

Transforming Waste Management through Education: Enhancing Solid Waste Disposal Practices in Barangay Lapasan, Cagayan de Oro City

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ABSTRACT

The growing waste crisis in urban areas calls for innovative solutions, and environmental education has emerged as a powerful tool in transforming waste disposal practices. This study explored the impact of environmental education on solid waste management behaviors in Barangay Lapasan, Cagayan de Oro City. Focusing on key educational strategies, such as community awareness programs, school-based curricula, media campaigns, and workshops, the research assessed their influence on waste segregation, household waste reduction, proper waste collection, and participation in recycling and composting. Using a descriptive-correlational research design, 150 respondents were selected through stratified random sampling to evaluate their perceptions and actions regarding waste management. The results revealed that environmental education significantly improved waste disposal practices, with community awareness programs and school curricula proving most effective. Regression analysis further showed that workshops and school-based curricula had a marked positive impact on promoting sustainable waste management behaviors. The study also identified gaps in local waste management strategies, suggesting that tailored interventions are necessary to address community-specific challenges. Based on the findings, the study advocates for strengthening community-based environmental education, incorporating interactive learning within schools, and enhancing media campaigns to encourage more sustainable waste management practices. This research provides essential insights for policymakers and local leaders, offering a data-driven framework for improving solid waste disposal practices through effective environmental education at the barangay level.

Keywords: *Environmental Education, Waste Management, Community Awareness, Recycling, Sustainable Practices, Solid Waste Disposal*

INTRODUCTION

The escalating challenge of solid waste disposal in urban areas, exacerbated by rapid population growth, industrialization, and increased consumption, has become one of the most pressing environmental issues worldwide. Barangay Lapasan, a commercial and residential area in Cagayan de Oro City, is no exception. Like many other urban centers, Lapasan faces mounting difficulties in managing solid waste, which continues to increase due to expanding economic activities and a growing population. The traditional methods of waste management, such as landfilling and burning, have proven inadequate in handling the volume of waste generated in the barangay. As waste disposal issues worsen, the negative impact on the environment, public health, and sanitation becomes more evident. It is in this context that the need for effective solid waste management solutions, such as environmental education, has become critical.

Environmental education has been recognized globally as a key strategy in fostering sustainable waste management practices. Many countries, both developed and developing, have incorporated environmental education into their national frameworks to promote waste reduction, recycling, and segregation (Miller & Green, 2023). According to Garcia and Cruz (2021), environmental education

serves as a powerful tool for changing people's waste disposal behaviors by raising awareness and providing knowledge about the environmental impact of improper waste management. Moreover, research by Chen and Rivera (2023) shows that areas with strong environmental education campaigns tend to see higher rates of recycling and proper waste segregation, demonstrating the effectiveness of these initiatives in shaping responsible waste management behaviors.

However, while the global importance of environmental education in waste management is well-documented, there is a lack of research focusing on its direct impact at the barangay or local community level. Studies have often concentrated on large-scale, national strategies, neglecting how localized education efforts can influence community waste management practices. This gap in the literature highlights the need for more research on how tailored educational programs, such as community awareness campaigns, school-based curricula, and media outreach, can specifically improve waste disposal practices in smaller urban settings like Barangay Lapasan (Garcia & Cruz, 2021).

In the Philippines, the Ecological Solid Waste Management Act (RA 9003) mandates the implementation of waste segregation and recycling programs across local government units (LGUs). Similarly, the National Environmental Awareness and Education Act (RA 9512) obligates the inclusion of environmental subjects in formal and informal education systems. Despite these legal frameworks, however, poor enforcement and limited funding have hindered the full execution of these policies, particularly at the barangay level (Reyes & Mendoza, 2023). This has resulted in a lack of significant improvement in local waste disposal behaviors, despite the legal provisions in place.

Barangay Lapasan's waste disposal problems are compounded by inadequate waste segregation, ineffective waste collection systems, and minimal participation in recycling programs. Despite various waste management projects introduced by the municipal government, such as waste retrieval and recycling initiatives, these efforts have yielded limited success. Studies by Lopez and Wang (2024) indicate that while public education is a fundamental aspect of effective waste management programs, a lack of community engagement and awareness remains a significant barrier. Many residents in Barangay Lapasan continue to dispose of waste improperly, contributing to environmental degradation and public health risks. Additionally, informal waste disposal habits, such as illegal dumping and burning, persist, exacerbating the problem.

This study seeks to address this gap by exploring the role of environmental education in improving waste disposal practices in Barangay Lapasan. It will evaluate the impact of various environmental education strategies, including community awareness programs, school-based curricula, media campaigns, and workshops, on waste segregation, household waste reduction, and participation in recycling and composting. According to Garcia and Wong (2023), community-based environmental education programs have the potential to significantly reduce waste generation and improve recycling rates. This research builds on these findings by investigating the specific ways in which localized environmental education can influence waste management behaviors at the barangay level.

In Barangay Lapasan, although municipal waste collection systems exist, waste segregation compliance remains low, and many households continue to lack proper waste disposal knowledge (Torres & Lim, 2022). The lack of education and awareness about waste management contributes to the persistence of unsustainable disposal practices, such as throwing waste into streets or open spaces. Furthermore, there is minimal participation in recycling and composting programs, with many residents unaware of the environmental and economic benefits of these practices. The findings of Chen and Zhao (2023) support this, showing that when local residents are properly educated about the benefits of recycling and composting, participation in these programs significantly increases.

The objective of this study is to assess the effectiveness of environmental education on improving

waste segregation compliance, household waste reduction, proper waste collection and disposal, and participation in recycling and composting programs in Barangay Lapasan. Research by Kumar and Shrestha (2022) has demonstrated that environmental education initiatives, when tailored to local contexts, are critical in fostering positive waste management behaviors. By analyzing how educational efforts at the barangay level influence waste management practices, this study will provide insights into the types of interventions that are most effective in creating long-lasting behavioral changes.

LITERATURE REVIEW

Effective waste segregation plays a vital role in managing solid waste in urban areas. According to Kim and Lee (2022), complying with segregation policies is essential for reducing landfill usage and promoting recycling. Furthermore, Martinez and Tan (2023) emphasize that enforcement mechanisms, such as penalties and incentives, significantly influence waste segregation behaviors among households. Chen and Rivera (2023) suggest that communities with well-organized waste collection systems and public education campaigns show higher compliance rates. These studies demonstrate the importance of local government interventions and community engagement in fostering long-term adherence to waste segregation policies.

Household waste reduction is another crucial element in sustainable waste management. Nguyen and Patel (2022) highlight that behavior modification programs, which focus on reusing materials and promoting sustainable consumption, effectively reduce household waste. Singh and Torres (2023) further support this by noting that community-driven initiatives also encourage households to minimize waste generation. Garcia and Wong (2023) add that financial incentives, such as pay-as-you-throw schemes, are effective in motivating households to reduce waste. Lopez and Kim (2024) also emphasize that practices such as composting and material repurposing significantly lower household waste outputs, underlining the importance of community-based waste reduction programs.

Proper waste collection and disposal mechanisms are essential for ensuring that solid waste is managed efficiently and in an environmentally friendly manner. Hernandez and Park (2023) argue that communities with structured municipal waste collection systems experience fewer environmental hazards, as organized systems reduce illegal dumping. Martinez and Singh (2022) echo this sentiment, asserting that having well-maintained disposal facilities significantly improves public health and sanitation standards. Chen and Rivera (2023) further note that modern waste collection technologies, such as smart bins equipped with sensors, enhance the efficiency of waste disposal. Nguyen and Patel (2023) suggest that collaborations between government agencies and private companies improve waste collection services and infrastructure.

Participation in recycling and composting programs plays an integral role in reducing the waste that ends up in landfills. Garcia and Wong (2023) demonstrate that communities with established recycling infrastructures tend to have higher participation rates. Public education campaigns also enhance community engagement in recycling, leading to better resource recovery and less waste in landfills (Lopez & Kim, 2024). Similarly, Hernandez and Park (2023) argue that urban composting programs are effective in reducing organic waste and promoting soil health. Martinez and Singh (2022) suggest that community-based composting initiatives also support local agriculture, making composting an effective tool for both waste management and environmental sustainability.

Media and campaign strategies have a significant impact on shaping public attitudes and behaviors toward waste management. Hernandez and Park (2023) found that mass media, including television, radio, and social media, are effective tools for spreading awareness about proper waste disposal practices. Garcia and Wong (2023) emphasize that structured campaigns increase public participation in recycling and waste management activities. Furthermore, Nguyen and Patel (2023) highlight the

role of behavior-change communication, where persuasive messaging and interactive content are used to improve public attitudes toward waste segregation and recycling.

Workshops and training programs have proven to be effective in equipping communities with the knowledge and skills needed to practice sustainable waste management. Chen and Rivera (2023) note that hands-on training on topics like waste segregation and composting improves compliance with environmental regulations. Martinez and Singh (2022) also point out that collaboration with environmental agencies and NGOs enhances the effectiveness of training programs, ensuring long-term community commitment to waste management. Moreover, Nguyen and Patel (2023) argue that tailoring these programs to the specific needs of communities ensures greater success. Training programs aimed at key stakeholders, such as educators and local leaders, also promote wider implementation of waste management strategies (Garcia & Wong, 2023).

MATERIALS AND METHODS

This study utilized a descriptive-correlational research design to examine the impact of environmental education on solid waste disposal practices in Barangay Lapasan, Cagayan de Oro City. It focused on evaluating the effectiveness of various environmental education strategies, including community awareness programs, school-based curricula, media campaigns, and workshops, in influencing waste management behaviors such as waste segregation, household waste reduction, proper waste collection and disposal, and participation in recycling and composting. The descriptive component of the study provided an in-depth analysis of these educational interventions, while the correlational aspect employed regression analysis to explore statistical relationships and assess the influence of these programs on specific waste disposal behaviors.

The research was conducted in Barangay Lapasan, a rapidly urbanizing area that faces significant waste management challenges due to population growth, increased commercial activity, and limited community involvement. The barangay struggles with issues such as inefficient waste segregation, poor waste collection systems, and low participation in recycling programs, problems that are compounded by a lack of environmental awareness and weak enforcement of waste management policies. The study aimed to explore how environmental education initiatives could improve waste management practices and foster more responsible waste disposal habits among residents, businesses, and local institutions. The findings were expected to offer valuable insights that could guide local government units and community leaders in developing more effective policies and strategies to tackle solid waste problems.

Stratified random sampling was employed to ensure a balanced representation from key stakeholder groups, including household members, business owners, educators, local government officials, community leaders, and waste management personnel. A structured questionnaire, which combined both quantitative and qualitative components—such as Likert-scale items and open-ended interview questions—was used to collect data. The research involved surveys, interviews, and document analysis to gather comprehensive insights into the effectiveness of environmental education efforts. Ethical considerations, including informed consent, voluntary participation, and confidentiality, were strictly observed to protect participant rights and ensure the integrity of the study. Statistical analyses, such as descriptive statistics and regression models, were used to provide a thorough evaluation of how environmental education influenced waste management behaviors in Barangay Lapasan.

RESULTS AND DISCUSSION

1. How do local stakeholders assess the effectiveness of environmental education in improving solid waste disposal practices in terms of:

1.1 Waste segregation compliance;

1.2 Household waste reduction;

1.3 Proper waste collection and disposal; and

1.4 Participation in recycling and composting programs?

Table 1 presents the summary of local stakeholders assessed the effectiveness of environmental education in improving solid waste disposal practices. The overall mean is 3.53 (SD = 0.61), described as "Strongly Agree," indicating that stakeholders believe educational initiatives are highly effective in encouraging responsible waste behavior. The standard deviation reflects a moderate response variation, suggesting that while most agree, the extent of perceived impact varies slightly across practice areas. This aligns with research by Jimenez and Tan (2021), who found that diverse educational channels lead to varying levels of behavioral uptake. The mean score reflects a consistent endorsement of educational efforts promoting solid waste management.

Among the four domains, the highest mean of 3.57 (SD = 0.57) was observed in participation in recycling and composting programs. This suggests that stakeholders are most confident about the positive outcomes of education in promoting these practices. It indicates the presence of visible, community-led recycling initiatives that reinforce learning. Martinez and Uy (2022) confirmed that hands-on activities, such as composting workshops, significantly improve engagement and retention. This high score illustrates the effectiveness of practical, experiential learning in solid waste management.

In contrast, the lowest mean was 3.47 (SD = 0.63) under waste segregation compliance, though it still falls under "Strongly Agree." This suggests that while respondents support segregation, challenges may remain regarding the consistency or availability of necessary infrastructure. The higher standard deviation further implies discrepancies in practice across communities. Rivera and Lao (2020) state that barriers to adequate segregation include a lack of enforcement, inadequate facilities, and irregular monitoring. These findings indicate that educational efforts must be coupled with systemic improvements to achieve uniform compliance.

Table 1
Summary of Local Stakeholders Assessed the Effectiveness of Environmental Education in Improving Solid Waste Disposal Practices

Indicators	Mean	Std. Deviation	Response	Interpretation
Waste Segregation Compliance	3.47	0.63	Strongly Agree	Highly Sustainable
Household waste reduction	3.53	0.62	Strongly Agree	Highly Sustainable
Proper waste collection and disposal	3.53	0.60	Strongly Agree	Highly Sustainable
Participation in recycling and composting programs	3.57	0.57	Strongly Agree	Highly Sustainable
Overall	3.53	0.61	Strongly Agree	Highly Sustainable

Legend: 1.00-1.75 Strongly Disagree(Poor Sustainability), 1.76-2.50 Disagree(Low Sustainability), 2.51-3.25 Agree(Moderately Sustainable), and 3.26-4.00 Strongly Agree(Highly Sustainable)

2. How do local stakeholders evaluate different environmental education initiatives in terms of:

2.1 Community awareness programs;

2.2 School-based environmental curriculum;

2.3 Media and campaign strategies; and 2.4 Workshops and training?

Table 2 presents the summary of local stakeholders evaluated different environmental education initiatives. The overall mean is 3.54 (SD = 0.62), interpreted as “Strongly Agree” and “Highly Effective.” This suggests that environmental education strategies have been well received, indicating their success in raising awareness and encouraging sustainable practices. The relatively low standard deviation also signifies consistency in responses, suggesting shared experiences among stakeholders. According to Bernardo and Velasquez (2021), integrated and multi-platform education programs foster improved community commitment to environmental goals. These findings emphasize the importance of maintaining diversified educational efforts across the sectors evaluated.

Among the initiatives, community awareness programs earned the highest mean of 3.67 (SD = 0.56), suggesting that localized education and outreach are the most impactful. The low standard deviation reflects strong agreement, indicating that these programs are not only visible but also practical and well-received. Soriano and Guzman (2022) noted that grassroots education tends to have a more lasting influence due to its adaptability and relevance to community needs. This reinforces the value of direct, community-based environmental education.

On the other hand, the lowest mean was observed in media and campaign strategies, which scored 3.43 (SD = 0.67), though still categorized as “Highly Effective.” The slightly higher deviation suggests uneven access or varying perceptions about the quality and reach of these media efforts. Delos Santos and Rivera (2020) found that while digital platforms have expanded educational access, they still face challenges with equity and clarity of messaging. Therefore, continued improvement of media strategies is necessary to ensure broader engagement.

Table 2

The Summary of Local Stakeholders Evaluated Different Environmental Education Initiatives

Indicators	Mean	Std. Deviation	Response	Interpretation
Community Awareness Programs	3.67	0.56	Strongly Agree	Highly Effective
School-based Environmental Curriculum	3.50	0.63	Strongly Agree	Highly Effective
Media and Campaign Strategies	3.43	0.67	Strongly Agree	Highly Effective
Workshops and Training	3.54	0.63	Strongly Agree	Highly Effective
Overall	3.54	0.62	Strongly Agree	Highly Effective

Legend: 1.00-1.75 Strongly Disagree(Poor Effectiveness), 1.76-2.50 Disagree(Low Effectiveness), 2.51-3.25 Agree(Moderately Effective), and 3.26-4.00 Strongly Agree(Highly Effective)

3. Does environmental education affect solid waste disposal practices in Barangay Lapasan, Cagayan de Oro City?

Table 3 depicts the test of the significant affect of environmental education on solid waste disposal practices in Barangay Lapasan, Cagayan de Oro City. The overall model is significant (p-value = 0.000), and the Adjusted R² value of 0.298 suggests that environmental education initiatives can explain 29.8% of the variation in solid waste disposal practices. Among the individual variables, workshops and training ($\beta = 0.299$, $p = 0.000$) and school-based environmental curriculum ($\beta = 0.214$, $p = 0.009$) significantly positively affect solid waste disposal practices. This indicates that community training and formal education programs strongly predict positive waste disposal behavior. While other

factors, such as media campaigns and community awareness programs, also influence waste practices, their effects are less pronounced.

The findings suggest that community-based workshops and formal school curricula are pivotal in improving solid waste disposal practices. Environmental education programs, particularly those that engage participants in hands-on activities and provide practical tools for waste management, have the most significant impact. As emphasized by Bernardo and Velasquez (2021), interactive learning environments, such as workshops, lead to more tangible changes in behavior compared to passive forms of education. Expanding these types of educational interventions can further enhance sustainable waste management in the community.

Table 3

The Test of Significant Affect on Environmental Education to Solid Waste Disposal Practices in Barangay Lapasan, Cagayan de Oro City

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	1.387	.287		4.835	.000
Community Awareness Programs	.126	.071	.147	1.780	.077
School-based Environmental Curriculum	.196	.074	.214	2.639	.009
Media and Campaign Strategies	.072	.074	.083	.983	.327
Workshops and Training	.250	.066	.299	3.766	.000

Note: Adjusted $r^2 = .298$ ANOVA for Regression $F = 16.826$, $p = .000$

4. Based on the findings, what programs can be recommended to enhance environmental education and promote sustainable solid waste management in Barangay Lapasan, Cagayan de Oro City?

Based on the findings, it is recommended that community awareness programs be strengthened in Barangay Lapasan to enhance environmental education and promote sustainable solid waste management practices. The study highlights the positive impact of community-based initiatives in raising environmental consciousness, with respondents strongly agreeing on their effectiveness. Expanding these programs to include more localized and accessible waste management solutions could further enhance their reach. These initiatives should also incorporate follow-up activities to ensure continued community engagement. Del Mundo and Navarro (2023) noted that grassroots outreach and visibility are essential in fostering long-term environmental attitudes, especially when tailored to specific community needs.

School-based environmental curricula also play a critical role in instilling sustainable waste management practices. The study found that environmental education within schools has been highly effective in shaping students' perceptions and behaviors toward sustainability. To build on this success, integrating more interactive learning experiences, such as hands-on waste segregation and recycling activities, would encourage greater student involvement. According to Lagman and Soriano (2022), embedding sustainability practices in school curricula has fostered environmental responsibility in future generations, thus contributing to long-term positive changes in waste management behavior.

Finally, it is recommended that media and campaign strategies be enhanced to improve public participation in waste management practices. The study indicated that media campaigns have raised awareness but have had mixed results in behavior change. To address this, campaigns should provide actionable steps and encourage consistent follow-up actions. Leveraging digital platforms and social media for engagement can amplify the impact. As Mendoza and Cruz (2021) emphasized, the media's role in promoting sustainable behavior is crucial, but its effectiveness can be maximized when the

content is informative, actionable, and engaging, thus ensuring greater participation and behavior change.

CONCLUSION

The findings from this study indicate that local stakeholders in Barangay Lapasan assess environmental education as highly effective in improving solid waste disposal practices. With an overall mean of 3.53, respondents strongly agreed that educational initiatives positively influenced behaviors related to waste segregation, household waste reduction, and participation in recycling and composting programs. The highest mean was observed in the area of recycling and composting, highlighting the success of hands-on, community-based programs in fostering active participation. This aligns with previous research by Martinez and Uy (2022), which emphasized that practical, experiential learning plays a key role in engaging communities in sustainable waste management. However, while stakeholders expressed strong support for waste segregation efforts, the slightly lower mean score of 3.47 in this area reflects ongoing challenges in ensuring consistent compliance, primarily due to infrastructural limitations and enforcement barriers.

The study also highlighted the varying effectiveness of different environmental education strategies. Community awareness programs were rated the most effective, with a mean score of 3.67, suggesting that localized and accessible outreach initiatives are particularly impactful in fostering environmental responsibility. This finding supports Soriano and Guzman's (2022) assertion that grassroots education programs, when tailored to the specific needs of the community, have long-lasting effects. On the other hand, media and campaign strategies received the lowest score of 3.43, indicating that while they raise awareness, their impact on behavior change is less pronounced. These results suggest that media campaigns must evolve to offer more actionable steps and consistent follow-up to maximize their effectiveness in promoting sustainable practices.

Given these insights, the study recommends enhancing community awareness programs, integrating interactive learning into school curricula, and improving media and campaign strategies. By focusing on localized, hands-on education and increasing the availability of resources for waste management, Barangay Lapasan can strengthen its waste management efforts. Moreover, expanding media campaigns to provide clear, actionable guidance and engaging local communities through digital platforms can further drive behavior change. The findings suggest that a multifaceted approach, combining education, community involvement, and policy enforcement, is essential to achieve long-term sustainability in waste management practices in Barangay Lapasan.

Recommendations

Based on the findings of this study, several recommendations can be made to enhance environmental education and promote sustainable solid waste management practices in Barangay Lapasan, Cagayan de Oro City.

- 1. Strengthen Community Awareness Programs.** The study found that community awareness programs were the most effective in improving waste management behaviors, particularly in recycling and composting. It is recommended that the local government and community organizations expand these programs by incorporating more localized and accessible waste management solutions. Programs should be designed to engage various community sectors, including residents, business owners, and youth groups. Regular follow-up activities and community-based initiatives, such as neighborhood clean-up drives and waste segregation demonstrations, should be integrated to ensure continuous engagement and reinforce the importance of sustainable waste practices. As Del Mundo and Navarro (2023) suggest, grassroots outreach and

visibility are key to fostering long-term environmental attitudes.

2. **Enhance School-Based Environmental Curricula.** The study highlighted the effectiveness of school-based environmental education in shaping students' waste management behaviors. To build on this success, it is recommended that schools integrate more interactive and hands-on learning experiences related to waste segregation, recycling, and composting. Activities such as waste sorting competitions, school recycling programs, and gardening projects utilizing compost can actively engage students and instill responsible waste disposal habits. Furthermore, incorporating sustainability practices into various school subjects and extracurricular activities will promote a culture of environmental responsibility among future generations. According to Lagman and Soriano (2022), embedding sustainability practices in the curriculum can lead to lasting positive changes in waste management behaviors.
3. **Improve Media and Campaign Strategies.** While media campaigns have raised awareness, the study indicated that their impact on behavior change has been limited. To address this, it is recommended that future media campaigns provide more actionable steps and encourage consistent follow-up actions. Media outlets, including television, radio, and digital platforms, should emphasize practical solutions for waste management, such as how to properly segregate waste, the benefits of composting, and ways to reduce single-use plastics. Social media platforms can be leveraged to engage younger audiences by sharing informative, visually appealing, and interactive content. Collaborating with local influencers and community leaders can also help amplify the reach and credibility of these campaigns. As Mendoza and Cruz (2021) emphasize, campaigns must not only inform but also motivate individuals to take sustainable actions by providing clear, accessible instructions and regular updates.
4. **Strengthen Waste Segregation Infrastructure.** The study revealed challenges in waste segregation compliance, mainly due to inadequate facilities and enforcement mechanisms. It is recommended that Barangay Lapasan invest in more accessible waste segregation bins, particularly in high-traffic areas such as public markets, schools, and residential zones. Regular monitoring and a clearer waste disposal policy should be implemented to ensure better compliance. Additionally, local authorities should collaborate with community leaders to enforce waste segregation laws effectively. This may include creating incentives for households and businesses that consistently follow waste segregation practices, as well as penalties for non-compliance. By improving the infrastructure and enforcement of segregation policies, the barangay can promote greater adherence to waste management regulations.
5. **Encourage Public-Private Partnerships for Waste Management.** Collaboration between the local government, businesses, and environmental organizations can help improve waste management systems in Barangay Lapasan. Public-private partnerships can provide financial and logistical support for waste management initiatives, such as setting up recycling centers, creating educational materials, and funding community workshops. Engaging businesses in waste reduction and recycling programs will also contribute to reducing the volume of waste generated, particularly from commercial activities. These partnerships can help ensure that sustainable waste management practices are incorporated into the daily operations of local businesses, which will have a ripple effect on the wider community.

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