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The Engagement of Intermediate Learners in the Application of 5 R's Waste Management

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ABSTRACT: The study examined the engagement of intermediate learners in applying the 5 R's of waste management—reduce, reuse, recycle, recover, and repair as a means of promoting environmental awareness and sustainable practices in schools. A descriptive-quantitative design was utilized. The study found that overall engagement of intermediate learners was high, although participation in reducing was lower compared to other practices. Results indicated that age influenced engagement in waste recovery and repair, while sex affected participation in four of the R's, except recycling. While grade level showed some variation in engagement, but not significantly in reducing. These findings highlight behavioral gaps, particularly in reducing waste, that need to be addressed through targeted instructional strategies. The data further served as a basis for recommending the integration of contextualized comics into instruction to enhance student engagement and promote waste reduction practices. Likewise, incorporating 5 R's concepts across subject areas and strengthening school-wide eco-friendly initiatives were suggested. Future research on the acceptability and effectiveness of comics-based reading materials for enhancing student engagement in waste reduction was also recommended.

KEYWORDS: 5 R's Waste Management, Waste Management, Student Engagement, Intermediate Learners, Environmental Awareness

I. INTRODUCTION

Effective waste management is crucial for protecting environmental health and promoting sustainable development. The environment can be greatly impacted by the way waste is handled. Thus, policies must be in place to properly handle the waste. Improper disposal of waste leads to pollution, health hazards, and resource depletion, highlighting the urgent need for innovative and comprehensive waste management strategies. Waste management is a critical environmental issue that directly affects the environment and public health (Debrah et al., 2021). It is a complex issue involving political, socioeconomic, institutional, and environmental components, made more difficult by the global increase in waste generation. Effective waste management is essential for preserving environmental cleanliness, public health, and aesthetic standards (Bohn, 2024), lessening the negative effects of waste on society and the environment, and promoting sustainable development.

Moreover, schools are key sites for sharing waste management education and information (Molina & Catan, 2021), and addressing waste management in schools is a major responsibility (Base8innovations, 2024) that reduces pollution and fosters a sustainable mindset in young learners. In order to change public perceptions, campaigns to educate learners about the detrimental effects of poor waste management are essential. Building a solid foundation in young learners is crucial for instilling lasting values, making early waste management education essential for fostering environmental consciousness and lifelong learning that benefits both current and future generations. Despite the fact that the application of the 5 R's in waste management has been rarely studied, there is a need for research on how students acquire the necessary knowledge and skills to apply them in real-world scenarios. This need is further supported by research from Cruz & Nabor (2022), which reveals that while waste management has been introduced in schools, there's still a need for systematic and well-defined goals and practices to highlight its importance. Although various environmental laws were released within the last decade in the Philippines, awareness about the content and objectives of these laws remains too low (Paul and Johannes, 2024).

Students often lack role models and appropriate training, and many are not used to segregating waste at home. Further hindrances include a lack of manpower and budget to improve and sustain technical systems. Accordingly, environmental

knowledge is key to a clean and sustainable environment (Harman and Yenikalayci, 2022), but a lack of funding, educated teachers, sufficient knowledge, awareness, practice, and interest are obstacles to environmental sustainability. Each student is accountable for the health of their surroundings, a factor critical to minimizing hazardous waste and fostering environmental sustainability. This study investigates the engagement of intermediate learners in applying 5 R's waste management, building upon their foundational knowledge from previous environmental education. By analyzing how students translate these principles into practical, real-world behaviors, the research seeks to provide a guide for enhancing waste management curricula and strengthening the implementation of sustainable practices within schools.

II. METHODS

The study employed a descriptive quantitative research design to explore and describe the engagement of learners in the application of the 5 R's waste management without manipulating any variables. Data were collected from intermediate learners, with a total population of 783 pupils. The researchers identified and selected respondents fairly and without bias from Grade 4, 5, and 6 levels, resulting in a total of two hundred sixty-five (265) respondents determined using Slovin's formula and selected randomly. The primary instrument used was a validated researcher-made questionnaire checklist to gather necessary data regarding the engagement of intermediate learners in the 5 R's waste management: Recycle, Reduce, Reuse, Recover, and Repair. The survey was administered face-to-face using pencil-and-paper forms; all respondents completed and returned the researcher-made questionnaires, achieving a 100 percent retrieval rate. The instrument consisted of two parts. The first part gathered demographic information such as age, sex, and grade level. The second part assessed the level of engagement in the application of the 5 R's. Responses were recorded using a five-point Likert scale: Strongly Agree (4.21–5.00), Agree (3.41–4.20), Neutral (2.61–3.40), Disagree (1.81–2.60), and Strongly Disagree (1.00–1.80). Prior to the conduct of the study, the necessary consent was obtained from Muntindilaw Elementary School. To ensure accurate data analysis, weighted mean was computed to describe the level of engagement of learners in the 5 R's waste management. One-Way ANOVA was utilized to determine the significant difference between the respondents' profile and their level of engagement in the application of the 5 R's waste management.

III. RESULTS AND DISCUSSION

Discussion of the engagement of intermediate learners in the application of the 5 R's waste management is shown in a textual and tabular presentation.

It is depicted in Table 1 that when grouped according to age, among the intermediate learners, 207 out of 265, or 78.1 percent belongs to the range of 10-12 years old. This indicates that the majority of the respondents fall within this age range. To be followed by 9-year-olds and below, with a frequency of 31 and 11.7 percent. The third was 13 years old and above, with a frequency of 27 and 10.2 percent. This implies a strong concentration within the 10-12-year-old age group, making up a substantial majority of the respondents.

As to sex, females hold the top rank with the frequency of 151 or 57 percent compared to males with the frequency of 114

or 43 percent. This reveals a slightly higher proportion of females. As to grade level, 90 out of 265 were grade 5, and 34 percent, which ranked first. While 88 out of 265 were grade 4, and 33.2 percent ranked second. In grade 6, there were only a total of 87 out of 265, or 32.8 percent, in the third rank. This implies that grade 5 has the highest frequency and percentage, followed closely by grade 4 and grade 6.

Table 1. Profile of the Respondents in terms of Age, Sex, and Grade Level

Age	**Frequency**	**Percent**	**Rank**
13 years old and above	27	10.2	3
10-12 years old	207	78.1	1
9 years old and below	31	11.7	2
Total	**265**	**100.0**	
Sex	**Frequency**	**Percent**	**Rank**
Female	151	57.0	1
Male	114	43.0	2

Total	265	100.0	
Grade Level	**Frequency**	**Percent**	**Rank**
Grade 4	88	33.2	2
Grade 5	90	34.0	1
Grade 6	87	32.8	3
Total	**265**	**100.0**	

From the data shown in Table 2, the respondents got a very high overall weighted mean of 4.34, which indicates a strong agreement among students regarding their positive engagement with recycling practices, specifically, on their understanding of the importance of recycling properly, staying informed about recycling practices, and ensuring proper disposal of recyclable items. However, while these practices received strong agreement, the slightly lower score for participating in environmental activities suggests a possibility for additional collective action. Nonetheless, the overall strongly agree rate indicates a favorable trend toward responsible recycling practices. This finding is supported by the study of Taouahria (2024), who emphasized that individuals with confidence in their recycling skills and resources are more likely to participate in recycling initiatives, which promotes a good attitude toward recycling.

Table 2. Computed Mean on the Level of Engagement of Intermediate Learners in the Application of 5 R's Waste Management with respect to Recycle

Recycle	Mean	Verbal Interpretation	Rank
1. I try to recycle properly, even if it takes extra time.	4.43	Strongly Agree	1.5
2. I choose products that are eco-friendly, like those that are recyclable, compostable, or made from recyclable materials.	4.33	Strongly Agree	4
3. I keep myself informed about recycling practices.	4.43	Strongly Agree	1.5
4. I join activities like clean-up drives or environmental workshops to help the environment.	4.19	Agree	5
5. I make sure to dispose of recyclable items properly, such as using recyclable bins when available.	4.34	Strongly Agree	3
Overall	**4.34**	**Strongly Agree**	

The data presented in Table 3 shows the respondents' engagement on waste reduction, revealing an overall mean of 4.07, interpreted as Agree. It is a mixed but generally positive attitude towards waste reduction. This implies that the respondents' agreement on avoiding throwaway things and eliminating packaging is just moderate, but they strongly agree on basic practices like using reusable water bottles and disposing of waste properly. This finding is supported by the study of Sewak et al. (2021), who highlight that reducing waste has become a global concern because individuals are not actively taking action to reduce the amount of waste that is produced and properly sorting waste, which is essential for efficient waste reduction. It is also supported by Craig (2022), who emphasizes that students should be taught about waste management and waste reduction. Therefore, implementing the 5 R's program in schools is crucial to encourage students to practice waste reduction.

Table 3. Computed Mean on the Level of Engagement of Intermediate Learners in the Application of 5 R's Waste Management with respect to Reduce

Reduce	Mean	Verbal Interpretation	Rank
1. I try to avoid using disposable cups and cutlery.	3.58	Agree	4
2. I try not to use single-use plastic bags for lunch and recess.	3.53	Agree	5
3. I bring my own water bottle when I go to school.	4.61	Strongly Agree	2
4. I buy foods and beverages that come in minimal packaging.	3.99	Agree	3
5. I throw garbage in proper garbage bins.	4.63	Strongly Agree	1
Overall	**4.07**	**Agree**	

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As observed from the data in Table 4, the overall weighted mean of reuse is 4.20, indicating that the respondents generally agreed with the statements regarding practicing reusing materials. Specifically, the respondents have a strong agreement when it comes to reusing things that will help them develop practical skills like crafting and designing. This total score shows that respondents generally agree with the statements regarding reuse, demonstrating a favorable attitude toward reusing objects and materials. However, they place somewhat less emphasis on the fun of creative reuse. The data suggests that the respondents who have a favorable attitude toward material reuse are highly inclined to look for chances for reuse and value the skills that are acquired through these practices. This result affirms the finding of Cabias et al. (2024), who state that while people are engaged with reusing materials, they are not embracing it completely. Therefore, the actual practice of reuse and people's awareness of it are not the same.

Table 4. Computed Mean on the Level of Engagement of Intermediate Learners in the Application of 5 R's Waste Management with respect to Reuse

Reuse	Mean	Verbal Interpretation	Rank
1. I always try to reuse materials instead of throwing them away.	4.14	Agree	4
2. I actively seek out opportunities to reuse things in my daily life.	4.25	Strongly Agree	2
3. I use reusable items, such as glasses, bags, or any container.	4.23	Strongly Agree	3
4. Reusing things will help me develop practical skills like crafting and designing.	4.28	Strongly Agree	1
5. I find it fun and exciting to come up with creative ways to reuse materials.	4.12	Agree	5
Overall	**4.20**	**Agree**	

It is depicted in Table 5 that waste recovery obtained an overall weighted mean of 4.18, interpreted as Agree. Specifically, the respondents express strong agreement about sharing their used items for others to enjoy, reusing paper for drawing, and their involvement in cleaning up trash, indicating a high commitment to the recovery concept. This overall score indicates that the respondents generally agree with the statements regarding recovery, demonstrating a favorable attitude toward recovering objects and materials. This finding is supported by the study of Urban Ecology (2020), emphasizing that the goal of waste management should be to give discarded items a second chance instead of just throwing away garbage. The objective is to offer it a second chance at life while minimizing its negative effects on the environment and optimizing its value. This connects with the learners' engagement in recovery practices by emphasizing that better technology can support their individual efforts by improving the systems that manage waste recovery.

Table 5. Computed Mean on the Level of Engagement of Intermediate Learners in the Application of 5 R's Waste Management with respect to Recover

Recover	Mean	Verbal Interpretation	Rank
1. I use paper again for drawing, so it can be recovered and not wasted.	4.29	Strongly Agree	2
2. I keep some broken items because I believe I can still use them.	3.98	Agree	5
3. I bring my old books to school so they can be recovered and shared with other students.	4.02	Agree	4
4. I give my used stuff so they can be recovered and enjoyed by other kids.	4.32	Strongly Agree	1
5. I help pick up trash in the school, like plastic bottles, paper, and books, so that it can be recovered.	4.28	Strongly Agree	3
Overall	**4.18**	**Agree**	

It is depicted in Table 6 that repair obtained an overall weighted mean of 4.27, as the respondents strongly agreed with their

engagement in repair. Specifically, it shows that the learners are quite committed to repair practices, especially when it comes to actively repairing broken goods and determining their usefulness. Their strong desire to learn more about repair techniques further demonstrates their dedication to sustainability and ingenuity. Their repair habits are influenced by both practical and artistic incentives, as evidenced by the tied scores for saving money and making new things out of old materials. All things considered, the results indicate that, on average, respondents strongly agree with the statements about repair, reflecting a positive attitude towards repairing items and materials.

These findings are aligned with the statement of O'Byrne and Hobson (2024), who encourage a culture of repair in educational institutions, and enabling students to take an active role in the circular economy are key components of increasing students' waste repairability. This can also help students acquire a variety of repair skills. Moreover, it has been said by Moalem & Mosgaard (2021) that practicing repair techniques, especially in a group setting, helps individuals regain a variety of lost skills. Therefore, it is feasible to empower students to become active contributors to a more sustainable future by establishing a supportive environment where they can access resources, learn about repair, and engage in practical initiatives (Meißner, 2021).

Table 6. Computed Mean on the Level of Engagement of Intermediate Learners in the Application of 5 R's Waste Management with respect to Repair

Repair	Mean	Verbal Interpretation	Rank
1. I try to fix broken things in our house instead of discarding them.	4.29	Strongly Agree	2
2. I create new things, like crafts or art projects, using old materials.	4.25	Strongly Agree	4.5
3. I am interested in learning more about repairing basic items.	4.27	Strongly Agree	3
4. Before I throw away broken things, I make sure first if they can still be useful.	4.31	Strongly Agree	1
5. I try to repair damaged things because it can save money.	4.25	Strongly Agree	4.5
Overall	**4.27**	**Strongly Agree**	

The composite table reflects all the specific aspects of the intermediate learners' engagement in the application of the 5 R's waste management, having a general weighted mean of 4.21 with verbal interpretation of Strongly Agree. Specifically, the respondents demonstrate a strong agreement with waste management, with a special emphasis on recycling and repair. Reusing and recovering are also supported. Furthermore, it is worth noting that despite waste reduction's lower ranking, the mean score of 4.07 still suggests a favorable attitude toward it. This implies that even if it may not be the highest priority, it is still seen as significant. The majority of responses show strong agreement with the waste management aspects shown in this table.

This aligns with the study of Bui et al. (2021), who believed that materials created through recycling and reuse provide an effective solution to the waste management issue. However, despite students showing positive attitudes toward waste management, Dung et al. (2017), cited by Asio (2021), reveal that there is still a lack of knowledge on the issue, indicating the need for more effective education and awareness efforts. Therefore, Labiba (2024) argued that there is a need for a solution that not only reduces the accumulation of waste but also involves the active role of the community, especially the younger generation, in preserving the environment.

Table 7. Composite table on the Engagement of Intermediate Learners in the Application of 5 R's Waste Management with respect to Recycle, Reduce, Reuse, Recover and Repair

Aspects	Mean	Verbal Interpretation	Rank
A. Recycle	4.34	Strongly Agree	1
B. Reduce	4.07	Agree	5
C. Reuse	4.20	Agree	3
D. Recover	4.18	Agree	4
E. Repair	4.27	Strongly Agree	2
General	**4.21**	**Strongly Agree**	

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Table 8 shows the hypothesis on the significant difference of the profile of the respondents in terms of age and their engagement in the 5 R's waste management with respect to the aspects. The p-value of recycle is 0.68, which is greater than 0.05, indicating that the null hypothesis is failed to reject and that there is no significant difference in overall engagement with the 5 Rs between different age groups. Specifically, there is a statistically significant difference in how different age groups interact with waste recovery and repair. However, there is no significant difference in engagement with recycling, reducing, or reusing waste between different age groups. Overall, this result leads to an indication that there is no significant difference found that the age of intermediate learners respondents is not a factor in their engagement in the application of 5 R's waste management.

This finding contradicts the study of Debrah et al. (2021), which discusses that age is considered to be one of the essential variables concerning environmental education. Students with a higher level of education managed the waste better than those with a lower level, which means that older age managed waste well. Hence, the knowledge of a university student cannot be compared with that of secondary and primary school students. Thus, younger participants, due to less experience in the field and less education, may be less open to receiving information about waste management, when compared to older age. Additionally, Alkaitis (2022) mentioned that raising awareness in proper waste management should begin with the younger generation, to prevent a significant amount of waste.

Table 8. Significant Difference between the Profile of the Respondents in terms of Age and their Level of Engagement in the Application of 5 R's Waste Management with respect to the Aspects

Aspects	Source of Variation	Sum of Squares	df	Mean Square	F	p-value	H_o	VI
Recycle	Between Groups	.468	2	.234	.942	.391	FR	NS
	Within Groups	65.088	262	.248				
	Total	65.556	264					
Reduce	Between Groups	.001	2	.000	.001	.999	FR	NS
	Within Groups	87.774	262	.335				
	Total	87.774	264					
Reuse	Between Groups	.793	2	.396	1.087	.339	FR	NS
	Within Groups	95.486	262	.364				
	Total	96.279	264					
Recover	Between Groups	3.419	2	1.709	4.106	.018	R	S
	Within Groups	109.085	262	.416				
	Total	112.504	264					
Repair	Between Groups	3.326	2	1.663	4.611	.011	R	S
	Within Groups	94.504	262	.361				
	Total	97.830	264					
Grand Mean	Between Groups	1.050	2	.525	2.715	.68	FR	NS
	Within Groups	50.662	262	.193				
	Total	51.712	264					

Legend: R - Reject. S - Significant; FR - Failed to Reject: NS - Not Significant

Table 9 presents the result of the ANOVA on the significant difference of the profile of the respondents in terms of sex and their engagement of 5 R's waste management with respect to the aspects.

It is depicted from the table that the hypothesis on the significant difference of the profile of the respondents in terms of sex is rejected since the computed p-value of .000 is less than 0.05, thus the null hypothesis is rejected. This result implies that there are significant differences in engagement between sexes for the reduce, reuse, recover, and repair practices, while there is no significant difference for the recycle practices. Nevertheless, the overall mean indicates that there are significant differences between treatment groups in the engagement of intermediate learners in applying the 5 R's of waste management based on sex.

This finding supports the study of Ferrer (2015) as cited by Wang & Zhang (2021), which discusses the differing viewpoints and behaviors of male and female students regarding waste management practices, in which it shows no statistically significant differences between sexes in terms of environmental knowledge and practices among students.

Table 9. Significant Difference between the Profile of the Respondents in terms of Sex and their Level of Engagement in the Application of 5 R's Waste Management with respect to the Aspects

Aspects	Source of Variation	Sum of Squares	df	Mean Square	F	p-value	H_o	VI
Recycle	Between Groups	.825	1	.825	3.351	.068	FR	NS
	Within Groups	64.731	263	.246				
	Total	65.556	264					
Reduce	Between Groups	1.932	1	1.932	5.918	.016	R	S
	Within Groups	85.843	263	.326				
	Total	87.774	264					
Reuse	Between Groups	4.069	1	4.069	11.606	.001	R	S
	Within Groups	92.209	263	.351				
	Total	96.279	264					
Recover	Between Groups	7.600	1	7.600	19.053	.000	R	S
	Within Groups	104.904	263	.399				
	Total	112.504	264					
Repair	Between Groups	3.386	1	3.386	9.430	.002	R	S
	Within Groups	94.444	263	.359				
	Total	97.830	264					
Grand Mean	Between Groups	3.177	1	3.177	17.216	.000	R	S
	Within Groups	48.535	263	.185				
	Total	51.712	264					

Legend: R - Reject. S - Significant; FR - Failed to Reject: NS - Not Significant

Table 10 presents the significant difference between the profile of the respondents in terms of grade level and their level of engagement in the 5 R's waste management with respect to these aspects.

The table shows the hypothesis on the significance difference of the profile of the respondents in terms of grade level in their engagement of 5 R's waste management is rejected since the computed p-value of .005 is less than 0.05, thus the null

hypothesis is rejected. These results imply that there are significant differences in the engagement of intermediate learners in the application of the 5 R's of waste management for recycling, reusing, recovering, and repairing based on grade level. However, there is no significant difference for reducing. Thus, grade level may influence how intermediate learners engage with various waste management practices, particularly in recycle, reuse, recover, and repair. Overall, there are significant differences in engagement in the application of the 5 R's of waste management among different grade levels.

This finding supports the study of Haugh (2022), which shows that the higher the grade level, the more knowledge students have about climate change and pro-environmental behaviors. Therefore, educating the students on pro-environmental behaviors, especially in the 5 R's application, seems to impact the success of a school's waste management programs. Thus, students who were educated on recycling and the environment influenced the recycling behaviors at school. The more students know and learn about the environment, recycling, and food waste, the more likely they are to care and follow environmental procedures. Additionally, the earlier students learn these behaviors, the more likely they are to maintain them later in life.

Table 10. Significant Difference between the Profile of the Respondents in terms of Grade Level and their Level of Engagement in the Application of 5 R's Waste Management with respect to the Aspects

Aspects	Source of Variation	Sum of Squares	df	Mean Square	F	p-value	H_o	VI
Recycle	Between Groups	2.395	2	1.197	4.967	.008	R	S
	Within Groups	63.161	262	.241				
	Total	65.556	264					
Reduce	Between Groups	.281	2	.140	.420	.657	FR	NS
	Within Groups	87.494	262	.334				
	Total	87.774	264					
Reuse	Between Groups	2.293	2	1.146	3.196	.043	R	S
	Within Groups	93.986	262	.359				
	Total	96.279	264					
Recover	Between Groups	4.378	2	2.189	5.304	.006	R	S
	Within Groups	108.126	262	.413				
	Total	112.504	264					
Repair	Between Groups	3.414	2	1.707	4.737	.010	R	S
	Within Groups	94.416	262	.360				
	Total	97.830	264					
Grand Mean	Between Groups	2.042	2	1.021	5.386	.005	R	S
	Within Groups	49.669	262	.190				
	Total	51.712	264					

Legend: R - Reject. S - Significant; FR - Failed to Reject: NS - Not Significant

IV. CONCLUSION AND RECOMMENDATION

The findings revealed that the majority of intermediate learners from Muntindilaw Elementary School are 10–12 years old,

mostly female, and in Grade 5. They demonstrated strong engagement in the 5 R's of waste management, particularly in recycling, reducing, and reusing, which were not significantly affected by demographic factors. However, deeper involvement in recovering and repairing was more prevalent among older learners, female learners, and those in higher grade levels, indicating that these demographics are better indicators of their understanding and application of waste management practices. Hence, it is recommended that programs and activities be strengthened to ensure consistent participation in all components of the 5 R's, especially in recovering and repairing, where variations in engagement were observed. Learners should be provided with more opportunities to take part in repair-focused activities to develop practical skills and deepen their comprehension of waste management concepts. Teachers are encouraged to integrate tasks that involve fixing items and reducing waste into their daily lessons to help learners connect environmental responsibility with real-life situations. Schools should continue promoting eco-friendly practices, particularly by emphasizing waste reduction to enhance the efficiency and sustainability of waste management initiatives. Furthermore, future researchers are encouraged to explore the acceptability and effectiveness of comics-based reading materials in enhancing students' higher-level engagement in waste reduction.

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