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Solid Waste Management Practices and Implementation among Science Teachers in Leon, Iloilo

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ABSTRACT

This study assessed solid waste management (SWM) practices and their implementation among science teachers in the District of Leon I, Leon, Iloilo, and identified integration points for the DepEd Science curriculum. Using a descriptive-correlational design, 62 teachers answered a Likert questionnaire on segregation, reduction, recycling/reuse, disposal, and policy implementation. Practices were moderate: segregation scored highest; disposal was weakest. Older teachers (≥36) showed stronger segregation and implementation; female teachers reported better disposal practices. Seminar attendance showed no significant effects. Segregation, reduction, and recycling/reuse were positively associated with implementation, while disposal was not. Findings point to gaps in the final handling of waste and in the knowledge of sanctions under RA 9003. The school SWM package for Science, class waste audits, color-coded bin use, composting investigations, plastic-use reduction challenges, and eco-monitor roles, aligned with ESD and RA 9003. These actions translate policy into habits, strengthen implementation, and support reductions in school waste.

Keywords: Solid waste management (SWM); DepEd Science curriculum integration; RA 9003 compliance; Education for Sustainable Development; Science teachers.

BACKGROUND OF STUDY

Environmental degradation remains a defining challenge of our time, and the way societies manage municipal solid waste (MSW) sits at its core. Globally, waste volumes and costs are projected to climb steeply without stronger prevention and segregation, underscoring the urgency of upstream solutions (UNEP, 2024). In the Philippines, national baselines indicate an average MSW generation of ~0.40 kg per person per day and a rise in total waste from ~13.48 million tons (2010) to ~18.05 million tons (2020), highlighting sustained growth pressures (DENR-EMB, 2020; Jao, 2024).

Policy frameworks already mandate action and position schools as leverage points. The Ecological Solid Waste Management Act's updated Implementing Rules and Regulations emphasize segregation at source and education (DENR, 2025). In basic education, DepEd Order No. 5, s. 2014 operationalizes school-level SWM, while more recent guidance reiterates school responsibilities for campus cleanliness and SWM practices (DepEd, 2014; DepEd, 2022). Consistent with these mandates, contemporary evidence shows that education, social participation, and behaviorally informed interventions materially improve segregation and related practices (Trushna et al., 2024). Emerging Philippine studies with learners likewise point to knowledge–attitude–practice (KAP) dynamics as proximate drivers of behavior (Canlas & Mendoza, 2025; Mercado, 2023).

Nevertheless, a concrete local picture reveals persistent gaps. Iloilo City's average daily waste reached ~400 tons in 2023, and the city is developing an integrated facility designed to handle ~475 tons/day—signals of scale that demand stronger upstream reduction and segregation behaviors (City ENRO/IMT News, 2023; CityNet, 2024).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

In Leon, Iloilo—where Bayag National High School is situated—household- or community-level studies in Western Visayas exist. However, school-based, public secondary evidence outside highly urbanized centers remains sparse relative to policy expectations. Recent work on students' SWM/KAP comes from other regions, reinforcing that localized, school-specific diagnostics are still limited for municipalities like Leon (Canlas & Mendoza, 2025; Molina & Catan, 2021; Bagundang, 2024; Mercado, 2023). Accordingly, this study examines SWM in the District of Leon I to establish a baseline of student KAP and prevailing school practices; assess alignment with RA 9003 (per 2025 IRR), RA 9512–aligned DepEd directives, and DepEd Order No. 5, s. 2014; and identify targeted, school-appropriate interventions to improve segregation, recovery, and safe disposal. By explicitly linking national mandates to local realities—and by grounding recommendations in current evidence on education- and behavior-based levers—this study aims to generate actionable guidance for school administrators and teachers, support compliance, and contribute to reducing MSW-related environmental and health risks in the community (UNEP, 2024; DENR, 2025; DepEd, 2014, 2022; Trushna et al., 2024).

Statement of the Problem

The focus of this research was to explore how solid waste management is implemented and practiced in the District of Leon I, located in Leon, Iloilo. Specifically, the study aims to address the following questions:

1. What is the sociodemographic profile of the respondents in terms of;

a. Age

b. Sex; and

C. Number of solid waste management seminars?

2. What are the respondent practices on Solid Waste Management described in terms of:

a. Segregation;

b. Waste Reduction;

c. Waste recycling and Reuse

d. Waste Disposal?

3. What level of implementation did the respondents have on solid waste management practices?

4. Is there a significant difference between the level of solid waste management practice when grouped according to teachers' sociodemographic profiles?

5. Is there a significant difference between the level of solid waste management implementation when grouped according to teachers' sociodemographic profiles?

6. Is there a significant relationship between the level of practice in solid waste management and the level of implementation by the teachers?

7. Based on the research result, what Integration to the DepEd Science Curriculum Intervention Plan can be formulated?

RESEARCH METHODOLOGY

Research Design

The researcher was employing a descriptive correlational research design in this study to collect data from respondents and address the specific features of the available data required for the investigation. According to Gill and Johnson (2015), a descriptive design examines specific features of a particular respondent at a certain

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

time or at different times for comparative purposes. This study approach deems it acceptable to investigate how the student demographic profile, solid waste management practices, and implementation may correlate to each of the variables.

Respondents of the Study

The respondents of this study were the 62 science teachers assigned to the three secondary junior high schools in the District of Leon I. These include eight teachers from Bayag National High School, 21 teachers from Tacuyong Sur National High School, and 33 teachers from Leon National High School. Since the total number of science teachers in the district is relatively manageable, the study made use of total enumeration, which means that all members of the population were included as respondents rather than selecting only a sample.

These respondents are considered the most appropriate for the conduct of the study because they serve as the direct facilitators of science instruction and project-based learning activities in their respective schools. Teachers not only deliver the science curriculum but also observe closely how students practice, apply, and develop skills in line with scientific concepts and environmental awareness. Their perceptions are therefore critical in identifying students' strengths, learning challenges, and behavioral patterns in science-related practices.

This comprehensive approach also provides a stronger basis for recommending strategies that may improve instructional practices and the implementation of science programs across the district.

Table 1. Distribution of survey respondents in District of Leon I Secondary Junior High School

School	**Number of Science Teachers**
Bayag National High School	8
Tacuyong Sur National High School	21
Leon National High School	33
TOTAL	62

Research Instrument

The study utilized the adapted instrument developed by Gatang (2022), entitled "Research Instrument for Teacher Respondents in Relation to Solid Waste Management Practices. This instrument was chosen because it was specifically designed to assess solid waste management practices from the perspective of teachers, making it appropriate for the objectives of the study.

The questionnaire had three main parts. Part I, the "Demographic Profile," gathered basic information such as age, sex, highest educational attainment, number of seminars attended in solid waste management, and length of service. Part II measured the level of solid waste management practices through 40 items, equally divided into four categories: Waste Segregation, Waste Reduction, Waste Recycling and Reuse, and Waste Disposal. Each category contained 10 questions. Respondents answered these items using a 4-point Likert scale ranging from *1 = Strongly Disagree* to *4 = Strongly Agree*. Teachers indicated the extent to which they agreed or disagreed with each statement based on their own classroom and school experiences. Part III focused on the implementation of solid waste management practices, consisting of 10 items that examined teachers' knowledge and application of policies and programs such as Republic Act 9003 and school-based waste initiatives. This section was also answered using the same 4-point Likert scale.

Data Gathering Procedure

The research process began with the researcher sending a formal letter to request approval from the Dean of the Graduate School prior to conducting the data collection. The necessary revisions suggested during the pre-

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

oral defense were incorporated into the manuscript and duly signed by the panel of interrogators. Afterward, the researcher discussed the purpose of the study with the district supervisor and the school principals of the participating schools. Once permission was granted, the research instrument, adapted from Gatang (2022), was finalized and prepared for reproduction. Printed copies were provided for areas with weak or no internet connection, while Google Forms were created for teachers with stable online access. At this stage, ethical considerations were addressed by securing informed consent, ensuring voluntary participation, and explaining that all responses would be treated with strict confidentiality and used solely for academic purposes. No names were required, and anonymity was maintained throughout the process.

Upon receiving approval from the school principals, the researcher scheduled the data collection with the junior high school science teachers across the District of Leon I. During a Collaborative Expertise session; the researcher explained the nature, purpose, and scope of the study, as well as the rights of the respondents. Science teachers were guided in answering the questionnaires either online through Google Forms or face-to-face using printed copies, depending on the availability of internet connectivity. Adequate time was provided for the completion of the instrument, and the researcher remained available to clarify any questions while ensuring that the teachers' responses reflected their own views and practices. Participation was voluntary, and respondents were assured that their data would remain private and protected in accordance with research ethics.

After all responses were collected, the researcher consolidated both the digital and printed questionnaires. The data were carefully tabulated, encoded, and stored securely with restricted access to prevent unauthorized use. To further ensure confidentiality, no identifying information was included in the dataset. The processed data were then forwarded to a licensed statistician for analysis and interpretation. Ethical standards were strictly followed by maintaining data privacy, storing responses safely, and ensuring that findings were reported in aggregate form only, without linking results to individual respondents.

Data Treatment and Procedure

For the sociodemographic profile of the respondents in terms of age, sex, and number of solid waste management seminars. The data on the respondents' profiles were analyzed using frequency counts and percentages to show the distribution of teachers across age, sex, and seminars attended.

For the level respondent, the practices on solid waste management were described in terms of segregation, waste reduction, waste recycling and reuse, and waste disposal. The practices of respondents were analyzed using the mean and standard deviation to determine the level of practice in each category. The values were interpreted using a descriptive scale of low, moderate, or high.

The level of implementation that the respondents had of solid waste management practices. The implementation data were analyzed using the mean and standard deviation. The descriptive interpretation showed whether the teachers' level of implementation was low, moderate, or high.

There is a significant difference in the level of solid waste management practice when grouped according to teachers' sociodemographic profiles. The differences were tested using the Chi-Square Test of Independence. This determined whether age, sex, and number of seminars significantly affected the teachers' level of practice.

There is a significant difference in the level of solid waste management implementation when grouped according to teachers' sociodemographic profiles. The data were also tested using the Chi-Square Test of Independence. This examined whether implementation levels varied significantly when teachers were grouped by their demographic characteristics.

A significant relationship between the level of practice in solid waste management and the level of implementation by the teachers?

The relationship was tested using Spearman's rho correlation coefficient. This identified whether higher levels of practice were associated with higher levels of implementation.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

RESULTS AND DISCUSSION

Sociodemographic profile of the teacher in terms of Age, Sex, and Number of solid waste management seminars.

The demographic profile of the teachers' respondents shows that the ages of 36–40 years (29.0%) and over 40 (29.0%), followed by 26–30 (24.2%) and 31–35 (17.7%), with 58% aged 36 and above. In terms of sex, female teachers comprise the clear majority (72.6%) versus male teachers (27.4%). As the seminar profile is dominated by teachers who have not attended any seminar (67.7%), followed at a distance by those with one (16.1%) and two (11.3%) seminars. At the same time, very small and equal minorities report three, four, or five seminars (1.6% each). This distribution signals a substantial professional-development gap: two-thirds of respondents report zero recent training exposure. As to the teacher profile, it implies predominantly female, largely mid to late-career, and—with notable exceptions—underexposed to recent seminars.

This result, aligned in New South Wales, revealed that mid-to-late-career teachers reported low participation in recent training unless the programs were specifically designed to be meaningful, collegial, and respectful (Gore et al., 2021). Similarly, Christie (2023) noted that mid-career teachers who lack structured PD opportunities tend to feel under-supported, which correlates with lower engagement in new instructional practices. Talafian (2025) showed that responsive professional development, tailored to teacher needs, was less available in rural or under–resourced districts, leaving many teachers with no recent training exposure. Regarding the profile of teachers, multiple studies confirm that the teaching profession remains predominantly female in many contexts, especially in public schools, and that many of these female teachers are in mid to late career stages (i.e., 10–20+ years of experience) (Talafian, 2025; Gore et al., 2021; Christie, 2023). These studies also found that older or more experienced teachers often have fewer recent seminar or workshop exposures compared to those earlier in their careers, due in part to diminished access, scheduling constraints, or lack of PD offerings designed for them (Gore et al., 2021; Talafian, 2025).

Table 1. Sociodemographic Profile of the Teacher Respondent

Profile	**Frequency**	**Percentage**
Age in years		
26-30	15	24.2%
31-35	11	17.7%
36-40	18	29.0%
over 40	18	29.0%
Sex		
Male	17	27.4%
Female	45	72.6%
Number of Seminars		
0	42	67.7%
1	10	16.1%
2	7	11.3%

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

3	1	1.6%
4	1	1.6%
5	1	1.6%

Student practices on Solid Waste Management can be described in terms of Segregation, Waste Reduction, Waste recycling and Reuse, and Waste Disposal, as perceived by the Teacher.

Table 2 presents the extent of solid waste management (SWM) practices as perceived by teacher respondents, grouped into four categories: Waste Reduction, Waste Segregation, Waste Recycling/Reuse, and Waste Disposal. In the Waste Segregation category, the highest mean among the categories (M = 3.43, SD = 0.77), interpreted as *Moderate*. Teachers and administrators strongly reminded students to segregate waste (M = 3.69), while the use of trash cans for biodegradable waste (M = 3.56) and plastic segregation (M = 3.50) were also rated high. However, student observation of segregation (M = 2.94) was only moderate, suggesting that while systems are in place, student compliance remains inconsistent.

The moderate level of waste segregation implies that schools have established visible systems, such as trash bins and regular reminders from teachers and administrators, which help reinforce compliance. However, the lower student observation rating suggests that the sustainability of these practices depends on active student participation. This highlights the need for integrating stronger habit-building strategies and student-led monitoring mechanisms into daily routines to ensure consistency beyond teacher supervision.

Furthermore, the waste reduction was followed closely with a mean of 3.35 (SD = 0.83), which was also interpreted as *moderate*. Practices like encouraging students to avoid plastics (M = 3.63) and administration support through posters and environmental advocacy (M = 3.63 and 3.50, respectively) were rated high. However, actions such as discouraging canteen sellers from using plastics (M = 2.88) and purchasing recycled school supplies (M = 3.13) received only moderate ratings, indicating partial implementation of reduction strategies.

The findings on waste reduction indicate that while schools actively promote campaigns and encourage students to minimize plastic use, these practices remain only partially embedded in school culture. The moderate ratings for canteen and school supply policies imply that institutional reinforcement is still lacking. This suggests that policy-level interventions—such as procurement guidelines for recyclable materials and agreements with canteen operators—could transform waste reduction from occasional initiatives into systemic practices.

In terms of waste recycling/reuse, it was next, with a mean of 3.04 (SD = 0.78), which was interpreted as *moderate*. Composting biodegradable materials (M = 3.56) and reusing big plastic bottles as pails (M = 3.44) were notable practices. However, reusing papers and old magazines (M = 2.75) and recycling plastic cups into pots (M = 2.56) received lower ratings, showing that while some recycling practices are evident, others are less consistently applied.

The moderate scores in recycling and reuse point to the presence of creative practices, such as composting and reusing containers, but these are not uniformly applied across all materials. The low ratings for recycling paper and plastic cups suggest barriers such as a lack of resources, training, or awareness about possible reuse projects. This indicates the need for capacity-building programs for both teachers and students, coupled with resource support, to expand recycling practices and embed them into classroom and extracurricular activities.

Besides, the Waste Disposal received the lowest overall mean score (M = 2.63, SD = 1.02), but still fell under *Moderate*. Among the disposal practices, piling biodegradable materials to decompose (M = 3.19) and selling metals to buyers (M = 3.13) were moderately observed. Conversely, practices like burning leaves and papers (M = 2.19), indiscriminate throwing of wastes (M = 2.13), and reliance on barangay collection (M = 2.13) were rated low, reflecting improper or inconsistent disposal methods.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

The lowest mean for waste disposal underscores significant gaps in the proper handling of residual waste. Low ratings for practices like indiscriminate throwing and burning of waste highlight lingering reliance on outdated and harmful disposal methods. This finding implies an urgent need for infrastructure support, such as more reliable barangay collection systems, accessible composting facilities, and continuous training for both students and staff to eliminate unsafe disposal practices and align with Republic Act 9003 standards.

This result aligned with studies that have documented that waste disposal practices, particularly those involving disposal in proper facilities and avoiding burning or open dumping, tend to be among the weakest in school and community settings. In the study of Nairobi public schools, researchers found that while awareness of disposal norms was high, actual adherence to proper disposal methods was consistently low, often due to lack of infrastructure and institutional enforcement (Odhiambo et al., 2024). Similarly, a study in rural Indonesian schools observed that although teachers promoted segregation and reuse, disposal behaviors such as open burning or unregulated dumping remained common because of limited waste collection services and weak oversight (Putri, Rahman, & Rosidi, 2023). Regarding recycling and reuse, several studies show that simpler reuse actions are more frequently practiced than more labor-intensive methods like recycling paper, creating art from recyclables, or cleaning and repurposing plastics. For instance, a survey in Malaysian secondary schools showed that composting and reuse of large plastic items had moderate uptake, but the reuse of paper and plastic arts projects had much lower frequency (Aziz & Hassan, 2022). Likewise, in a community in Greece, citizens reported engaging more in source separation and reduction but much less in recycling "difficult" items (e.g., paper crafts) due to lack of facilities and inconvenience (Konstantinidou, Ioannou, Tsantopoulos, & Arabatzis, 2024).

Table 2. Extent of Solid Waste Management Practices when perceived by Teacher Respondents

Solid Waste Management Practices: Waste Segregation			
Items	**Mean**	**SD**	**Interpretation**
Trash cans for biodegradable materials are used in the school/classrooms.	3.56	0.73	High
Biodegradable wastes such as plants, papers, and easily decomposed materials are segregated.	3.44	0.96	Moderate
Non-biodegradable materials are also segregated from others.	3.44	0.73	Moderate
Bottles and glasses are also separated from other materials	3.19	0.66	Moderate
Metals and other similar materials are also segregated from the trash.	3.44	0.89	Moderate
Plastics are placed in one container/sack.	3.50	0.73	High
Segregation of wastes is a practice in the school.	3.38	0.72	Moderate
Students observe the segregation of wastes.	2.94	0.68	Moderate
Teachers remind students to segregate waste.	3.69	0.70	High
Head/Administrators of the school remind the teachers and students to observe cleanliness and separate waste material	3.69	0.70	High
Total	**3.43**	**0.77**	**Moderate**
Solid Waste Management Practices: Waste Disposal			

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Items	**Mean**	**SD**	**Interpretation**
Biodegradable materials are piled in one area to decompose.	3.19	0.75	Moderate
Plastics and bottles are placed in one container for collection by the barangay or sold to buyers	2.94	0.77	Moderate
Liquid wastes and some chemical wastes are buried in one place in the school.	3.00	0.73	Moderate
Leaves and papers are burned in the school.	2.19	1.11	Low
Papers are collected and sold to buyers.	2.38	0.89	Low
Metals and similar objects are collected and sold to buyers.	3.13	0.89	Moderate
Wastes are just thrown anywhere in the school.	2.13	1.15	Low
Collected wastes are collected and placed in incinerators.	2.44	0.89	Low
Collected wastes are buried in garbage pits at the back of the school.	2.75	1.00	Moderate
Wastes in the school are collected by the barangay mobile/trucks for disposal.	2.13	1.31	Low
Total	**2.63**	**1.02**	**Moderate**
Solid Waste Management Practices: Waste Recycling/Re-use			
Items	**Mean**	**SD**	**Interpretation**
Plastic cups are recycled into flower pots.	2.56	0.89	Moderate
Tin cans are also used for gardening.	2.94	0.77	Moderate
Biodegradable materials such as decayed leaves, animal manure, twigs, and other easily decomposed materials are used as compost materials for plants.	3.56	0.73	High
Plastic bags are cleaned and reused.	2.81	0.66	Moderate
Plastic bags are cleaned and reused.	2.81	0.66	Moderate
Papers and old magazines are recycled into papier-mache and used in artworks.	2.75	0.77	Moderate
Bottled plastics are used in artworks.	3.13	0.81	Moderate
Plastic wastes are recycled into art projects by students.	3.31	0.70	Moderate
Big bottled plastics are used as pails.	3.44	0.51	Moderate
Big tin cans are used as a medium for measurement in rice and other commodities.	3.06	0.85	Moderate

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Total	**3.04**	**0.78**	**Moderate**
Solid Waste Management Practices: Waste Reduction			
Items	**Mean**	**SD**	**Interpretation**
The administration encourages teachers and students to help reduce waste and maintain the cleanliness of the surroundings by making posters.	3.63	1.02	High
Teachers teach children how to reduce waste.	3.38	1.02	Moderate
Students are encouraged not to always use plastic but instead to use recyclable materials.	3.63	0.72	High
Canteen sellers are encouraged not to use plastic as food wrap.	2.88	0.72	Moderate
Purchase and use school supplies made from recycled products, such as pencils made from blue jeans and binders made from old boxes.	3.13	0.62	Moderate
Save packaging, colored paper, egg cartons, and other items for arts and crafts projects.	3.13	0.62	Moderate
When buying lunch and snacks, grab only what you need.	3.50	0.73	High
Remember to recycle your cans and bottles after finishing eating.	3.44	0.73	Moderate
The school administrators advocate an environmentally friendly atmosphere.	3.50	1.03	High
The administration coordinates closely with the local government units to collect waste in schools regularly.	3.31	0.79	Moderate
Total	**3.35**	**0.83**	**Moderate**

Level Of Implementation Of the Respondents On The Solid Waste Management Practices

Table 3 presents the level of solid waste management (SWM) implementation as reported by the teacher-respondents. The data show how teachers rated their awareness, knowledge, and actual implementation of SWM programs and policies in their schools. The highest mean scores were obtained from two items: *"I possess a comprehensive understanding of Republic Act 9003, also known as the Ecological Solid Waste Management Act of 2000"* (M = 3.63, SD = 1.02) and *"I am acquainted with the policies governing the school's solid waste management program"* (M = 3.63, SD = 0.72). Both were rated High, suggesting that teachers were well-informed of the national law and institutional policies guiding SWM. Likewise, *"I am aware of the importance of segregating waste according to the labels provided on trash cans before disposal"* (M = 3.50, SD = 0.73) and *"I am fully aware of the significance of recycling and its role in waste management"* (M = 3.50, SD = 1.03) were rated High, showing strong recognition of segregation and recycling as core practices.

Besides the, Items such as *"I am capable of distinguishing between biodegradable and non-biodegradable waste"* (M = 3.44, SD = 0.73), *"I am well-informed about the Solid Waste Management (SWM) Program implemented within the school"* (M = 3.38, SD = 1.02), and *"I actively practice waste minimization strategies such as reuse, recycle, and reduce"* (M = 3.31, SD = 0.79) were rated Moderate. This reflects adequate but not consistent application, pointing to areas where practices may not be fully institutionalized. Similarly, *"I am adequately informed about the purpose and objectives of implementing the Solid Waste Management (SWM)*

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

program" (M = 3.13, SD = 0.62) and *"I possess knowledge regarding the potential health risks associated with improper trash disposal"* (M = 3.13, SD = 0.62) were also Moderate, suggesting room for improvement in teacher awareness of program goals and health implications. The lowest score was recorded in the item *"I am familiar with the sanctions imposed for any violations of the Solid Waste Management (SWM) program"* (M = 2.88, SD = 0.72), which was interpreted as Moderate. This indicates that teachers were less informed about enforcement mechanisms and penalties, highlighting a gap in policy dissemination and compliance monitoring.

The results imply that teachers in the District of Leon I demonstrate a strong awareness of Republic Act 9003 and its related policies, which indicates that legislative frameworks are reaching the school level. However, the moderate ratings in areas such as knowledge of program objectives, health risks, and especially sanctions for noncompliance suggest gaps in policy dissemination and training. This pattern aligns with Romualdo, Arroyo, and Cristobal-Cipriano (2022), who found that while schools showed high levels of policy awareness, actual implementation and enforcement mechanisms were often weaker. Similarly, Espiritu (2024) noted that although teachers and students were aware of segregation, reduction, and recycling policies, their knowledge and practice of waste disposal and sanctions lagged.

The relatively lower scores on sanctions knowledge also highlight the need for stronger capacity-building and enforcement orientations in teacher professional development. A study in Cebu schools confirmed that awareness of circular economy and SWM policies was positively correlated with implementation. However, gaps persisted when enforcement was unclear or when monitoring mechanisms were weak (Auman & Inocian, 2023). Furthermore, Nerida and Dela Cruz (2025) emphasized that weak supervision, insufficient resources, and a lack of clear sanctions often hampered the full implementation of RA 9003 in schools.

Therefore, the findings of this study suggest that while teachers possess adequate awareness of policies and basic practices such as segregation and recycling, practical and institutional supports—particularly on compliance monitoring and sanctions—remain limited. Addressing these gaps through targeted professional development and stronger policy communication could enhance the fidelity of school-based SWM programs. This is consistent with Buthelezi, Tshibalo, and Tshimbana (2025), who found that even when legislation was well-established, successful school implementation depended on teacher training, adequate resources, and clear enforcement.

Table 3. Level of Solid Waste Management Implementation

Level of Solid Waste Management Implementation			
Items	**Mean**	**SD**	**Interpretation**
I possess a comprehensive understanding of Republic Act 9003, also known as the Ecological Solid Waste Management Act of 2000.	3.63	1.02	High
I am well informed about the Solid Waste Management (SWM) Program implemented within the school.	3.38	1.02	Moderate
I am acquainted with the policies governing the school's solid waste management program.	3.63	0.72	High
I am familiar with the sanctions imposed for any violations of the Solid Waste Management (SWM) program.	2.88	0.72	Moderate
I am adequately informed about the purpose and objectives of implementing the Solid Waste Management (SWM) program.	3.13	0.62	Moderate
I possess knowledge regarding the potential health risks associated with	3.13	0.62	Moderate

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

improper trash disposal.			
I am aware of the importance of segregating waste according to the labels provided on trash cans before disposal.	3.50	0.73	High
I am capable of distinguishing between biodegradable and non-biodegradable waste.	3.44	0.73	Moderate
I am fully aware of the significance of recycling and its role in waste management.	3.50	1.03	High
I actively practice waste minimization strategies such as reuse, recycle, and reduce.	3.31	0.79	Moderate
Total	**3.35**	**0.83**	**Moderate**

The Significant Difference Between The Level Of Solid Waste Management Practice And Implementation When Grouped According To Teacher Profile.

Table 4.0 presents the analysis of variance (ANOVA) results comparing teachers' solid waste management (SWM) practices across age groups. The findings reveal both similarities and differences in how teachers of varying ages engage in SWM activities, with implications for professional development and policy design. The analysis shows a significant difference in waste segregation practices across age groups ($F = 2.851$, $p = .045$). Teachers aged 36–40 (M = 3.87) reported the highest engagement in segregation practices, followed by those over 40 (M = 3.59). The youngest groups (26–30, M = 3.41; 31–35, M = 3.35) demonstrated comparatively lower levels. This suggests that mid- to late-career teachers are more consistent in applying segregation routines, possibly due to accumulated experience, stronger adherence to school policies, and greater exposure to long-term environmental programs. Studies confirm that age can positively influence environmental responsibility, as older teachers often demonstrate more eco-oriented behaviors (Ágoston et al., 2024; Lin, Li, & Sun, 2024). This finding implies that capacity-building interventions should pay closer attention to younger cohorts, who may need additional training and motivation to strengthen their segregation practices.

The differences in waste disposal practices across age groups were not statistically significant ($F = 2.449$, $p = .073$). However, teachers aged 31–35 (M = 3.01) and 36–40 (M = 2.94) reported slightly higher means compared to those aged 26–30 (M = 2.55) and over 40 (M = 2.67). This pattern suggests that while age may not strongly influence disposal practices, contextual factors such as school infrastructure and availability of disposal facilities likely play a larger role. Henyo (2023) found that lapses in disposal practices among students and teachers were often due to inadequate facilities rather than a lack of awareness. Thus, policy efforts should focus on improving disposal systems across schools rather than targeting specific age groups.

Besides, no significant differences were observed across age groups in recycling and reuse practices ($F = 0.635$, $p = .595$). Mean scores were fairly uniform, ranging from 3.09 to 3.36. This consistency suggests that recycling and reuse are moderately practiced across all teacher age groups, perhaps because these activities are already embedded in daily routines like paper reuse, plastic bottle collection, and classroom recycling projects. As noted by Molina and Catan (2021), recycling practices in schools often rely on institutionalized programs rather than individual demographics. Hence, improvements in this area may be better achieved through program strengthening rather than demographic-specific training.

In the Waste Reduction, similarly, waste reduction practices did not significantly differ by age group ($F = 1.832$, $p = .151$). Nonetheless, teachers aged 36–40 (M = 3.59) and over 40 (M = 3.51) reported higher means compared to younger cohorts (26–30, M = 3.17; 31–35, M = 3.42). This aligns with evidence that older adults often demonstrate stronger pro-environmental habits, including reduction-oriented behaviors (Ágoston et al., 2024). However, as reduction is considered the most challenging aspect of the 3Rs hierarchy (Mahayuddin, 2024), additional awareness-building among younger teachers may still be warranted.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Table 4.0 Analysis of Variance of Solid Waste Management Practices by Age

Practices	Age Group	n	M	SD	F	p	Significance	Decision
Waste Segregation	26–30	15	3.41	0.78	2.851	.045	Significant	Reject Ho
	31–35	11	3.35	0.43				
	36–40	18	3.87	0.16				
	Over 40	18	3.59	0.62				
Waste Disposal	26–30	15	2.55	0.33	2.449	.073	Not Sig.	Fail to Reject Ho
	31–35	11	3.01	0.56				
	36–40	18	2.94	0.70				
	Over 40	18	2.67	0.43				
Waste Recycling/Reuse	26–30	15	3.13	0.55	0.635	.595	Not Sig.	Fail to Reject Ho
	31–35	11	3.21	0.48				
	36–40	18	3.36	0.67				
	Over 40	18	3.09	0.68				
Waste Reduction	26–30	15	3.17	0.77	1.832	.151	Not Sig.	Fail to Reject Ho
	31–35	11	3.42	0.41				
	36–40	18	3.59	0.51				
	Over 40	18	3.51	0.39				

Note. $p < .05$ was set as the level of significance.

Table 4.1 presents the t-test results comparing the level of solid waste management (SWM) practices of teacher-respondents when grouped according to sex. The results reveal that only Waste Disposal showed a significant difference ($p = 0.006$), with female teachers ($M = 2.89$, $SD = 0.58$) reporting higher disposal practices compared to their male counterparts ($M = 2.48$, $SD = 0.27$). This indicates that sex plays a role in how waste disposal is practiced, while for other dimensions—waste segregation, waste recycling/reuse, and waste reduction—no significant differences were found.

The significant result in waste disposal implies that female teachers tend to demonstrate stronger adherence to proper disposal practices than males. This aligns with broader environmental behavior studies, which consistently highlight that women exhibit higher pro-environmental concern and are more consistent in eco-friendly practices (Ágoston et al., 2024; Lin, Li, & Sun, 2024). In the context of SWM, female teachers may be more meticulous about compliance with school waste disposal rules, which enhances overall program implementation.

On the other hand, the absence of significant differences in segregation, reduction, and recycling practices suggests that both male and female teachers are relatively aligned in these aspects. This convergence may be due to shared exposure to the same school programs, institutional policies, and common working environments, which minimize gender-based variation, as Stacchini et al. (2024) note. Contextual and institutional factors can reduce demographic differences in waste-related behaviors when strong organizational norms exist.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Table 4.1 t-Test Results for Differences in Solid Waste Management Practices in terms of Sex

Practices	Sex	N	Mean	SD	t-value	p-value	Decision
Waste Segregation	Male	17	3.76	0.25	1.486	0.142	Not Significant
	Female	45	3.52	0.64			
Waste Disposal	Male	17	2.48	0.27	-2.822	0.006	Significant
	Female	45	2.89	0.58			
Waste Recycling/Reuse	Male	17	3.05	0.5	-1.209	0.231	Not Significant
	Female	45	3.26	0.64			
Waste Reduction	Male	17	3.43	0.49	-0.039	0.969	Not Significant
	Female	45	3.44	0.58			

Note. p < .05 was set as the level of significance.

Table 4.2 presents the results of the t-test comparing solid waste management (SWM) practices across different numbers of seminars attended by teacher-respondents. The results show that across all four practice areas—waste segregation, waste disposal, waste recycling/reuse, and waste reduction—no statistically significant differences were observed, as all *p*-values exceeded the 0.05 threshold. This means that whether teachers had attended zero, one, or multiple seminars did not significantly influence their level of reported SWM practices. Although not statistically significant, the descriptive means indicate slight variations. For instance, teachers who attended at least one seminar generally scored higher in waste segregation (M = 3.82) and recycling/reuse (M = 3.60) compared to those with no seminar attendance (M = 3.52 and M = 3.07, respectively). Similarly, teachers with two to four seminars reported higher means in waste reduction (M = 3.57–3.80) than those with none (M = 3.36). These patterns suggest that seminar exposure may help reinforce good practices, even if the differences are not strong enough to be statistically conclusive. Waste disposal consistently received the lowest mean across all groups (M = 2.76–3.00), with particularly low scores among teachers with no seminar exposure (M = 2.76). This aligns with prior studies showing that while awareness of segregation and recycling is often emphasized, proper disposal practices—especially final waste handling—remain less consistent (Abdon & Farin, 2022; Canlas & Mendoza, 2025).

The findings imply that while seminars provide useful reinforcement, they may not yet be sufficiently impactful in changing or standardizing teacher practices. This could be due to the limited frequency, depth, or follow-through of training activities. Scholars emphasize that effective professional development should be continuous, context-specific, and practice-oriented to yield stronger behavioral outcomes (Lindvall et al., 2025; Zhou, Liu, & Zhang, 2023). The low scores in waste disposal further highlight the need to design seminar content that moves beyond awareness and focuses on practical, school-based solutions for residual waste management, which remains a weak link in many institutions (Espiritu, 2024; Romualdo, Arroyo, & Cristobal-Cipriano, 2022).

Table 4.2 t-Test Results for Differences in Solid Waste Management Practices in terms of Number of Seminars

Practices	Number of Seminars	N	Mean	SD	F-value	p-value	Decision
Waste Segregation	0	42	3.52	0.63	0.78	0.568	Not Sig.
	1	10	3.82	0.32			

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

	2	7	3.57	0.43			
	3	1	4	—			
	4	1	4	—			
	5	1	3.1	—			
Waste Disposal	0	42	2.76	0.63	0.106	0.991	Not Sig.
	1	10	2.74	0.13			
	2	7	2.89	0.56			
	3	1	2.9	—			
	4	1	2.8	—			
	5	1	3	—			
Waste Recycling/Reuse	0	42	3.07	0.64	1.721	0.145	Not Sig.
	1	10	3.6	0.46			
	2	7	3.34	0.36			
	3	1	3.9	—			
	4	1	3.1	—			
	5	1	3	—			
Waste Reduction	0	42	3.36	0.61	0.661	0.654	Not Sig.
	1	10	3.61	0.46			
	2	7	3.57	0.31			
	3	1	3.7	—			
	4	1	3.8	—			
	5	1	3	—			

Analysis Of Variance (Anova) Results For Differences In Solid Waste Management Implementation In Terms Of Teacher Profile

Table 5 presents the Analysis of Variance (ANOVA) results comparing the level of solid waste management (SWM) implementation across different age groups of teacher-respondents. The findings indicate that teachers aged 36–40 years obtained the highest mean score (M = 3.80, SD = 0.34), followed closely by those over 40 years (M = 3.71, SD = 0.31). These values were higher compared to the younger groups, specifically ages 26–30 (M = 3.25, SD = 0.99) and 31–35 (M = 3.29, SD = 0.49). The computed *F*-value of 3.56 and a *p*-value of .02 revealed a statistically significant difference, leading to the decision that age is indeed associated with varying levels of SWM implementation among teachers.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

The results suggest that older teachers, particularly those aged 36 and above, demonstrated stronger implementation of SWM practices compared to their younger counterparts. This pattern may be attributed to the greater professional maturity, accumulated experience, and exposure to long-term school programs among senior teachers, which often translate into more consistent application of environmental policies and practices (Ágoston, Kővári, Hámornik, Bereczkei, & Sándor, 2024). Prior studies also highlight that pro-environmental behaviors, such as waste reduction and recycling, tend to increase with age, as older individuals are more likely to prioritize sustainability and community well-being (Lin, Li, & Sun, 2024).

Conversely, the lower scores among younger teachers indicate possible gaps in training or less familiarity with institutionalized waste management protocols. This finding aligns with Verzosa et al. (2024), who emphasized that sociodemographic characteristics, including age, significantly influence waste management awareness and practices. It also implies the need for targeted professional development and mentoring programs for younger teachers, ensuring they are adequately equipped to implement Republic Act 9003 and related DepEd directives effectively.

Table 5. Analysis of Variance (ANOVA) Results for Differences in Solid Waste Management Implementation in Terms of Age

Age Group	***n***	**Mean**	**SD**	***F***	***p***	**Decision**
26–30	15	3.25	0.99			
31–35	11	3.29	0.49			
36–40	18	3.8	0.34			
Over 40	18	3.71	0.31	3.56	0.02	Significant

Table 5.1 presents the t-test results comparing the level of solid waste management (SWM) implementation between male and female teachers. Male respondents (M = 3.74, SD = 0.29) reported slightly higher implementation levels compared to female respondents (M = 3.48, SD = 0.69). However, the computed t-value of 1.513 with a p-value of 0.136 indicated that the difference was not statistically significant at the 0.05 level of significance. This means that sex did not play a decisive role in shaping teachers' implementation of solid waste management practices in the District of Leon I. Both male and female teachers demonstrated generally comparable levels of knowledge and application of SWM policies and programs.

The non-significant difference implies that interventions to strengthen SWM implementation may be designed without prioritizing one sex over the other, as both groups exhibit similar levels of engagement. This finding supports earlier research showing that while gender may sometimes influence pro-environmental attitudes, actual implementation often depends more on institutional supports and professional training than on sex differences (Ágoston et al., 2024; Lin, Li, & Sun, 2024). The result underscores the importance of focusing on common challenges such as limited training, resource gaps, or insufficient monitoring rather than assuming sex-based disparities. Hence, professional development on Republic Act 9003 and related DepEd policies should be inclusive, ensuring that both male and female teachers receive equal access to capacity-building programs that enhance their implementation of solid waste management in schools.

Table 5.1. t-Test Results for Differences in Solid Waste Management Implementation in Terms of Sex.

Sex	**N**	**Mean**	**SD**	**t-value**	**p-value**	**Decision**
Male	17	3.74	0.29	1.513	0.136	Not Significant
Female	45	3.48	0.69			

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Table 5.2 presents the Analysis of Variance (ANOVA) results examining whether solid waste management (SWM) implementation differed significantly among teachers based on the number of seminars they attended. The descriptive results show that teachers who had attended four seminars reported the highest mean level of implementation (M = 3.90), while those with five seminars had the lowest (M = 3.00). Teachers with no seminar exposure also had a relatively high mean (M = 3.51), comparable to those with two seminars (M = 3.50).

Despite these variations in mean scores, the ANOVA test yielded an *F*-value of 0.449 with a *p*-value of 0.812, which is above the 0.05 significance threshold. This indicates that the observed differences were not statistically significant. In other words, the number of SWM seminars attended by teachers did not produce a meaningful effect on their reported level of SWM implementation.

The results imply that seminar attendance alone may not directly translate into higher implementation of SWM practices. This aligns with earlier findings that professional development programs must be sustained, practice-oriented, and supported by institutional structures to generate lasting behavioral change (Zhou, Liu, & Zhang, 2023; Lindvall et al., 2025). A single or occasional seminar may increase awareness, but without follow-up training, mentoring, and reinforcement at the school level, its impact on implementation remains limited.

Additionally, the finding that teachers with no seminars still reported a moderate-to-high level of implementation suggests that other factors—such as school policy enforcement, peer practices, or personal environmental values—may exert stronger influence than formal training. Studies by Canlas & Mendoza (2025) and Margate & Padilla (2025) similarly emphasize that institutional culture and leadership support play a critical role in shaping waste management practices in schools, sometimes more than individual exposure to capacity-building activities.

Table 5.2. Analysis of Variance (ANOVA) Results for Differences in Solid Waste Management Implementation in terms of Number of Seminars

Number of Seminars	***n***	**Mean**	**SD**	***F*-value**	***p*-value**	**Decision**
0	42	3.51	0.7			
1	10	3.75	0.32			
2	7	3.5	0.47			
3	1	3.6	—			
4	1	3.9	—			
5	1	3	—			
Between groups				0.449	0.812	Not Sig.

Relationship Between the Level of Practices on Solid Waste Management and the Level of Implementation of the Teachers

Table 6.0 presents the correlation between the level of solid waste management (SWM) practices and the level of implementation among teacher-respondents. The findings reveal that three practice categories—waste segregation, waste recycling/reuse, and waste reduction—are significantly and positively correlated with implementation, while waste disposal shows no significant relationship.

The strongest correlation was found in waste segregation (Spearman's rho = .700, $p < .001$). This indicates that teachers who consistently practice segregation are also more likely to implement broader SWM programs effectively in schools. This finding aligns with Abdon and Farin (2022), who observed that segregation is often

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

the most consistently practiced behavior among both students and teachers, serving as the foundation for other SWM activities. Segregation has been widely regarded as the "gateway practice" that fosters awareness and compliance with institutional SWM policies (Molina & Catan, 2021).

Waste reduction also showed a strong positive correlation with implementation (rho = .638, p < .001). This suggests that minimizing waste at the source—through practices such as avoiding single-use plastics or reusing materials—is critical to sustaining school-level implementation. Literature supports this result: Canlas and Mendoza (2025) emphasized that waste reduction sits at the top of the waste management hierarchy, and schools that foster reduction behaviors see stronger alignment with both RA 9003 mandates and DepEd policies.

The correlation between recycling/reuse and implementation is moderate but significant (rho = .395, p < .001). This implies that recycling and reusing practices contribute to implementation, though less strongly than segregation or reduction. Similar patterns were reported by Japus et al. (2023), who found that recycling behaviors among junior high school students often depended on available facilities and institutional encouragement. This suggests that while teachers recognize the value of recycling, constraints in infrastructure (e.g., recycling bins, collection systems) may limit its full implementation. Interestingly, waste disposal practices were not significantly correlated with implementation (rho = .200, p = .208). This reflects a possible gap between everyday disposal habits and broader SWM program execution. Previous studies have noted that while teachers and students may be aware of correct disposal methods, inconsistencies arise due to a lack of resources or weak enforcement of sanctions (Henyo, 2023; Margate & Padilla, 2025). The low correlation in this study supports the idea that disposal, as the final stage in the waste hierarchy, is less effective as a driver of implementation compared to preventive and proactive practices like segregation and reduction.

Table 6.0 Relationship Between the Level of Practices on Solid Waste Management and the Level of Implementation of the Teachers

Practices	**Spearman's rho**	**p-value**	**Significance**	**Decision**
Waste Segregation	.700**	< .001	Significant	Reject Ho
Waste Disposal	0.2	0.208	Not Significant	Fail to Reject Ho
Waste Recycling/Re-use	.395**	< .001	Significant	Reject Ho
Waste Reduction	.638**	< .001	Significant	Reject Ho

CONCLUSION

Drawing from the findings of the study, the researcher reaches several compelling conclusions that illuminate the key insights uncovered throughout the research process. The findings suggest that while teachers in District of Leon I have a strong awareness of SWM laws and policies, actual practices and implementation remain only moderately applied. Age and sex influenced some aspects of practice, but seminar attendance did not significantly impact outcomes, showing that training opportunities were either lacking or not sufficiently effective. The strong correlations between preventive practices (segregation, reduction, and recycling) and implementation highlight that these are the driving forces of effective school-based SWM. However, the weak role of waste disposal shows that without proper facilities and enforcement, compliance remains limited. Overall, the results point to the importance of continuous teacher training, policy reinforcement, and resource provision to strengthen SWM in schools.

RECOMMENDATION

The findings of this research emerge from a thorough analysis, culminating in a profound conclusion that reveals the intricacies of the study's subject matter.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

For Local Government Unit (LGU) Personnel. Support schools with the basics that make good habits possible every day. Ensure regular, reliable waste collection that matches school schedules, and provide color-coded bins with clear labels for segregation. Help schools set up or access composting areas and a drop-off point or junkshop partner for recyclables so disposal does not default to burning or open dumping. Sign simple MOAs with schools and canteen operators to reduce single-use plastics and to favor recyclable or refill options. Since most teachers are mid- to late-career and many have had no recent seminars, offer short, on-site orientations and coaching rather than one-off lectures—ideally timed within the school day.

For City Solid Waste Management (SWM) Officers. Build school programs around the "gateway" practices that strongly link to better implementation of segregation and waste reduction, and then fix the weak point: disposal. Issue a simple citywide School SWM Playbook that standardizes bin colors and labels, daily routines, and class-level roles for student eco-monitors. Pair this with a disposal solution map: which schools have composting, which have MRF access, who the accredited buyers are, and the exact pickup days, so no one relies on burning or open dumping.

For the District Supervisor. Forge formal partnerships with local government units (LGUs) to address waste disposal at the system level. This includes ensuring regular collection, establishing composting hubs, and providing clustered access to materials recovery facilities (MRFs). Conduct quarterly audits of Republic Act 9003 compliance and provide schools with clear and actionable feedback. Instead of focusing on one-off seminars, reallocate resources toward coaching-based implementation and cross-school mentoring. Support this initiative with a simple division dashboard that tracks progress in segregation, reduction, and recycling.

For the School Principal. Institutionalize segregation and reduction practices by standardizing bins and signage in every classroom and enforcing procurement rules that minimize single-use materials. Implement daily homeroom checks to reinforce compliance. Create a solid waste management (SWM) focal team tasked with running short coaching cycles, pairing younger staff with experienced implementers, and coordinating with the barangay to ensure proper disposal and reliable recyclables offtake.

For Science Teachers. Integrate SWM concepts into inquiry-based learning projects, such as waste audits, composting or biodegradation experiments, and upcycling activities. Reinforce these lessons with end-of-class segregation routines and quick tallying to encourage consistent practice. Teachers should model expected behaviors, provide immediate feedback, and present simple evidence of impact (e.g., monthly kilograms of waste diverted) to promote student ownership of SWM initiatives.

For Students. Practice strict daily segregation and reduction by bringing reusable items, refusing single-use plastics, and maintaining class scorecards to ensure bins are clean and correctly labeled. Take active leadership by organizing peer campaigns, collection drives, and environmental activities. Report unresolved disposal issues to the school's eco-team so that systemic gaps can be addressed at the administrative and community levels.

For Future Researchers. Employ mixed-method designs that combine surveys with objective metrics such as weigh-ins and bin contamination rates. Use longitudinal or quasi-experimental approaches to compare the effectiveness of coaching and infrastructure-based interventions against traditional seminars. Explore moderators such as teacher age, tenure, and school resourcing. Incorporate cost-effectiveness analyses to guide scalable adoption of SWM practices across the division.

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