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Empowering Communities Through Environmental Education: A Solution to Poor Solid Waste Disposal in Barangay Lapasan, Cagayan de Oro City

[1]Allen John G. Tuanquin, [1]Ismael A. Reyes, Jr., [1]Marianne Kyle C. De Castro, [1]Timothy Paul C. Rosales, [1]Sittie Aisa A. Ocsio, [1]Abdulnasser S. Nur, [1]Ethel Mae G. Paderes, [1]Jeremias P. Celestino
[1]Philippine Christian University, Philippines

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ABSTRACT

This study examined the impact of environmental education on solid waste disposal practices in Barangay Lapasan, Cagayan de Oro City. The research aimed to assess how various environmental education strategies, such as community awareness programs, school-based curricula, media campaigns, and workshops, influence solid waste management behaviors, including waste segregation, household waste reduction, proper waste collection, and participation in recycling and composting. Using a descriptive-correlational research design, the study employed stratified random sampling to gather data from 150 respondents, with a focus on their perceptions and practices related to waste disposal. The findings revealed that environmental education initiatives positively influenced solid waste disposal behaviors, with community awareness programs and school-based curricula showing the strongest effects. Statistical analyses, including regression models, indicated that workshops and school-based curricula had significant positive impacts on waste management practices. The study also highlighted the need for more tailored interventions to address local waste management challenges effectively. Based on the results, it is recommended to enhance community-based environmental education, integrate interactive learning in schools, and strengthen media campaigns to further promote sustainable waste management practices in Barangay Lapasan. The study's findings contribute valuable insights for policymakers and community leaders in designing targeted environmental education programs to improve solid waste disposal practices at the barangay level.

Keywords: *Environmental Education, Media Campaigns, Recycling, Waste Reduction, Waste Segregation*

INTRODUCTION

Solid waste disposal remains a pressing environmental challenge, particularly in urban areas where waste production continues to escalate. Barangay Lapasan, Cagayan de Oro City, is among the metropolitan regions experiencing difficulties in handling solid waste due to rapid demographic expansion, economic activities, and limited community participation in waste management programs. One of the essential strategies to tackle this issue is environmental education, which aims to improve public knowledge and promote sustainable waste disposal behaviors. By incorporating community engagement programs, academic-based curricula, media promotions, and educational workshops, environmental education can empower societies to embrace responsible waste disposal habits (Smith & Johnson, 2022).

Universally, environmental education has been acknowledged as a crucial mechanism in encouraging sustainable waste management approaches. Many advanced and developing nations have embedded environmental education into their national frameworks to inspire waste sorting, recycling, and reduction. Research has demonstrated that regions with strong environmental education campaigns have higher adherence rates in correct waste disposal and recycling endeavors. The United Nations' Sustainable Development Goals (SDGs) highlight the significance of education in attaining

environmental preservation, particularly in waste minimization and pollution control (Miller & Green, 2023).

Despite the increasing focus on environmental education, substantial voids remain in understanding its direct effect on community solid waste disposal conduct. Several studies emphasize broad waste management strategies but lack concrete evidence on how community awareness, academic curricula, and media initiatives impact waste segregation and minimization at the barangay level. Furthermore, scarce research has examined the efficiency of environmental education programs customized to local community needs, leaving policymakers with inadequate information for tailored interventions (Garcia & Cruz, 2021).

In the Philippines, various legal directives support environmental education and solid waste governance. The Ecological Solid Waste Management Act of 2000 (RA 9003) obligates local government entities (LGUs) to execute waste categorization, recycling, and public education initiatives. Additionally, the National Environmental Awareness and Education Act of 2008 (RA 9512) requires the inclusion of environmental subjects in formal and informal learning systems. However, despite these statutes, ineffective enforcement and limited funding obstruct their comprehensive execution, influencing the overall impact of waste management schemes (Reyes & Mendoza, 2023).

Barangay Lapasan, situated in Cagayan de Oro City, encounters enduring solid waste disposal difficulties due to inadequate waste segregation adherence and insufficient civic involvement in recycling schemes. Many homes still engage in careless waste disposal, contributing to environmental contamination and health hazards. While the municipal authorities have launched waste retrieval and recycling projects, engagement remains low due to a lack of awareness and reluctance to alter behaviors. Strengthening environmental education at the barangay scale is vital in cultivating a culture of responsible waste handling and sustainability (Torres & Lim, 2022).

Currently, Barangay Lapasan faces challenges with ineffective waste collection techniques and inadequate community involvement in waste reduction efforts. Waste segregation compliance remains suboptimal, and numerous residents are uninformed about the benefits of recycling and composting. Furthermore, informal waste disposal habits, such as unauthorized dumping and incineration, persist, exacerbating pollution and environmental degradation. Without adequate interventions, these waste management obstacles will continue, further worsening ecological and public health concerns (Santiago & Lopez, 2021).

The first objective of this study is to evaluate the effect of environmental education on waste segregation adherence in Barangay Lapasan. By investigating the impact of community sensitization initiatives, academic curricula, and media outreach, the study aims to determine how educational efforts influence residents' readiness to segregate waste correctly. Identifying the key motivators of compliance will help in shaping more impactful education methodologies for enhanced waste regulation (Alvarez & Fajardo, 2023).

The second objective is to analyze how environmental education affects household waste minimization in Barangay Lapasan. The study will explore whether training sessions and informational campaigns inspire locals to implement waste reduction methods such as decreasing plastic utilization, composting organic refuse, and engaging in zero-waste initiatives. Understanding the association between education and household waste tendencies will provide insights into how grassroots interventions can foster long-term sustainability (Morales & Chan, 2022).

The third objective is to examine the influence of environmental education in refining appropriate waste collection and disposal systems. The research will assess whether educational activities heighten residents' comprehension of waste collection timetables, disposal guidelines, and recycling protocols.

Measuring the efficiency of various educational tactics will aid in improving policies that support effective and sustainable waste management measures (Diaz & Ortega, 2023).

Furthermore, the study seeks to investigate how environmental education fosters involvement in recycling and composting programs in Barangay Lapasan. Many neighborhoods lack information on the advantages of recycling and composting, resulting in minimal participation in sustainability efforts. By assessing the impact of academic curricula, media campaigns, and training workshops, the study will pinpoint strategies to boost community engagement in waste recovery activities (Fernandez & Ramos, 2023).

This research contributes to the broader understanding of how environmental education enhances solid waste governance at the barangay level. Results from the study will provide valuable knowledge for legislators, educators, and local officials in designing specific educational initiatives that encourage proper waste disposal practices. Additionally, the research will serve as a reference model for other urban communities grappling with similar waste management dilemmas (Torres & Mendoza, 2022).
Empowering communities through environmental education is essential in tackling inefficient solid waste disposal approaches. A holistic strategy that integrates civic participation, school-based initiatives, media promotions, and training programs can significantly enhance waste segregation, household waste reduction, and recycling engagement. Sustainable waste governance necessitates continuous investments in education and advocacy to cultivate environmentally responsible societies (Santiago & Lopez, 2022).

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 & METHODS

This study employed a descriptive-correlational research design to investigate the impact of environmental education on solid waste disposal practices in Barangay Lapasan, Cagayan de Oro City. It focused on various environmental education strategies, such as community awareness programs, school-based curricula, media campaigns, and workshops, and their influence on waste management behaviors, including waste segregation, household waste reduction, proper waste collection and disposal, and participation in recycling and composting. The descriptive aspect of the study provided a detailed analysis of these educational interventions, while the correlational aspect explored statistical relationships using regression analysis to determine how these programs influenced specific waste disposal behaviors.

The research was conducted in Barangay Lapasan, an urbanized area experiencing significant waste management challenges due to rapid population growth and commercial activity. The barangay faces issues such as inefficient waste segregation, poor collection systems, and low recycling participation, often exacerbated by limited environmental awareness and weak enforcement of waste management policies. Given these challenges, the study aimed to explore how environmental education could enhance waste management practices and promote responsible waste disposal among residents, businesses, and local institutions. The findings were expected to provide valuable insights for local government units and community leaders in formulating more effective policies and strategies to address solid waste issues.

Stratified random sampling was used to ensure diverse representation from key stakeholder groups, including household members, business owners, educators, local government officials, community

leaders, and waste management personnel. The study employed a structured questionnaire with both quantitative and qualitative components, including Likert-scale items and open-ended interview questions. Data were collected through surveys, interviews, and document analysis, ensuring comprehensive insights into the effectiveness of environmental education initiatives. The research adhered to ethical guidelines, including informed consent, voluntary participation, and confidentiality, to ensure the integrity of the study and protect participant rights. Statistical analysis, including descriptive statistics and regression models, provided a robust evaluation of the impact of environmental education on waste management behaviors in Barangay Lapasan.

RESULTS AND DISCUSSION

1. What is the demographic profile of respondents in terms of:
- **1.1 Sex;**
- **1.2 Age;**
- **1.3 Civil Status; and**
- **1.4 Education?**

Table 1
The Frequency and Percentage Distribution of the Demographic Profile of Respondents in terms of Sex

Sex	Frequency	Percentage
Male	74	49.3
Female	76	50.7
Total	**150**	**100**

Table 1 shows the frequency and percentage distribution of the demographic profile of respondents in terms of sex. The data reveals that 50.7% of the respondents were female while 49.3% were male, indicating a fairly balanced gender representation. This balanced distribution suggests inclusivity in participation, which supports equitable insights into community waste management perceptions. Gender plays a significant role in shaping environmental attitudes and behaviors, with women often more engaged in household-level waste practices. As noted by Garcia and Salcedo (2022), gender-inclusive approaches to environmental programs foster collaboration and sustainable community action. Therefore, ensuring gender diversity in stakeholder engagement can enhance the overall effectiveness of environmental education initiatives.

Table 2
The Frequency and Percentage Distribution of the Demographic Profile of Respondents in terms of Age

Age	Frequency	Percentage
18 to 21	26	17.3
22 to 25	34	22.7
26 to 29	23	15.3
30 and above	67	44.7
Total	**150**	**100**

Table 2 shows the frequency and percentage distribution of the demographic profile of respondents in terms of age. The data reveal that 44.7% of respondents are aged 30 and above, 22.7% are aged 22 to 25, 17.3% are aged 18 to 21, and 15.3% are aged 26 to 29. This distribution highlights the

predominance of older participants, indicating strong engagement from more mature stakeholders. The presence of various age groups reflects diverse experiences and environmental perspectives within the community. According to Ramos (2021), age diversity in community programs contributes to richer dialogue and more inclusive policy implementation. Thus, the findings suggest that age-related factors should be considered in the design of solid waste education campaigns.

Table 3 shows the frequency and percentage distribution of the demographic profile of respondents in terms of civil status. It shows that 53.3% of the respondents are single, while 46.7% are married. This relatively balanced distribution suggests that the perspectives provided reflect both individual and household-level experiences. Civil status may influence the level of engagement in waste management activities, particularly in the context of household responsibilities. Ledesma (2023) emphasized that environmental decisions are often shaped by the familial and domestic roles people assume. As such, future initiatives may benefit from tailoring strategies that consider the differing needs and behaviors of single and married individuals.

Table 3
The Frequency and Percentage Distribution of the Demographic Profile of Respondents in terms of Civil Status

Civil Status	Frequency	Percentage
Single	80	53.3
Married	70	46.7
Total	**150**	**100**

Table 4 shows the frequency and percentage distribution of the demographic profile of respondents in terms of education. The majority of respondents have completed high school (58.7%), followed by those with college education (18%), elementary education (16%), and post-graduate degrees (7.3%). This suggests that most respondents have a basic to intermediate educational background, with fewer having advanced education. Williams and Brown (2022) noted that individuals with lower levels of formal education may interpret environmental initiatives based on practical experiences rather than theoretical knowledge. Thus, educational interventions should consider simplifying environmental concepts and emphasizing visible, community-based results. Addressing this educational profile can help bridge knowledge gaps and improve participation in sustainable waste management practices.

Table 4
The Frequency and Percentage Distribution of the Demographic Profile of Respondents in terms of Education

Education	Frequency	Percentage
Elementary	24	16.0
High School	88	58.7
College	27	18.0
Post Graduate	11	7.3
Total	**150**	**100**

2. How do local stakeholders assess the effectiveness of environmental education in improving solid waste disposal practices in terms of:
- **2.1 Waste segregation compliance;**
- **2.2 Household waste reduction;**
- **2.3 Proper waste collection and disposal; and**
- **2.4 Participation in recycling and composting programs?**

Table 5 presents the local stakeholders assessed the effectiveness of environmental education in improving solid waste disposal practices in terms of waste segregation compliance. The overall mean is 3.47 (SD = 0.63), which is interpreted as "Strongly Agree," indicating that stakeholders view these educational efforts as highly sustainable. The relatively moderate standard deviation suggests some response variation but reflects a generally positive outlook. This result implies that environmental education has positively influenced solid waste segregation at the community level. Santos and Velasco (2021) state that consistent environmental education initiatives can significantly increase awareness and compliance with segregation practices. Therefore, reinforcing local programs can further strengthen long-term waste-sorting behaviors.

The item "I ensure that hazardous waste (e.g., batteries, chemicals) is disposed of separately" obtained the highest mean of 3.52 (SD = 0.59), interpreted as "Strongly Agree." This indicates that most respondents are highly aware of the importance of isolating hazardous waste, reflecting a deeper understanding of its environmental and health impacts. The low standard deviation shows a high level of agreement across the community. Villanueva and Cruz (2023) affirm that targeted information campaigns about hazardous waste improve compliance and reduce environmental hazards. This finding suggests the effectiveness of community education efforts in communicating the risks of dangerous, improper waste disposal.

Meanwhile, the statement "My household follows proper waste segregation practices as mandated by local policies" recorded the lowest mean of 3.42 (SD = 0.63), though still rated as "Strongly Agree." The slight drop in mean and higher deviation imply that while policies are known, their implementation varies across households. According to De Leon and Mendoza (2020), discrepancies in policy application often arise due to inconsistent enforcement and limited access to materials like color-coded bins. These findings indicate the need to strengthen operational support and policy implementation to ensure consistent compliance.

Table 5
The Local Stakeholders Assessed the Effectiveness of Environmental Education in Improving Solid Waste Disposal Practices in terms of Waste Segregation Compliance

Indicators	Mean	SD	Response	Interpretation
I regularly separate biodegradable, non-biodegradable, and recyclable waste at home.	3.43	0.70	Strongly Agree	Highly Sustainable
My household follows proper waste segregation practices as mandated by local policies.	3.42	0.63	Strongly Agree	Highly Sustainable
I am aware of the proper color coding of waste bins for segregation.	3.47	0.60	Strongly Agree	Highly Sustainable
I ensure that hazardous waste (e.g., batteries, chemicals) is disposed of separately.	3.52	0.59	Strongly Agree	Highly Sustainable
Waste segregation bins are available and accessible in my community.	3.49	0.64	Strongly Agree	Highly Sustainable
Overall	**3.47**	**0.63**	**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)

Table 6 presents the local stakeholders' assessment of the effectiveness of environmental education in improving solid waste disposal practices in terms of proper waste reduction. The overall mean is 3.53 (SD = 0.62), which falls under the "Strongly Agree" interpretation, indicating that stakeholders generally view environmental education as highly effective in encouraging proper waste reduction. The moderate standard deviation suggests variations in experiences or practices but maintains a central

agreement. This result highlights that waste reduction has gained traction among community members, thanks to the influence of educational programs. Dela Cruz and Garcia (2021) affirmed that sustained exposure to environmental campaigns can effectively instill waste-conscious behaviors. These findings support the development of community-based strategies focused on reducing unnecessary consumption.

The item with the highest mean is "I consciously reduce my household waste by minimizing single-use plastics," with a mean of 3.65 (SD = 0.56). This indicates that reducing plastic usage is a well-practiced habit, showing that stakeholders are aware of the environmental impact of plastic waste. The low standard deviation demonstrates strong agreement among respondents, suggesting widespread acceptance of this behavior. According to Lim and Bautista (2022), minimizing single-use plastics is often the first step in environmental responsibility due to its high visibility and accessibility. The result underscores the success of campaigns targeting plastic reduction and signals readiness for broader sustainable practices.

On the other hand, the item with the lowest mean is "I prefer buying products with minimal or eco-friendly packaging," which received a mean of 3.47 (SD = 0.66). Despite still being interpreted as "Strongly Agree," the higher standard deviation points to varying levels of behavior adoption, potentially due to cost or availability. This implies that while awareness exists, the practice is limited by external constraints. Santos and Yu (2020) observed that accessibility to eco-packaging is often influenced by supply chains and market structures, which affect consumer choices. Addressing these external limitations could help translate awareness into more consistent waste reduction behavior.

Table 6
The Local Stakeholders Assessed the Effectiveness of Environmental Education in Improving Solid Waste Disposal Practices in terms of Proper Waste Reduction

Indicators	Mean	SD	Response	Interpretation
I consciously reduce my household waste by minimizing single-use plastics.	3.65	0.56	Strongly Agree	Highly Sustainable
I reuse items such as bottles, containers, and bags to reduce waste.	3.48	0.62	Strongly Agree	Highly Sustainable
I prefer buying products with minimal or eco-friendly packaging.	3.47	0.66	Strongly Agree	Highly Sustainable
My household avoids food waste by planning meals and consuming leftovers.	3.56	0.65	Strongly Agree	Highly Sustainable
I participate in initiatives like refilling stations to reduce packaging waste.	3.48	0.61	Strongly Agree	Highly Sustainable
Overall	**3.53**	**0.62**	**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)

Table 7 presents the local stakeholders assessed the effectiveness of environmental education in improving solid waste disposal practices in terms of household waste reduction. The overall mean is 3.53 (SD = 0.60), indicating a "Strongly Agree" response, which implies that respondents generally perceive education to be instrumental in reducing household waste. The minimal standard deviation suggests consistent acknowledgment of household-based efforts across respondents. This reflects the positive impact of awareness programs focused on sustainable household habits such as food planning, reuse, and minimal packaging. According to Bautista and Legaspi (2021), household-level environmental education fosters a culture of accountability and proactive waste management. Therefore, education remains a powerful tool for promoting internalized and routine eco-conscious practices.

The highest mean score was 3.67 (SD = 0.55), associated with the item "I consciously reduce my household waste by minimizing single-use plastics." This indicates a high level of awareness and application of this sustainable behavior, consistent with broader environmental campaigns. The relatively low standard deviation confirms that this practice is widespread among respondents. This aligns with research by Alvarado and Dizon (2023), which emphasized that minimizing single-use plastics is a key behavior influenced by continuous education and media advocacy. The findings suggest a positive translation of awareness into action within households.

The lowest mean recorded was 3.49 (SD = 0.64) for the item "I participate in initiatives like refilling stations to reduce packaging waste." This suggests some limitations in access or availability of these initiatives despite general willingness. The relatively higher standard deviation implies that not all community members are equally able to engage in these practices. As observed by Santos and Lim (2020), infrastructure availability and logistical barriers hinder the widespread adoption of refilling practices. Efforts to expand access to such programs can help enhance waste reduction across more households.

Table 7
The Local Stakeholders Assessed the Effectiveness of Environmental Education in Improving Solid Waste Disposal Practices in terms of Household Waste Reduction

Indicators	Mean	SD	Response	Interpretation
I consciously reduce my household waste by minimizing single-use plastics.	3.67	0.55	Strongly Agree	Highly Sustainable
I reuse items such as bottles, containers, and bags to reduce waste.	3.51	0.60	Strongly Agree	Highly Sustainable
I prefer buying products with minimal or eco-friendly packaging.	3.51	0.61	Strongly Agree	Highly Sustainable
My household avoids food waste by planning meals and consuming leftovers.	3.51	0.60	Strongly Agree	Highly Sustainable
I participate in initiatives like refilling stations to reduce packaging waste.	3.49	0.64	Strongly Agree	Highly Sustainable
Overall	3.53	0.60	**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)

Table 8 presents the local stakeholders' assessment of the effectiveness of environmental education in improving solid waste disposal practices in terms of participation in recycling and composting programs. The overall mean is 3.57 (SD = 0.57), categorized under "Strongly Agree," suggesting strong agreement on the effectiveness of educational efforts. The relatively low standard deviation indicates respondents' consistency in recycling and composting. This finding suggests that these programs are well-understood and generally accessible in the community. According to Mariano and Del Rosario (2022), education significantly boosts participation in household-level recycling initiatives. These results affirm the community's engagement and the value of continued education in supporting recycling.

The item "I participate in recycling programs in my school, workplace, or community" earned the highest mean of 3.63 (SD = 0.52), suggesting widespread participation. This shows that institutional and community-based efforts successfully mobilize individuals into recycling programs. The low standard deviation reflects strong consensus and indicates that recycling behavior is common across age and demographic lines. Flores and Navarro (2020) found that integrating recycling into local institutions enhances participation and ensures program longevity. Thus, collaborative education between schools, LGUs, and households is a promising approach.

The item "I sell or donate recyclable materials to junk shops or recycling centers" received the lowest mean score of 3.53 (SD = 0.61), though still within the "Strongly Agree" category. This may indicate logistical or economic factors influencing the practice, even among willing participants. The slightly higher deviation suggests differing access levels to junk shops and recycling centers. As noted by Cordero and Sy (2021), while willingness to recycle exists, actual implementation often hinges on local infrastructure. Enhancing the logistics and incentives around recycling can improve material recovery rates.

Table 8
The Local Stakeholders Assessed the Effectiveness of Environmental Education in Improving Solid Waste Disposal Practices in terms of Participation in Recycling and Composting Programs

Indicators	Mean	SD	Response	Interpretation
I participate in recycling programs in my school, workplace, or community.	3.63	0.52	Strongly Agree	Highly Sustainable
I regularly segregate recyclable materials such as paper, plastic, and glass.	3.59	0.54	Strongly Agree	Highly Sustainable
I sell or donate recyclable materials to junk shops or recycling centers.	3.53	0.61	Strongly Agree	Highly Sustainable
I am aware of the benefits of composting biodegradable waste.	3.53	0.61	Strongly Agree	Highly Sustainable
I have tried composting food scraps and garden waste at home.	3.57	0.58	Strongly Agree	Highly Sustainable
Overall	**3.57**	**0.57**	**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)

3. 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 9 presents the local stakeholders evaluated different environmental education initiatives in terms of community awareness programs. The overall mean is 3.52 (SD = 0.62), indicating a "Strongly Agree" rating, which suggests that stakeholders believe community awareness programs are highly effective in promoting environmental sustainability. The moderately low standard deviation reflects a fairly consistent perspective across participants. This result affirms that grassroots education programs are successful in fostering environmental consciousness. Del Mundo and Navarro (2023) noted that community outreach and visibility directly correlate with stronger environmental attitudes. These findings highlight the importance of continued investment in local awareness programs.

The highest mean, 3.63 (SD = 0.54), was recorded for the item "The community awareness programs provide practical solutions to environmental issues." This reflects a strong agreement that practical applications and relatable solutions contribute significantly to learning retention and implementation. The low standard deviation supports the reliability of this sentiment across diverse groups. According to Fernandez and Yu (2022), education that connects with real-life challenges fosters more immediate community action. This result suggests that grounding environmental education in practical issues is an effective strategy.

Conversely, the item "I actively participate in environmental community awareness programs" yielded the lowest mean at 3.33 (SD = 0.78), although it still falls under the "Strongly Agree" category. The relatively high standard deviation indicates varied participation levels, likely due to differences in

access, availability, or personal motivation. Reyes and Tomas (2020) emphasized that while awareness is widespread, active participation often hinges on the convenience and frequency of program delivery. This implies a need for better outreach scheduling and incentives to encourage higher turnout.

Table 9
The Local Stakeholders Evaluated Different Environmental Education Initiatives in terms of Community Awareness Programs

Indicators	Mean	SD	Response	Interpretation
I actively participate in environmental community awareness programs.	3.33	0.78	Strongly Agree	Highly Effective
Local community programs have improved my environmental knowledge.	3.53	0.60	Strongly Agree	Highly Effective
I believe community programs effectively promote environmental sustainability.	3.55	0.60	Strongly Agree	Highly Effective
I feel motivated to apply eco-friendly practices after attending community programs.	3.55	0.59	Strongly Agree	Highly Effective
The community awareness programs provide practical solutions to environmental issues.	3.63	0.54	Strongly Agree	Highly Effective
Overall	3.52	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)

Table 10 presents the local stakeholders who evaluated different environmental education initiatives in terms of school-based environmental curriculum. The overall mean is 3.56 (SD = 0.58), which is interpreted as "Strongly Agree," indicating a strong approval of how environmental content is integrated into the curriculum. The relatively low standard deviation suggests a shared view among stakeholders regarding the school's role in promoting sustainability. This implies that schools effectively deliver environmental topics that resonate with students and community members. Lagman and Soriano (2022) emphasize that a well-integrated environmental curriculum helps build lifelong eco-conscious habits. These findings reinforce the value of formal education in shaping long-term environmental behaviors.

Table 10
The Local Stakeholders Evaluated Different Environmental Education Initiatives in terms of School-based Environmental Curriculum

Indicators	Mean	SD	Response	Interpretation
The school curriculum includes sufficient environmental education topics.	3.55	0.64	Strongly Agree	Highly Effective
I have learned about climate change and sustainability in my school subjects.	3.55	0.55	Strongly Agree	Highly Effective
School activities encourage students to adopt environmentally friendly habits.	3.51	0.62	Strongly Agree	Highly Effective
The curriculum provides practical applications for solving environmental issues.	3.62	0.56	Strongly Agree	Highly Effective
Teachers effectively integrate environmental education into their lessons.	3.57	0.55	Strongly Agree	Highly Effective
Overall	**3.56**	**0.58**	**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)

The highest mean score was 3.62 (SD = 0.56), associated with the item "The curriculum provides practical applications for solving environmental issues." This suggests that respondents find school-based lessons to apply to real-life environmental challenges. A low standard deviation indicates agreement on the relevance and effectiveness of these applications. According to Gomez and Robles (2021), curriculum content incorporating real-world context enhances learning outcomes and motivates student participation. This underscores the importance of experiential learning strategies in environmental education.

The item "School activities encourage students to adopt environmentally friendly habits" received the lowest mean of 3.51 (SD = 0.62), although it still earned a "Strongly Agree" interpretation. The slightly higher standard deviation reflects variability in implementing environmental initiatives across different schools. Bautista and Ong (2020) noted that disparities in resources and school leadership can influence the effectiveness of sustainability activities. This result indicates the need for more consistent school-wide programming to ensure uniform impact.

Table 11 presents the local stakeholders who evaluated different environmental education initiatives in terms of media and campaign strategies. The overall mean is 3.55 (SD = 0.60), which falls under the "Strongly Agree" category and is interpreted as "Highly Effective." This indicates that stakeholders perceive media campaigns as highly useful in promoting environmental awareness and behavior change. The moderate standard deviation suggests slight variations in how the messages are received across different groups. According to Mendoza and Cruz (2021), media platforms significantly shape environmental behavior through consistent and engaging messaging. This highlights the strategic value of media in reinforcing sustainability goals at the community level.

The item with the highest mean is "I learn a lot about environmental issues through media (TV, social media, newspapers)," with a score of 3.64 (SD = 0.55), interpreted as "Strongly Agree" and "Highly Effective." This shows that mass media and social media are recognized as key sources of environmental education. The relatively low standard deviation indicates a strong consensus among respondents on the effectiveness of these platforms. Herrera and Lim (2022) noted that social media enables the dissemination of timely and relatable environmental content, enhancing public engagement. Therefore, media platforms continue to be a powerful avenue for ecological education.

On the other hand, the lowest mean was observed in the item "I have changed my habits due to environmental awareness campaigns," which scored 3.47 (SD = 0.67), though still interpreted as "Strongly Agree" and "Highly Effective." The higher standard deviation indicates that not all stakeholders are equally influenced in changing behavior, possibly due to individual readiness or exposure. Antonio and Dela Peña (2020) found that while media campaigns create awareness, behavior change depends on sustained reinforcement and personal motivation. This suggests that campaigns should be designed to inform and provide actionable steps and consistent follow-up.

Table 11
The Local Stakeholders Evaluated Different Environmental Education Initiatives in terms of Media and Campaign Strategies

Indicators	Mean	SD	Response	Interpretation
I learn a lot about environmental issues through media (TV, social media, newspapers).	3.64	0.55	Strongly Agree	Highly Effective
Social media campaigns effectively raise awareness about environmental problems.	3.55	0.62	Strongly Agree	Highly Effective
I have changed my habits due to environmental awareness campaigns.	3.47	0.67	Strongly Agree	Highly Effective
Advertisements and documentaries influence my perception of environmental protection.	3.59	0.54	Strongly Agree	Highly Effective

I frequently engage with online environmental advocacy pages or forums.	3.51	0.62	Strongly Agree	Highly Effective
Overall	**3.55**	**0.60**	**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)

Table 12 presents the local stakeholders evaluated different environmental education initiatives in terms of workshops and trainings. The overall mean is 3.54 (SD = 0.63), which is interpreted as "Strongly Agree" and categorized as "Highly Effective." This indicates that stakeholders see workshops and training sessions as necessary in strengthening environmental awareness and behavior. The standard deviation shows some differences in opinions, but still reflects a strong central agreement. As emphasized by Ramos and Enriquez (2021), structured training activities help bridge the gap between knowledge and environmental action. This highlights the value of continuing these initiatives to deepen stakeholder commitment to sustainability.

The highest mean score was 3.67 (SD = 0.56), from the item "I have attended workshops or training on environmental conservation." This reflects high stakeholder participation in organized educational events. The low standard deviation indicates consistent responses, suggesting intense exposure to environmental training opportunities. Lopez and Arrieta (2023) emphasized that community workshops build shared experiences, enhancing environmental collaboration and action. This reinforces the importance of practical learning formats for community engagement.

The lowest mean was 3.43 (SD = 0.67) for the item "Workshops provide hands-on experience in solving environmental issues." While still rated "Strongly Agree," this indicates some variability in experiences regarding delivering practical content. De Castro and Miranda (2020) noted that workshop impact varies depending on facilitation quality and community readiness. This suggests that improving hands-on components and follow-through activities could strengthen training effectiveness.

Table 12
The Local Stakeholders Evaluated Different Environmental Education Initiatives in terms of Workshops and Training

Indicators	Mean	SD	Response	Interpretation
I have attended workshops or training on environmental conservation.	3.67	0.56	Strongly Agree	Highly Effective
Environmental training programs have improved my awareness and knowledge.	3.50	0.63	Strongly Agree	Highly Effective
Workshops provide hands-on experience in solving environmental issues.	3.43	0.67	Strongly Agree	Highly Effective
I am more committed to sustainable practices after attending environmental training.	3.49	0.67	Strongly Agree	Highly Effective
The training sessions offer practical steps for reducing environmental harm.	3.63	0.60	Strongly Agree	Highly Effective
Overall	**3.54**	**0.63**	**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. Is there a significant difference in how respondents perceive the solid waste disposal practices when grouped according to their demographic profiles?

Table 3 depicts the test for a significant difference in respondents' perceptions of solid waste disposal practices when grouped according to their demographic profiles. The data reveals that male respondents have a higher mean score (3.80) than female respondents (3.58) regarding solid waste disposal practices. The t-value is 21.091, and the p-value is 0.000, indicating a statistically significant difference at the 0.05 level. This means that the perception of solid waste practices significantly differs

between males and females. Males appear to demonstrate stronger engagement or awareness about solid waste management. This difference may be linked to roles, exposure, or access to community-driven environmental programs. Understanding such variations allows for a more tailored approach in planning environmental interventions.

This significant gender difference implies that environmental education programs might not be equally resonant across sexes. Therefore, tailored content or delivery methods may be necessary to engage women more effectively and encourage their participation in sustainable waste practices. Garcia and Salcedo (2022) emphasized integrating gender-sensitive perspectives in environmental programs to promote inclusivity and a more significant behavioral impact. Environmental campaigns may benefit from disaggregated strategies to close the gender gap and boost participation across diverse community segments.

Table 13
Test of Significant Difference in Respondents' Perception of the Solid Waste Disposal Practices when Grouped According to their Demographic Profile

Profile	Solid Waste Disposal Practices					
	Category	**Mean**	**f-value**	**t-value**	**Remarks**	**Decision on Ho**
Sex	Male	3.80	21.091	0.000	Significant	Rejected
	Female	3.58				

Significant if p-value <0.05
Legend: Ho is rejected if Significant
Ho is failed to reject if Not Significant

Table 14 depicts the test for a significant difference in respondents' perceptions of solid waste disposal practices when grouped according to their demographic profiles. The data shows a significant difference in the perception of solid waste disposal practices based on age groups. Respondents aged 30 and above had the highest mean score (3.85), followed by those aged 22 to 25 (3.72), 26 to 29 (3.65), and 18 to 21 (3.45). The p-value from the ANOVA test is 0.004, indicating that age statistically affects perception. This suggests that older respondents are more engaged or aware of solid waste management practices. This trend may be due to more exposure to educational campaigns and life experience.

The findings imply that age-targeted interventions may be necessary for effective environmental education. Younger respondents may require more foundational awareness-building strategies, while older individuals could benefit from deepening their existing knowledge. Ramos (2021) argued that tailoring programs to address specific age-related needs ensures better participation and effectiveness in sustainability efforts. A focused approach could lead to a more informed and engaged community in waste management practices.

Table 14
Test of Significant Difference in Respondents' Perceived Solid Waste Disposal Practices when Grouped According to their Demographic Profile

Profile	Solid Waste Disposal Practices					
	Category	**Mean**	**f-value**	**p-value**	**Remarks**	**Decision on Ho**
Age	18 to 21	3.65	0.624	0.601	Not Significant	Failed to Reject
	22 to 25	3.65				
	26 to 29	3.61				
	30 and above	3.75				

Significant if p-value <0.05
Legend: Ho is rejected if Significant
Ho is failed to reject if Not Significant

Table 15 depicts the test for a significant difference in respondents' perceptions of solid waste disposal practices when grouped according to their demographic profiles. Single respondents had a higher mean score (3.69) than married respondents (3.52), with a t-value of 0.278 and a p-value of 0.599, indicating that the difference is not statistically significant. This suggests that marital status may not significantly impact how solid waste disposal practices are perceived. Both single and married individuals seem to share similar perceptions of the effectiveness of solid waste practices despite their distinct life situations. This finding challenges the notion that household responsibilities, often associated with marital status, directly influence waste management perceptions. Ledesma (2023) emphasized that while family roles may influence some environmental behaviors, such as waste generation, education and outreach play a more prominent role in shaping public perception.

Given that civil status did not significantly affect perceptions, environmental education initiatives could be universally targeted without needing specific marital status adjustments. However, community programs might still benefit from addressing single and married individuals' unique needs, as domestic responsibilities could influence actual behavior rather than perceptions. Ledesma (2023) highlighted that social norms and community influence environmental behaviors more than marital status alone. Therefore, community-wide approaches that emphasize shared responsibility could further strengthen engagement.

Table 15
Test of Significant Difference in Respondents' Perceived the Solid Waste Disposal Practices when Grouped According to their Demographic Profile

Profile	Solid Waste Disposal Practices					
	Category	**Mean**	**f-value**	**t-value**	**Remarks**	**Decision on Ho**
Civil Status	Single	3.69	0.278	0.599	Not Significant	Failed to Reject
	Married	3.52				

Significant if p-value <0.05
Legend: Ho is rejected if Significant
Ho is failed to reject if Not Significant

Table 16 depicts the test for a significant difference in respondents' perceptions of solid waste disposal practices when grouped according to their demographic profiles. The overall mean scores for respondents with elementary education (3.75), high school education (3.68), college education (3.70), and post-graduate education (3.55) indicate that there is no significant difference between these groups. The p-value of 0.724 suggests that education level does not significantly affect perceptions of solid waste management practices. This indicates that environmental education has a broad reach in influencing perceptions of waste practices regardless of educational background. Even individuals with lower educational levels, such as those with only elementary education, demonstrate high levels of awareness. Williams and Brown (2022) emphasized that education in environmental matters can be effective across all levels of formal education.

Table 16
Test of Significant Difference in Respondents' Perceived the Solid Waste Disposal Practices when Grouped According to their Demographic Profile

Profile	Solid Waste Disposal Practices					
	Category	**Mean**	**f-value**	**p-value**	**Remarks**	**Decision on Ho**
Education	Elementary	3.75	0.441	0.724	Not Significant	Failed to Reject
	High School	3.68				
	College	3.70				
	Post Graduate	3.55				

Significant if p-value <0.05
Legend: Ho is rejected if Significant

Ho is failed to reject if Not Significant

The findings imply that environmental education campaigns can be designed without worrying about participants' educational levels, as the impact is widespread across all groups. This supports the need for general outreach initiatives that cater to all education levels, ensuring inclusivity. Williams and Brown (2022) suggest that simplifying content to match participants' knowledge level is key to increasing engagement. As such, making environmental education accessible to all, regardless of their formal education, will likely yield positive outcomes in solid waste management.

5. Is there a significant relationship between environmental education initiatives and solid waste disposal outcomes?

Table 17 depicts the test for a significant relationship between environmental education initiatives and solid waste disposal outcomes. The data shows the correlation between environmental education initiatives and solid waste disposal outcomes. All four educational initiatives—community awareness programs, school-based environmental curriculum, media and campaign strategies, and workshops and training—demonstrate significant positive relationships with waste segregation compliance, household waste reduction, proper waste collection, and participation in recycling programs. The correlations range from 0.238 to 0.424, with p-values all less than 0.05, indicating statistically significant relationships. This suggests that educational efforts have a measurable impact on solid waste disposal practices. The findings support the hypothesis that comprehensive environmental education initiatives, whether through community, school, media, or training programs, significantly enhance waste management behaviors. Mariano and Del Rosario (2022) found similar results in their study on the role of education in increasing recycling rates and waste reduction behaviors.

The significant relationships indicate that further investment in environmental education initiatives could strengthen sustainable waste management practices. The results suggest that a multi-faceted approach, combining community outreach, school curricula, media campaigns, and workshops, is the most effective way to encourage better waste management. Mariano and Del Rosario (2022) pointed out that integrating various educational platforms ensures more widespread and lasting changes in behavior. Therefore, continuing to support these initiatives and expanding their reach could have a lasting impact on improving community waste management practices.

Table 17
Test of the Significant Relationship between Environmental Education Initiatives and Solid Waste Disposal Outcomes

Environmental Education Initiatives	Solid Waste Disposal Outcomes											
	Waste Segregation Compliance			Household Waste Reduction			Proper Waste Collection and Disposal			Participating in Recycling and Composting Programs		
	r	p-value	Ho	r	p-value	Ho	r	p-value	Ho	r	p-value	Ho
Community Awareness Programs	.424**	.000	S	.405**	.000	S	.238**	0.003	S	.270**	.001	S
School-based Environmental Curriculum	.407**	.000	S	.363**	.000	S	.269**	.001	S	.396**	.000	S
Media and Campaign	.328**	.000	S	.403**	.000	S	.162*	.047	S	.303**	.000	S
Workshops and Training	.336**	.000	S	.409**	.000	S	.277**	.001	S	.340**	.000	S

Significant if p-value <0.05
Legend: Ho is rejected if Significant
Ho is failed to reject if Not Significant

CONCLUSION

Based on the findings from the study, it is clear that environmental education has a significant impact on improving solid waste disposal practices in Barangay Lapasan, Cagayan de Oro City. The study highlights that community-based programs, school curricula, media campaigns, and workshops effectively raise awareness and promote sustainable waste management behaviors. However, challenges remain in ensuring consistent participation, particularly among certain demographic groups, such as younger individuals and those with lower levels of education. The study also suggests that while knowledge and awareness are widespread, practical application of waste management practices like segregation and recycling requires more infrastructure support. Educational programs should continue to evolve to be more inclusive and address the community's varying needs.

The findings indicate that a multi-faceted approach to environmental education is necessary to strengthen sustainable waste management practices. The success of community outreach, coupled with school-based curricula and media campaigns, shows that diverse educational efforts are essential for fostering long-term behavior change. It is critical to ensure that these programs are informative and actionable, providing clear steps for participants to follow. Additionally, the study suggests that continuous reinforcement of these programs and improvements in local infrastructure will be vital in sustaining the positive effects of environmental education on waste management practices in Barangay Lapasan.

Recommendations

Based on the findings and conclusions, here are the recommendations:

1. Local Government Units and Policymakers. They should also improve facilities such as waste segregation bins and recycling centers, and create policies that encourage community participation in proper waste management practices.

2. Community Members and Households. Community members and households should take part in environmental education activities, join local waste reduction programs, and practice proper waste management by reducing waste, segregating trash correctly, and recycling whenever possible.

3. Educational Institutions and Teachers. Educational institutions and teachers should include environmental education in their lessons, give students hands-on activities, encourage eco-friendly habits, and promote sustainable practices through projects and discussions about waste management.

4. Environmental Advocacy Groups and Non-Governmental Organizations. Environmental advocacy groups and non-governmental organizations should work with communities, schools, and the media to raise environmental awareness, promote practical waste management practices, and encourage more people to take part in sustainability activities.

5. Researchers and Academicians. Researchers and academicians should conduct more studies to evaluate environmental education strategies, find new ways to increase participation, and examine the long-term effects of education on sustainable waste management in different communities.

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