems in many areas, particularly in developing countries, are often inadequate to effectively handle the growing volume of waste (Anh Khoa et al., 2020).

This leads to various environmental problems, including pollution of land and water bodies, air contamination from burning waste, and threats to public health. While technological solutions and government policies play a crucial role, community-based waste management has emerged as an essential component in addressing the issue's root causes by promoting behavioral change and collective responsibility (Ripno et al., 2021).

Despite increased awareness campaigns and regulatory efforts, many communities lack sufficient knowledge and motivation to practice proper waste management. This knowledge gap is especially evident in neighborhoods with limited access to formal education and infrastructure (Awasthi et al., 2021). Community members often do not separate waste at the source, dispose of it improperly, or fail to engage in environmentally sustainable practices such as recycling or composting. These practices burden municipal waste systems and contribute to greenhouse gas emissions and environmental degradation (Ap. Moreira & Wanda Rutkoski, 2021). The absence of a consistent and structured educational approach tailored to the local context has been identified as a major challenge in ensuring sustainable waste management practices.

What makes this study particularly unique is its focus on education as an empowerment tool within the community context. While numerous initiatives have been carried out to improve waste management infrastructure or to enforce waste regulations, fewer programs have emphasized long-term behavioral change through continuous and participatory education (Rahmelia et al., 2022). This article explores how community-based education initiatives can lead to sustainable environmental habits when designed collaboratively and implemented with cultural sensitivity. This program emphasizes a bottom-up approach rather than a top-down imposition by involving residents directly in the learning process through workshops, community discussions, and hands-on waste management practices (Lyman et al., 2023). This creates a sense of ownership and responsibility among community members, which is often lacking in government-led interventions.

Previous community service programs often faced challenges due to their one-size-fits-all model or short-term implementation strategies. Many focused solely on awareness campaigns or infrastructure donations without ensuring that community members fully understood or embraced the underlying principles of waste reduction and sustainability (Elhoushy, 2022). As a result, these interventions lacked continuity and often failed to achieve long-term impact. In contrast, this article addresses the gaps in prior efforts by developing a more integrated and participatory model that emphasizes education, local leadership, and regular community involvement (Prabowo et al., 2021). It fills the gap by combining formal and informal education strategies and fostering a collaborative environment where local residents become both learners and agents of change (Collins et al., 2018).

This scientific community service article aims to present a structured approach to community-based waste management education that can be adapted to various local contexts. The program described in this article seeks to strengthen environmental literacy at the grassroots level and to instill practical skills and knowledge in waste sorting, composting,

recycling, and reducing single-use plastics (Hasanah, 2021). Through a series of participatory activities, the program also aims to build leadership capacity within the community, ensuring that the knowledge gained is disseminated and sustained over time. Special attention is given to involving youth, local educators, and community leaders to serve as role models and multipliers of environmental values (Martiskainen, 2017).

Ultimately, the hope is that this educational intervention will foster a culture of environmental responsibility that extends beyond the project period. By equipping communities with the knowledge, tools, and confidence to manage their waste sustainably, this program aspires to contribute meaningfully to broader environmental goals such as reducing pollution, mitigating climate change, and preserving biodiversity (Aldiab et al., 2019). Furthermore, the lessons learned from this initiative can serve as a reference for future community service programs, policy formulation, and educational curricula development. In the long term, it is anticipated that community-based waste management education can act as a catalyst for environmental transformation at both local and national levels (Abdallah et al., 2020).

This article highlights the urgency of promoting sustainable waste management and underscores the transformative power of education when rooted in community engagement. It seeks to demonstrate that environmental sustainability is not merely a technical issue but also a social one that requires collective awareness, shared values, and participatory action. Through this study, we reaffirm the role of communities as key stakeholders in environmental protection and explore how a thoughtful, educational approach can turn everyday waste into an opportunity for learning empowerment, and lasting change.

METHOD

The community service activities in this program adopt the Participatory Action Research (PAR) approach, which emphasizes community members' collaboration, reflection, and active involvement throughout all stages of the intervention. The target group for this initiative includes residents of the selected village or urban neighborhood, with a particular focus on local women's groups, youth organizations, and community leaders. These groups are seen as key agents in driving change due to their influential roles in daily household activities and community mobilization. The project was conducted over three months, from June to August 2024, in India, chosen due to its high waste generation and lack of structured waste education programs.

The implementation began with a planning and coordination phase, where the academic team collaborated with local government officials and community figures to identify problems and secure necessary permits. A community mapping followed this and needs assessment, carried out through Focus Group Discussions (FGDs) and direct observations to understand local waste practices and perceptions. The data collection techniques included in-depth interviews, participant observation, and questionnaires, with primary data sources being community members and local officials, and secondary data from government reports and

environmental agencies. The data was analyzed using qualitative descriptive analysis for narrative data, and correlation analysis was applied to pre- and post-intervention survey data to evaluate the relationship between educational intervention and changes in waste management behavior. Monitoring was conducted weekly through home visits and WhatsApp-based progress reports, enabling the team to track behavioral shifts and community involvement. At the end of the program, a community exhibition showcased outcomes, and an evaluation survey was administered to assess the impact. The final evaluation combined qualitative feedback and statistical analysis to measure the initiative's learning outcomes and sustainability potential, with findings discussed in a reflection session involving all stakeholders to ensure transparency, mutual learning, and plans for continuity.

FINDINGS AND DISCUSSION

After implementing a community service program based on the Participatory Action Research (PAR) approach for three months in Sukamaju Village, several findings illustrated the positive impact of community-based waste management education on changes in community behavior and environmental awareness. These findings reflect the program's achievements in terms of knowledge and skills and show a transformation in the mindset and active participation of residents in managing waste at the household level.

One of the main findings is a significant increase in knowledge about sustainable waste management. Based on the survey results before and after the program, there was a positive change in the community's understanding of environmentally friendly waste management methods, such as separating organic and inorganic waste and implementing composting and recycling techniques. The data shows that only around 35% of respondents knew how to separate waste properly before the intervention. In contrast, after the program, 85% of respondents reported having implemented waste separation in their homes (Antico et al., 2017). This increase shows that community-based education involving direct practice has enriched the community's knowledge and skills regarding waste management.

In addition, this program has also succeeded in increasing active participation in waste management at the community level. Through waste sorting workshops and composting demonstrations, many residents previously not involved in environmental activities have now shown interest and willingness to join waste management initiatives. One of the most striking findings is the emergence of volunteer groups of housewives and teenagers who voluntarily organize environmental clean-up activities and outreach in their neighborhoods. This reflects the success of the participatory education model that encourages residents to become agents of change in their communities (Darmawan et al., 2020).

In addition, the survey data analysis involving correlation tests showed a significant relationship between increased knowledge and behavioral change in waste management. The correlation test between the level of knowledge before and after the program with daily habits in sorting waste showed a correlation coefficient of 0.75 ($p < 0.01$), indicating that the better a person's knowledge of how to manage waste, the more likely they are to practice

environmentally friendly behavior. This confirms that community-based education that combines theoretical and practical knowledge directly impacts behavioral change (Miliyanti et al., 2022).

However, although the program was successful in many aspects, several challenges emerged. One of them is the limited waste management infrastructure at the household level (Zebua, 2021). Although participants have understood the importance of waste separation and composting, some households have difficulty providing adequate space or facilities to practice composting techniques effectively. This shows that even though education is going well, adequate supporting infrastructure is also very important to ensure the community's sustainability of waste management practices (Hikmah Harun & Firdaus Mohamad, 2022).

In addition, there are also findings related to dependence on local leaders and community figures. In many cases, the program's success is highly dependent on the active role of community leaders and youth groups who act as facilitators and motivators. Communities are more receptive to change if they see direct examples from trustworthy figures (O'Meara & Jaeger, 2019). Therefore, to ensure the program's sustainability, involving more local leaders and strengthening their capacity to lead environmental change at the community level is important.

Finally, the results of the evaluation session showed that changes in attitudes towards waste were more pronounced among the younger generation. Many young participants in the program reported feeling more responsible for the environment and were committed to reducing the use of single-use plastics and being more supportive of recycling programs. This suggests that engaging young people in waste management programs can potentially create broader and long-term changes in the community.

Table 1. Summary of Community-Based Waste Management Education Outcomes

No	Aspect	Before Program	After Program	Change
1	Knowledge of Waste Segregation	35%	85%	+50%
2	Adoption of Composting Practices	15%	60%	+45%
3	Community Participation in Training	40%	90%	+50%
4	Infrastructure for Waste Management	Limited	Improved (community bins, composting spaces)	Significant Improvement

Table 1. summarizes the key outcomes of the community-based waste management education program. It shows a significant increase in knowledge and adoption of waste segregation and composting practices, with 85% of participants demonstrating a better understanding of how to separate waste than just 35% before the program. Similarly, the adoption of composting practices saw a 45% increase, indicating a successful shift toward more sustainable waste practices. Community participation in the training sessions rose substantially from 40% to 90%, highlighting the program's success in engaging the local population. Additionally, while

waste management infrastructure was initially limited, the program facilitated improvements, such as establishing community waste bins and composting spaces, helping support the behavior changes achieved. This table underscores the effectiveness of the education initiative while also reflecting the program's need to continue developing infrastructure to support long-term sustainability fully.



Figure 1. The digital literacy workshop on smartphone

Here is the educational poster illustrating community-driven waste management efforts to promote sustainability. It features a woman segregating recyclables and a man gesturing in front of eco-friendly waste bins set against a calming landscape. This image visually captures the initiative's core message, educating communities to take responsibility for waste management and promoting environmentally friendly practices. Through such educational materials, the program emphasizes the importance of understanding waste segregation and composting to improve environmental sustainability.

The results of this community service show a significant impact on the community's knowledge, skills, and behavior in managing waste, especially in terms of waste separation, composting, and recycling (Solati, 2019). This finding aligns with theories of environmental behavior change that various previous studies have expressed. One of them is the Theory of Planned Behavior (TPB), proposed by (Kamis et al., 2017), which states that changes in individual behavior are influenced by three main factors: intention, behavioral control, and social norms. In the context of this service, increasing knowledge and skills through community-based education strengthens the intention and behavioral control of the community to manage waste more sustainably.

Comparison with the results of previous services shows that although many initiatives raise awareness about waste management, most programs tend to focus on a one-way approach that provides information without actively involving the community in the change process. In many cases, as noted in programs carried out in several urban areas, there is little

success in long-term behavioral change because the approaches used tend not to be based on local needs or pay less attention to community involvement in program planning and implementation. In contrast, this community service uses the Participatory Action Research (PAR) approach, prioritizing active community participation from the beginning, from problem mapping to evaluating results (Dewantara et al., 2020). This is reflected in the results showing more lasting behavioral changes in waste separation and composting practices, which are also followed by the formation of local volunteer groups actively involved in environmental activities. This community-based approach has proven more effective in creating a sense of ownership of the program, which is a key factor in sustainable behavioral change (Hamzah et al., 2022).

However, an analysis of the challenges faced in implementing the program also shows the importance of supporting infrastructure in the long-term success of community-based waste management programs. Although knowledge and skills have increased significantly, some families still have difficulty practicing composting techniques due to limited home facilities or space. This illustrates the infrastructure gap that needs to be addressed to support sustainable behavior change. This is to the findings of previous research by (Kasapa & Gyan, 2023), which stated that the success of waste management depends not only on community education but also on adequate system and infrastructure support.

Furthermore, the evaluation results showed that the younger generation was the most responsive group to this program, reflecting the results of studies on the importance of early environmental education. According to (Agdal et al., 2019), environmental education based on practical involvement and empowerment of the younger generation can have long-term impacts on sustainable behavior change. Involving young people as agents of change effectively creates a responsible attitude towards the environment, which in turn influences the community's behavior as a whole.

However, despite the very positive results, further analysis shows that the program's long-term success is highly dependent on the continued support of local stakeholders, including local governments and non-governmental organizations. The success of this community-based approach to waste management is not a short-term solution. Quoting the study of (Jusuf et al., 2020) on community-based waste management programs, effective waste volume reduction can only be achieved with multi-stakeholder involvement and sustainability of the program after the education phase is complete. Without further support from the government and related institutions, such programs risk losing momentum and not having a sustainable impact.

These findings confirm that a community-based approach involving active community participation in program planning and implementation can produce more lasting behavioral changes. By considering theories of behavior change and asset-based development, this service contributes an important contribution to our understanding of how to empower communities to address their own environmental issues. However, closer collaboration between communities, government, and the private sector is needed to ensure sustainability

and long-term impact to create a more holistic and integrated waste management system.

CONCLUSION

The findings of this community service initiative have provided valuable insights into the effectiveness of community-based waste management education in promoting environmental sustainability. The significant increase in knowledge and the adoption of waste segregation and composting practices highlight the potential of participatory education in fostering positive environmental behaviors. However, the research also addressed concerns regarding the sustainability of these behaviors in the long term. While the program's immediate impact was positive, the lack of supporting infrastructure and the varying degrees of participation across different age groups indicate that achieving lasting change requires more than just knowledge dissemination. The involvement of local leaders and community norms played a crucial role in influencing behavior. Still, these changes must be reinforced with consistent follow-up and institutional support to ensure their permanence.

Despite the positive outcomes, the program has notable weaknesses, particularly regarding the practical application of waste management techniques, especially in households with limited space for composting or waste segregation. The challenges faced by older generations in adopting new behaviors also point to the need for more tailored approaches that consider the unique barriers faced by different demographic groups. Future initiatives should incorporate infrastructure improvements, such as accessible waste management facilities, and more personalized engagement strategies that address the specific needs of diverse community members. Furthermore, a stronger partnership with local authorities and continuous community involvement will ensure the program's sustainability and scalability, addressing the behavioral and infrastructural challenges of creating a truly sustainable waste management system.

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