PROMOTING ENVIRONMENTAL STEWARDSHIP: SCHOOL INITIATIVES FOR MANAGING BIODEGRADABLE WASTES

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ABSTRACT: *This study, Promoting Environmental Stewardship: School Initiatives for Managing Biodegradable Wastes, explores the effectiveness of school-based waste management programs in fostering ecological responsibility among students and staff. It evaluates current initiatives for managing biodegradable wastes in five educational institutions—Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School, Saint Louis School of Don Bosco, and Saint Pius X School of Samboan Inc.—to assess their impact on environmental stewardship. Utilizing a qualitative research design, the study gathered data through in-depth interviews with teachers and principals to examine changes in student behavior, awareness, and attitudes resulting from these initiatives. Specifically, the research addresses the following questions: (1) What are the concrete activities you have observed in the classroom to strictly integrate or implement proper segregation of waste in school?, (2) How does the school reinforce the proper segregation of waste to be observed in the whole institution?, and (3) What are the difficulties you have observed in the implementation? Findings indicate that although schools have taken steps toward managing biodegradable waste, these efforts are often hindered by low awareness, limited accountability, inadequate infrastructure, and minimal integration of environmental education. The study recommends strengthening awareness campaigns, improving disposal facilities, increasing student involvement, engaging faculty, and fostering a culture of shared responsibility. These actions are essential to transforming waste segregation into a deeply rooted practice that supports a cleaner, greener, and more sustainable school environment.*

Keywords: Proper segregation, implementation of waste management

INTRODUCTION

Environmental stewardship is an essential responsibility in fostering sustainable communities especially educational institutions. Schools play a crucial role in instilling environmental responsibility among students. As global concerns over waste accumulation and environmental degradation intensify, schools are increasingly implementing initiatives to manage biodegradable waste effectively [1]. These initiatives not only contribute to waste reduction, but also foster ecological consciousness, promoting long-term sustainable behaviors among students and staff (United Nations Educational, Scientific and Cultural Organization [2].

This study, "Promoting Environmental Stewardship: School Initiatives for Managing Biodegradable Wastes," examines the strategies or initiatives employed by select schools in managing biodegradable waste. Specifically, it focuses on Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School, Saint Louis School of Donbosco, and Saint Pius X School of Samboan Inc. to assess the effectiveness of their proper waste management activities. The study explores various school-based initiatives such as waste segregation, composting, recycling, curriculum integration of proper waste management and developing research projects that support ecological

responsibility aiming to identify best practices and areas for improvement. Research suggests that integrating sustainability practices into school programs significantly enhances students' environmental awareness and participation [3].

Proper management of biodegradable waste has numerous environmental benefits, including reducing landfill contributions, enriching soil through composting, and mitigating pollution [4]. Schools, as learning hubs, have the potential to cultivate responsible waste management habits that extend beyond the campus and into students' communities. This study investigates the level of engagement among students and faculty, analyzing how these initiatives impact environmental responsibility and awareness within the school setting. Furthermore, it aims to provide actionable recommendations to enhance waste management practices, reinforcing the role of educational institutions in environmental sustainability. By examining school-based waste management efforts, this research underscores the importance of integrating sustainability into education. Findings from this study will contribute to the broader discourse on environmental stewardship, emphasizing the need for schools to serve as catalysts for change in fostering eco-friendly practice and community awareness [5].

RATIONALE

In the face of escalating environmental challenges, educational institutions are uniquely positioned to cultivate a culture of sustainability and ecological awareness. As hubs for knowledge dissemination and character formation, schools can lead by example in addressing pressing environmental issues—particularly the management of biodegradable waste. Improper handling of such waste contributes significantly to environmental degradation, including soil and water pollution, greenhouse gas emissions, and public health risks. Thus, managing biodegradable waste is not merely a logistical concern but a moral and educational imperative.

The global call for environmental stewardship has emphasized the role of education in fostering sustainable behaviors. According to United Nations Educational, Scientific and Cultural Organization (UNESCO), schools have the potential to shape the environmental attitudes and actions of future generations. This potential becomes more critical as the volume of waste produced by communities continues to rise [6]. Educational institutions, through intentional and well-structured initiatives, can significantly contribute to waste reduction and the cultivation of lifelong sustainable habits among students and faculty. This study, *"Promoting Environmental Stewardship: School Initiatives in Managing Biodegradable Wastes,"* is rooted in the need to

understand and evaluate the practical strategies employed by schools to manage biodegradable waste responsibly. It specifically explores the efforts of five diverse institutions—Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School, Saint Louis School of Donbosco, and Saint Pius X School of Samboan Inc. These schools, with their varied contexts and community settings, provide a valuable lens through which to examine the current state and effectiveness of school-based waste management programs. Key initiatives, such as segregation practices, composting systems, awareness campaigns, and curriculum integration, are not only environmental solutions but also pedagogical tools that can deepen students' understanding of ecological issues. Research by United Nations Educational, Scientific and Cultural Organization (UNESCO) supports the idea that integrating sustainability into education fosters long-term environmental responsibility [6]. Moreover, as highlighted by recent studies, educational initiatives that emphasize participation and action enhance students' environmental literacy and engagement [7].

This study also recognizes the broader environmental benefits of proper biodegradable waste management, such as reducing reliance on landfills, minimizing pollution, and creating compost that can enhance school gardens or community agriculture [8]. However, despite these advantages, schools often encounter barriers in implementing and sustaining such initiatives, including lack of resources, limited expertise, and inconsistent participation from stakeholders.

By investigating the current initiatives, challenges, and levels of engagement within the selected schools, this research aims to identify best practices and gaps in implementation. It seeks to provide evidence-based recommendations that can support other schools in adopting or enhancing their own waste management systems. More importantly, it advocates for the institutionalization of environmental stewardship within the educational framework, recognizing schools as catalysts for community transformation.

Ultimately, the findings of this study will contribute to the broader discourse on environmental education and sustainable development. It underscores the urgent need for schools not only to teach about sustainability but also to model it in everyday practices. Through effective biodegradable waste management, schools can significantly influence societal attitudes and behaviors, making environmental stewardship an integral part of the educational experience and community life [6].

STATEMENT OF THE PROBLEM

This study aims to evaluate the current school initiatives for managing biodegradable wastes in promoting environmental stewardship at selected schools. By examining these school-based waste management initiatives, this study seeks to identify waste management initiatives and its implementations in promoting ecological awareness and environmental stewardship. Specifically, this study aims to answer the following questions:

1. What are the concrete activities you have observed in the classroom to strictly integrate or implement proper segregation of waste in school?
2. How does the school reinforce the proper segregation of waste to be observed in the whole institution?
3. What are the difficulties you have observed in the implementation?

PHILOSOPHICAL UNDERPINNINGS

This study is grounded in the philosophical paradigms of pragmatism, constructivism, and critical theory. These frameworks collectively inform the study's objectives, scope, and methodological approach. Pragmatism emphasizes the practical application of ideas and the evaluation of concepts based on their outcomes. In the context of environmental education, pragmatism supports the implementation of actionable strategies that yield tangible results. This aligns with the study's focus on assessing the effectiveness of school-based biodegradable waste management initiatives. By prioritizing real-world applications, pragmatism facilitates the development of educational practices that are responsive to environmental challenges [9][8]. Constructivism posits that knowledge is constructed through experiences and interactions within a social context. This perspective is pertinent to environmental education, where learners actively engage with environmental issues to build understanding. The study's emphasis on curriculum integration, student-led projects, and participatory activities reflects a constructivist approach, fostering deeper engagement and personal connection to environmental stewardship [7][6]. Critical theory examines the underlying power structures and societal factors that influence education and environmental practices. It advocates for transformative education that challenges existing norms and promotes social justice. In this study, critical theory informs the analysis of institutional and systemic barriers to effective waste management in schools. By addressing these challenges, the research aims to empower educational institutions to become agents of environmental and social change [5][6].

SCOPE AND LIMITATIONS OF THE STUDY

This study focuses on exploring and analyzing school-based initiatives that promote environmental stewardship through the management of biodegradable wastes. The research specifically centers on five educational institutions: Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School, Saint Louis School of Donbosco, and Saint Pius X School of Samboan Inc. The scope of the study includes the identification and evaluation of programs, practices, and policies implemented by these schools in handling biodegradable waste. These may include composting activities, segregation systems, awareness campaigns, student-led projects, and integration of environmental topics in the curriculum. The study also seeks to understand how these initiatives foster environmental values among students, faculty, and the wider school community. Data collection will involve qualitative methods such as interviews with school administrators, and teachers. The study is limited to biodegradable waste management practices within the campus setting and does not cover the management of non-biodegradable or hazardous wastes. Moreover, the research is geographically and institutionally delimited to the five aforementioned schools, and therefore does not aim to generalize its findings to all schools in the Philippines. The selection of these schools is based on their varying locations and educational setups, which may offer diverse insights into environmental stewardship practices.

The study will not measure long-term environmental impacts quantitatively but will instead focus on immediate and observable outcomes and stakeholder perceptions.

SIGNIFICANCE OF THE STUDY

This study is significant as it examines how schools can serve as key platforms for promoting environmental stewardship, specifically through managing biodegradable wastes. By focusing on five selected educational institutions—Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School, Saint Louis School of Donbosco, and Saint Pius X School of Samboan Inc.—the research highlights the role of localized school initiatives in fostering environmental awareness and sustainable practices. Moreover, this research study on Promoting Environmental Stewardship: School Initiatives for Managing Biodegradable Wastes have significant implications for the following stakeholders:

For School Leaders and Educators: By providing insights on what school's initiatives are useful in managing biodegradable wastes in promoting environmental stewardship among students.

For Students: School initiatives that promote environmental stewardship allow students to be more civic and responsible on managing their biodegradable wastes not only at school, but also at their homes.

For Local Communities and Stakeholders: Insights on schools' initiatives in managing biodegradable wastes that encourage and promote environmental stewardship can help local communities and stakeholders to adapt such initiatives to maintain the cleanliness on their locale. These schools' initiatives as well can promote civic responsibilities among community members.

REVIEW OF RELATED LITERATURE AND RELATED STUDIES

This section presents literature and studies relevant to the present study. It is divided into eleven parts: (1) Environmental Stewardship and Waste Management in Schools (2)Vermicomposting as a Sustainable Waste Management Practice (3) Biodegradable Waste Management Practices (4) Integrating Proper Waste Segregation in the Curriculum (5) Waste Segregation in the ESP (Edukasyon sa Pagpapakatao) Curriculum (6) Waste Segregation in the Senior High School Research Project Subject (7) Effectiveness of School-Based Waste Management Programs (8) Impact of Waste Segregation Education on Student Engagement (9) Solid Waste Management Awareness and Practices among Senior High School Students (10) Sustainability of Biodegradable Plastics in Waste Management (11) and Waste Management in Schools as a Component of Sustainable Development

Environmental Stewardship and Waste Management in Schools

Schools play a vital role in fostering environmental stewardship by integrating sustainable waste management practices into their educational frameworks. According to Tilbury, education for sustainable development enhances students' environmental awareness and encourages responsible waste disposal behaviors[3]. Proper waste management initiatives, particularly for biodegradable waste, help reduce pollution and instill eco-friendly habits that extend beyond the school setting [5].

Vermicomposting as a Sustainable Waste Management Practice

Hajam et al. emphasized the role of vermicomposting as an efficient, eco-friendly strategy for managing organic waste [10]. Their study demonstrated how earthworms can biologically process biodegradable materials—such as kitchen waste, paper, and agricultural residues—into nutrient-rich compost, which not only improves soil fertility but also reduces greenhouse gas emissions. Vermi transformation contributes to a circular economy, wherein waste is no longer viewed as a burden but as a resource for sustainable agricultural production. The research also highlighted the scalability of vermicomposting systems, making them suitable for both urban and rural settings, including educational institutions. Integrating this practice into school programs not only supports waste reduction but also provides valuable learning experiences for students in environmental stewardship, aligning with the goals of Education for Sustainable Development (ESD).

Biodegradable Waste Management Practices

Biodegradable waste, which includes food scraps, garden waste, and paper products, can be effectively managed through composting, waste segregation, and recycling [4]. Studies have shown that composting programs in schools not only minimize landfill waste but also provide educational opportunities for students to learn about soil enrichment and sustainable agriculture [11]. Similarly, proper waste segregation ensures that organic waste is efficiently processed, reducing environmental impact [12].

Integrating Proper Waste Segregation in the Curriculum

Integrating proper waste segregation into school curricula is a crucial strategy for fostering environmental responsibility among students. According to Tilbury, education plays a fundamental role in shaping students' attitudes and behaviors toward sustainability [3]. By incorporating waste management topics into various subjects more particularly in ESP and Research Project, schools can instill lifelong environmental consciousness and encourage responsible waste disposal practices. The United Nations Educational, Scientific and Cultural Organization (UNESCO) emphasizes that environmental education should be embedded within formal learning structures to promote sustainable development effectively [2].

Waste Segregation in the ESP (Edukasyon sa Pagpapakatao) Curriculum

Edukasyon sa Pagpapakatao (ESP), a subject in the Philippine curriculum that focuses on values education, presents an ideal platform for integrating waste segregation principles. Teaching waste management through ESP allows students to understand their moral and social responsibility in protecting the environment [13]. Studies show that when environmental values are incorporated into character education, students develop stronger pro-environmental behaviors [14]. By linking waste segregation to ethical responsibility, students learn that proper waste disposal is not only a regulatory requirement but also a reflection of personal and collective discipline. **Waste Segregation in the Senior High School Research Project Subject**

Incorporating waste management and segregation topics in the Research Project subject in senior high school allows

students to explore scientific and practical solutions to environmental challenges. According to Garcia and Torres, research-based learning enhances critical thinking and problem-solving skills, making it an effective approach for promoting sustainable waste management practices [15]. Senior high school students conducting research on waste segregation can analyze the efficiency of existing school-based programs, propose improvements, and develop innovative solutions such as recycling initiatives or composting projects [11].

Effectiveness of School-Based Waste Management Programs

Research highlights the importance of structured school-based waste management programs in promoting environmental responsibility. A study by Gifford and Nilsson found that active participation in waste management initiatives increases students' pro-environmental behavior, as hands-on learning reinforces sustainable habits [1]. Furthermore, school policies that mandate waste reduction, recycling, and proper disposal significantly contribute to long-term environmental benefits [2]. However, the success of these programs depends on institutional support, student engagement, and access to waste management resources [5].

Impact of Waste Segregation Education on Student Engagement

Research suggests that students who learn about waste segregation through formal curriculum integration demonstrate higher levels of participation in school-based environmental programs [5]. Educational interventions that combine theoretical knowledge with practical applications, such as waste audits and community clean-up drives, significantly increase students' awareness and engagement [4]. Furthermore, the success of these initiatives depends on the support of educators, school policies, and access to necessary waste management infrastructure [2].**Solid Waste Management Awareness and Practices among Senior High School Students.** Molina and Catan conducted a study at a state college in Zamboanga City, Philippines, assessing the awareness and practices related to solid waste management among 332 Grade 12 students across various academic strands [16]. The findings revealed that while students possessed substantial knowledge regarding the definition of solid waste, its detrimental effects, prohibited activities, and the importance of proper waste management, there was a notable deficiency in their understanding of specific laws governing waste management, such as Republic Act No. 9003. The primary sources of their awareness were identified as television or radio, parents, and social media. Despite the gaps in legal knowledge, students demonstrated commendable waste management practices, particularly in segregation, reduction, reuse, recycling, and disposal. This study underscores the pivotal role of educational institutions in fostering environmental awareness and the need to enhance curricular content to include comprehensive information on environmental legislation.

Sustainability of Biodegradable Plastics in Waste Management

Moshood et al. conducted a comprehensive review on the sustainability of biodegradable plastics, emphasizing their potential as a solution to global plastic pollution [17]. The study highlights those biodegradable plastics, when managed appropriately through methods like composting, can significantly reduce environmental impacts, including greenhouse gas emissions. Utilizing the triple bottom line framework—encompassing economic, social, and environmental aspects—the authors assess the viability of biodegradable plastics in promoting a circular economy. The research underscores the importance of life cycle assessments to ensure that the production and disposal of these materials align with sustainability goals. For educational institutions, integrating biodegradable plastics into waste management practices not only addresses environmental concerns but also serves as a practical teaching tool for students to understand sustainable materials and their role in environmental stewardship.

Waste Management in Schools as a Component of Sustainable Development

Haniva, Butar, and Ambarita conducted a bibliometric analysis to explore the role of waste management in schools within the context of sustainable development [18]. Analyzing 63 publications from 2010 to 2023, the study identified a growing body of research emphasizing the importance of integrating waste management practices in educational settings, particularly at the primary and junior high school levels. The analysis revealed that while 2022 saw the highest number of publications, 2021 was the most influential year in terms of citations and impact. Key themes emerging from the literature include the evaluation of waste management systems in schools, the environmental impacts of waste, and the integration of sustainability education into school curricula. The study underscores the need for increased international collaboration and suggests that schools serve as pivotal platforms for instilling sustainable waste management practices, thereby contributing to broader environmental goals.

DEFINITION OF TERMS

To ensure clarity and consistency throughout the study, the following key terms are defined based on their contextual relevance:

Biodegradable Waste – Refers to organic waste materials that can be broken down naturally by microorganisms. Examples include food scraps, garden waste, and paper products.

Environmental Stewardship – The practice of responsibly managing natural resources and the environment through sustainable actions and behaviors that promote ecological balance.

Waste Segregation – The systematic separation of waste into categories such as biodegradable, non-biodegradable, hazardous, and recyclable materials to ensure proper disposal and treatment.

7Rs Framework – A guiding principle in environmental sustainability that includes the practices of Rethink, Refuse, Reduce, Reuse, Repair, Regift, and Recycle, aimed at minimizing waste and promoting conscious consumption.

Composting – A biological process in which biodegradable waste is decomposed into nutrient-rich organic fertilizer, used to enhance soil fertility and support sustainable agriculture.

Smart Bins – Technologically advanced waste receptacles equipped with sensors that detect and assist in the automatic sorting of waste, improving hygiene and efficiency in segregation.

Curriculum Integration – The incorporation of environmental education and sustainability-related topics into various academic subjects to develop students' awareness and responsibility toward ecological issues.

Collaborative Stewardship – A shared approach to environmental management that involves cooperation among students, educators, and school personnel to promote sustainable practices within the institution.

Resource Conservation – The practice of using natural and human-made resources efficiently and responsibly to ensure their availability for future generations.

RESEARCH METHODOLOGY

This research explores the steps taken to gather information for the study. It explains the overall approach, the participants involved, the setting where data was collected, the tools used to gather information, and the methods for collecting that information.

RESEARCH PARADIGM

This study employs a qualitative-descriptive research paradigm to explore and evaluate school-based initiatives in managing biodegradable wastes, aiming to promote environmental stewardship in selected educational institutions. This approach focuses on understanding current practices, their effectiveness, and the challenges encountered in implementing sustainable waste management systems. Guided by the research questions, the study examines existing initiatives, assesses their impact on fostering ecological responsibility among stakeholders, and identifies areas for improvement. It begins by profiling the schools based on their location and teacher population to contextualize the institutional setting. Data on the biodegradable waste management programs currently implemented in the five selected schools will be collected and analyzed to determine their structure, scope, and alignment with environmental goals. Furthermore, the study evaluates the perceived and actual effectiveness of these programs in instilling environmental stewardship among students and faculty. Special attention is given to institutional practices promoting waste segregation and the extent to which these are reinforced throughout the school community. The paradigm also encompasses the identification of barriers to the sustainability of such initiatives and concludes with the formulation of evidence-based
recommendations to enhance the efficacy of biodegradable waste management practices. Through this approach, the research aims to provide a holistic and grounded understanding of how school-led efforts contribute to the broader objective of environmental conservation and awareness.

RESEARCH APPROACH

This study adopts a qualitative research design aimed at assessing the effectiveness of biodegradable waste management initiatives in promoting environmental stewardship among students. The qualitative approach enables the researcher to explore the lived experiences, perceptions, and attitudes of school stakeholders involved in these initiatives. Through in-depth interviews, the study captures insights into how environmental awareness and stewardship are fostered within the school setting.

RESEARCH DESIGN

The study utilizes a descriptive qualitative research design that assess the effectiveness of the different schools' initiatives in managing biodegradable wastes in order to promote environmental stewardships among students on these five educational institutions namely, Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School, Saint Louis School of Don Bosco, and Saint Pius X School of Samboan Inc. Data were collected through in-depth interviews from teachers and principal to determine the change of behavior and attitude or improved knowledge and awareness among students to the implemented school initiatives in managing biodegradable wastes.

RESEARCH LOCALE

The study was conducted across five educational institutions: Divine Grace International Christian School, Decor Carmeli Academy Inc., Manjuyod National High School (Senior High School Department only), Saint Louis School of Don Bosco, and Saint Pius X School of Samboan Inc. Divine Grace International Christian School is a private institution located along the National Road in Bacong, Negros Oriental, with a total of 17 teachers. Decor Carmeli Academy Inc., established in 1956, is a private school situated in Zamboanguita, Negros Oriental, and has 22 teachers. Manjuyod National High School's Senior High School Department, a public institution founded in 2016, is located in Manjuyod, Negros Oriental, and comprises 30 teachers. Saint Louis School of Don Bosco, a Christian private school located in Barangay Calindagan, Dumaguete City, has a faculty of 55 teachers. Saint Pius X School of Samboan Inc., managed by the DST Sisters, is a Christian private school located in Poblacion, Samboan, Cebu, near Saint Michael the Archangel Church, with a total of 12 teachers. These schools represent a mix of public and private institutions in both rural and urban settings, offering a diverse context for examining environmental stewardship practices.

PARTICIPANTS OF THE STUDY

The participants of this study include a principal of the school , Technology and Livelihood Education (TLE) teachers, Filipino and English teachers who are also handling Technical Vocational and Livelihood (TVL) subjects, a research project adviser and teacher advisers of Kindergarten and Grades 4 and 6. The inclusion of the participants allows for a comprehensive assessment on promoting environmental stewardship on regards to the different schools' initiatives in managing biodegradable wastes. A total of 15 research respondents were selected as study sample.

SAMPLING TECHNIQUE

This study employs purposive sampling, a non-probability sampling technique where participants are intentionally selected based on specific criteria relevant to the research objectives. Purposive sampling is ideal for this study as it focuses on selecting individuals who have direct experience, expertise, or roles related to biodegradable waste management and environmental initiatives within their respective schools. This ensures that the data gathered are rich, relevant, and insightful for addressing the study's research questions.

Participants will be selected based on the following criteria:

1) Faculty members involved in environmental or science-related subjects (e.g., Science, Technology and Livelihood Education (TLE), Social Studies, Research Project Adviser).
2) School administrators, guidance counselors, or coordinators of school-based environmental programs or student organizations
3) Personnel responsible for implementing, monitoring, or evaluating waste segregation and biodegradable waste practices in the school.
4) Teachers or staff who have actively participated in school-wide sustainability initiatives.

RESEARCH METHODS

This study employed descriptive qualitative research design to identify, assess and evaluate the current initiatives implemented by selected schools on managing their biodegradable wastes. The primary tool for data collection is the in-depth interview. An interview guide composed of open-ended questions is utilized to facilitate the conversation, allowing participants to share their thoughts freely. Interviews are conducted face-to-face or online, depending on participant availability and school protocols. The questions are designed to gather data on: The current biodegradable waste management practices, The perceived behavioral and attitudinal changes among students, and the challenges encountered during implementation. Collected data are analyzed through thematic analysis. The process includes: Transcription of recorded interviews, Initial coding of significant statements and ideas, Categorization into broader themes and sub-themes, Interpretation to derive meaning and draw conclusions related to the effectiveness of the initiatives

RESEARCH INSTRUMENTS

The primary research instrument employed in this study is a semi-structured interview guide. This tool is specifically designed to explore the current initiatives, experiences, and perceptions of school personnel regarding biodegradable waste management and environmental stewardship within their institutions.

The interview guide consists of open-ended questions, grouped into the following key sections:

Current Waste Management Initiatives – focuses on identifying existing biodegradable waste management practices and the stakeholders involved in implementing them.

Promotion of Environmental Stewardship – explores how school initiatives influence student awareness, behavior, and engagement in environmental protection.

Reinforcement of School-Wide Practices – investigates the institutional strategies and policies for reinforcing proper waste segregation and sustainable practices.

Challenges and Recommendations – identifies barriers in program implementation and gathers suggestions for improvement.

This instrument was crafted based on the research questions and is aimed at ensuring data relevance and depth. It underwent validation through consultation with research adviser to ensure content clarity, coherence, and alignment with the study objectives.

The semi-structured nature of the interview allows flexibility for probing deeper into participant responses, enabling the researcher to capture more nuanced insights and lived experiences related to the subject matter.

ETHICAL CONSIDERATIONS

Ethical integrity is upheld throughout the research process. The following measures are observed:

Informed consent is secured from all participants before data collection.

Confidentiality and anonymity are maintained to protect the identity of participants and their institutions.

Participants are given the right to withdraw at any stage of the research without any repercussions.

All data collected are used solely for academic purposes.

NARRATIVE REFLECTION

Conducting this research started as a requirement for Agricultural Arts but quickly became a personal and transformative experience. We gained valuable insights not only into biodegradable waste management but also into how schools can lead in promoting environmental responsibility. Visiting different institutions showed us the creative and practical ways schools implement sustainability, even with limited resources—through composting, smart bins, gardening, and the 7Rs.

We also saw the challenges: inconsistent waste segregation, lack of awareness, and limited facilities. These obstacles reminded us that real change takes time, persistence, and cooperation. Most importantly, we learned that sustainability is not just about policies but about cultivating lasting habits and shared values.

This project helped us grow as researchers and as advocates. It changed how we view our environment and encouraged us to be more responsible in our daily actions. We hope our work sparks further action and inspires others to create positive change in their own communities.

RESULTS AND DISCUSSION

Question 1: What are the concrete activities you have observed in the classroom to strictly integrate or implement proper segregation of waste in school?

Emergent Framework

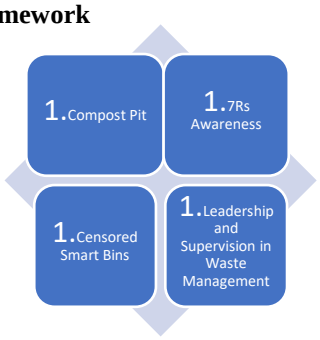

Figure No. 1: Emergent Them No. 2

The framework identifies four key themes essential for school-based waste management: Compost Pit, 7Rs Awareness, Censored Smart Bins, and Leadership and Supervision. These interconnected elements support environmental stewardship among students and staff. Compost pits promote biodegradable waste processing, while 7Rs Awareness fosters responsible waste behavior. Censored

smart bins enable efficient segregation through technology. Leadership ensures proper implementation through guidance and accountability.

The 7Rs (Rethink, Refuse, Reduce, Reuse, Repair, Regift, Recycle) drive behavioral change by minimizing waste at the source. Leadership and supervision further strengthen governance and encourage active participation.

Technical and Livelihood Education (TLE) supports this framework by providing practical skills through activities like composting and gardening, reinforcing sustainable waste practices and environmental understanding.

These findings are relevant to the statement shared by participant:

P1: "As TLE teacher, particularly in the areas of agriculture and environmental sustainability, composting and gardening projects and valuable hands-on activities that teach students how to manage biodegradable waste properly while promoting sustainable agriculture. These activities do not only help reduce waste, but also provide students with essential life skills in gardening and food production. For instance, composting that turns biodegradable wastes into fertilizer that promotes cost effective fertilizer and organic farming"

The findings above say that integrating composting and gardening in TLE education offers multiple benefits, from effective biodegradable waste management to promoting sustainable agriculture. These hands-on activities not only reduce waste and improve soil fertility but also equip students with valuable life skills in gardening and food production. By incorporating such programs, schools can play a significant role in promoting environmental sustainability and self-sufficiency among learners.

In addition, proper waste segregation is a crucial component of effective waste management in educational institutions. Schools play a vital role in instilling environmental responsibility among students by implementing structured waste management programs such as the 7Rs Framework in waste management [19]. Waste segregation ensures that recyclable and biodegradable materials are properly sorted, reducing landfill waste and promoting sustainability [20]. These findings are relevant to the following statements shared by participants:

P2: "At our school, we strictly enforce proper waste segregation by following school regulations, particularly those related to garbage disposal. To promote responsibility among students, we implement a program called the 7Rs Inspection and Evaluation, which was introduced by the school district division. This program ensures the cleanliness of the school campus and reinforces proper waste segregation. Through this initiative, teachers, students, and staff become more aware of the importance of proper waste management and monitoring. The 7Rs stand for Rethink, Refuse, Reduce, Reuse, Repair, Recycle, and Rot—a framework that helps maintain a safe, clean, and active school environment."

P3: "At Manjuyod National High School, we strictly implement proper waste segregation by assigning students daily cleaning duties. Every afternoon before dismissal, students are responsible for cleaning the classroom and ensuring that waste is properly segregated according to the labeled trash bins inside or outside the classroom: biodegradable, nonbiodegradable, hazardous, and recyclable materials such as plastic bottles. Before dismissal, students must take responsibility for disposing of their garbage properly and ensuring that the classroom is completely clean. Within our school campus, aside from students assigned to clean their classrooms, utility personnel are also responsible for managing waste. Every day, they are assigned to collect waste from various areas outside the classroom buildings and transport it to the designated disposal area."

The findings show that applying the 7Rs framework promotes a clean and sustainable school environment, supported by active participation, monitoring, and leadership. Smart bins and student-led projects enhance engagement and eco-consciousness through technology. Strong leadership ensures effective waste policy enforcement, while TLE activities like composting and gardening build practical sustainability skills. Combining traditional methods with modern tools fosters responsible waste habits and prepares students for a sustainable future.

Question 2. How does the school reinforce the proper segregation of waste to be observed in the whole institution?

Emergent Framework

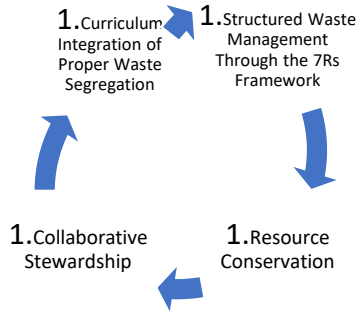

Figure 2: Emergent Framework no. 2

The framework presents a structured approach to school-based waste management centered on the 7Rs (Rethink, Refuse, Reduce, Reuse, Repurpose, Recycle, Recover). It emphasizes minimizing waste, conserving resources, and promoting sustainability.

Key components include:

- **Structured Waste Management**: Guided by the 7Rs to reduce consumption and explore material reuse.
- **Resource Conservation**: Promotes efficient use of natural and man-made resources.
- **Collaborative Stewardship**: Encourages shared responsibility among students, educators, communities, and policymakers.
- **Curriculum Integration**: Embeds waste management education to instill long-term sustainable habits.

Technical and Livelihood Education (TLE) reinforces these goals through hands-on activities like composting and gardening, which enhance students' skills in environmental sustainability. Together, these elements create a holistic system that fosters responsible behavior and a culture of sustainability in schools.

The participants emphasized the importance of a structured and collaborative approach to waste management in schools.

P1 shared that their school enforces proper waste segregation through daily routines, designated bins, regular monitoring,

and strong teacher and utility staff involvement. These coordinated efforts ensure consistent compliance and foster a culture of cleanliness and responsibility.

P2 highlighted a system where Grade 11 and 12 students take turns cleaning shared classrooms and sorting waste into clearly labeled bins. This daily practice, supported by utility personnel and reinforced through educational materials and teacher supervision, cultivates discipline and cooperation among students.

P3 explained that their school integrates waste management into the curriculum, using subjects like Values Education, Practical Research, and Science to instill environmental responsibility, encourage research, and raise awareness about the health and ecological impacts of waste.

Overall, the findings show that collaborative stewardship—shared responsibility among students, teachers, and staff—combined with curriculum integration and structured systems like the 7Rs, leads to effective and sustainable waste management. This framework nurtures environmental awareness, responsible behavior, and long-term resource conservation both in school and the wider community.

2.1 Collaborative Stewardship

Collaborative stewardship emphasizes collective responsibility for environmental sustainability. According to UNESCO, education for sustainable development (ESD) fosters a sense of shared responsibility among students, teachers, and the community [21]. This aligns with Participant 1's statement that the school integrates waste segregation into daily routines, with teachers and utility personnel actively guiding students. Similarly, Chalkley highlights that involving all stakeholders in sustainability initiatives ensures consistent implementation and long-term impact [22]. The school's approach of assigning cleaning duties to students and involving utility staff reflects this collaborative effort, fostering a culture of shared responsibility.

2.2 Curriculum Integration of Proper Waste Segregation

Integrating waste management into the curriculum is a proven strategy for instilling sustainable behaviors. UNESCO emphasizes that embedding sustainability concepts into subjects like Science, Values Education, and Practical Research helps students understand the environmental and health impacts of waste [23]. Participant 3's statement supports this, noting that the school integrates waste management into subjects such as Values Education, Practical Research, and Science and Health. Additionally, McBeth and Volk argue that curriculum-based environmental education enhances students' knowledge and skills, empowering them to adopt sustainable practices in their daily lives [24].

2.3 Structured Waste Management Through the 7Rs Framework

The 7Rs Framework (Rethink, Refuse, Reduce, Reuse, Repair, Regift, and Recycle) provides a structured approach to waste management. Zero Waste International Alliance advocates for this framework as a comprehensive strategy to minimize waste and promote resource efficiency. Participant 1's statement highlights the school's adoption of the 7Rs Framework, including practices like reducing plastic use, reusing materials, and recycling [25]. Furthermore, EPA emphasizes the importance of clear waste segregation systems, such as color-coded bins, to ensure proper disposal. The school's implementation of these practices aligns with global standards for sustainable waste management [26].

2.4 **Resource Conservation**

Resource conservation is a critical component of sustainability efforts in schools. UNEP highlights the importance of reducing resource consumption through policies and infrastructure improvements, such as water-efficient faucets and energy-saving systems [27]. Participant 3's statement reflects this, noting the school's strict policies on water and electricity usage. Additionally, Eco-Schools emphasizes the role of student-led campaigns in promoting energy conservation and reducing waste [28]. The school's paperless communication system and promotion of eco-friendly alternatives, such as reusable water bottles, demonstrate its commitment to resource conservation.

The Conceptual framework aligns with the principles of Education for Sustainable Development (ESD) as outlined by UNESCO, which emphasizes the importance of integrating sustainability into education and fostering collective action. [21].

Question 3: What are the difficulties you have observed in the implementation?

Emergent Framework

Figure 3: Emergent Framework no. 3

Schools face several challenges in sustaining proper waste segregation, including low student awareness, poor compliance, and weak enforcement of policies. Logistical issues like unclear bin labels and inefficient collection systems also contribute to improper waste disposal. Responsibility often falls on janitors rather than being shared by the whole school community. Limited environmental education further weakens students' understanding of the long-term effects of poor waste management.

To address these issues, schools need stronger awareness campaigns, improved waste systems, and integration of environmental education into the curriculum.

A conceptual framework identifies four key elements affecting waste segregation:

1. **Waste Segregation Challenges (Red)** – Difficulty sorting waste due to limited infrastructure, unclear guidelines, and low public compliance.
2. **Segregation Barriers (Orange)** – Cultural attitudes, lack of awareness, and logistical problems that hinder proper implementation.
3. **Responsibility on Waste (Yellow-Green)** – The need for shared accountability among individuals, schools, and communities to ensure sustained efforts.

4. **Environmental Education (Green)** – Promotes awareness and responsible behavior, encouraging long-term sustainable practices.

In the Philippine context—marked by rapid urbanization and a growing population—effective solid waste management is crucial. However, despite the mandates of R.A. No. 9512, which requires environmental education in all schools, implementation often falls short. Many students do not take responsibility for their waste, leading to improper disposal and contamination of segregated bins. Weak accountability, limited awareness, and poor enforcement undermine the system.

Participant Insights:

- ***P1*** *observed that students often neglect their role in waste management, mixing biodegradable and non-biodegradable waste, especially without close supervision. This weakens the overall system despite efforts by teachers and staff.*
- ***P2*** *noted widespread confusion about proper segregation among students, staff, and even parents. A lack of clear guidance and labeling contributes to incorrect disposal.*
- ***P3*** *highlighted that low awareness, limited resources, and inconsistent enforcement are key barriers. Many students don't fully understand waste categories or the purpose of segregation. Even when aware, poorly placed or insufficient bins hinder compliance.*

These challenges reflect the need for stronger environmental education, clearer systems, and shared responsibility. Addressing knowledge gaps and infrastructure issues is essential for sustainable waste management in schools.

CONCLUSION

The successful implementation of proper waste segregation in schools requires a combination of awareness, responsibility, and structured waste management systems. However, challenges such as low awareness, lack of student accountability, segregation barriers, and inadequate environmental education continue to hinder its effectiveness. Many students fail to take responsibility for their own waste, leading to improper disposal and weakening the overall waste management system. Additionally, confusion regarding waste segregation, insufficient waste bins, and inconsistent enforcement contribute to non-compliance. To address these issues, schools must strengthen awareness campaigns, improve waste disposal facilities, actively engage students in sustainability programs, and integrate environmental education into the curriculum. By fostering a culture of environmental responsibility, schools can encourage proper waste segregation practices, leading to a cleaner and more sustainable learning environment. Effective waste management is not only a matter of policy but also a shared responsibility among students, teachers, and staff. Ensuring consistent adherence to waste segregation guidelines will contribute to long-term environmental sustainability within the school community.

RECOMMENDATIONS

Based on the findings, it is strongly recommended that schools enhance awareness campaigns through creative and engaging methods such as posters, social media, and school events to educate students and staff on the importance of waste segregation. Student accountability should be promoted by establishing initiatives like environmental clubs or ambassador programs, along with incentives for consistent participation. Waste disposal facilities must be improved by providing clearly labeled and accessible bins for various types of waste. Environmental education should be integrated into the curriculum and supplemented with workshops, guest speakers, and field trips. Faculty and staff engagement is essential; they should receive training and actively model responsible waste practices, with waste management discussed in meetings. To address barriers, schools must offer simple, clear segregation guidelines with visual aids and reminders. Enforcing consistent waste management rules, with regular compliance checks, is crucial. Ultimately, fostering a culture of environmental responsibility—where all members of the school community feel accountable and work collaboratively—will embed waste segregation as a lasting and meaningful practice.

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