
Influence of Waste Segregation Literacy and Solid Waste Management Practices as Determinants of Student Pro-Environmental Behavior towards Environmental Science

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Abstract — Inconsistent pro-environmental behavior is an ecological concern. This study examined the influence of waste-segregation literacy and solid waste management practices on students' pro-environmental behavior in environmental science. Using a diagnostic research design, simple random sampling, survey techniques, and multiple linear regression analysis, the data collected from 200 junior high school students revealed that only solid waste management practices are significant in influencing the criterion. This result partly supports the Social Cognitive Theory. Other determinants may be explored through the qualitative generated themes. Training that promotes experiential, hands-on waste management to bridge the gap between knowledge and daily action.

Keywords: Influence of waste segregation literacy, Solid waste management practices, Student pro-environmental behavior, Environmental science

I. INTRODUCTION

Pro-environmental behavior remains a significant global challenge (Steg, 2023).

This lack of behavioral alignment is a primary obstacle to international strategies to mitigate climate change, as current frameworks fail to address the psychological and structural hurdles that impede consistent green action (Thomas, 2020; Gifford & Chen, 2022). In Southeast Asia, the problem of pro-environmental behavior is exacerbated by rapid urbanization and lack of supportive infrastructure, which hinders the translation of classroom knowledge into daily habits among youth (Li et al., 2023; Nguyen & Luu, 2021).

Pro-environmental behavior is a critical national concern in the Philippines, where a disconnect exists between legislative frameworks, such as the Ecological Solid Waste Management Act, and students' actual practices (Bernardo, 2021). In the remote schools of Don Marcelino, Davao Occidental, the problem of pro-environmental behavior is shaped by localized values and geographic factors that differ from those in urban areas, leading to a 56% variance in students' actions (Vijaykumar, 2023; Samanth, 2024). The failure to address these localized drivers creates a significant learning gap; without understanding these unique socio-geographic constraints, waste management frameworks will remain ineffective, leading to persistent environmental degradation and the continued misalignment of educational goals with actual student practices. For this reason, this study was conducted.

This study is significant because it supports sustainable environmental goals by highlighting the importance of fostering waste-segregation literacy and solid waste management practices to enhance pro-environmental behavior in environmental science.

In the Philippine context, the findings provide empirical evidence to inform future researchers and support the Department of Education's goal of fostering behavior-focused interventions that move beyond mere awareness toward measurable sustainability. Furthermore, the study is valuable to Holy Cross of Davao College, as it identifies key factors influencing students' pro-environmental behavior, thereby guiding the development of practice-based strategies and supportive school policies that transform passive learners into active agents of change.

This study was aimed at determining the significance of waste segregation literacy and solid waste management practices are significant determinants of student pro-environmental behavior in environmental science. Specifically, it aims to determine the levels of student waste segregation literacy in terms of knowledge, attitude, and practice; solid waste management practices in terms of waste segregation, waste disposal, and waste recycling/reuse; and the pro-environmental behavior in environmental science in terms of conservation lifestyle, land stewardship social environmentalism, and environmental citizenship. Moreover, it aims to determine the significance of the correlation between waste segregation literacy, solid waste management practices, and the student pro-environmental behavior in environmental science. In addition, it aims also to determine the significance of the individual and combined influence of waste segregation literacy and solid waste management practices on student pro-environmental behavior in environmental science. This study was based on the Social Cognitive Theory of Albert Bandura in 1986.

II. METHODOLOGY

This study employed a diagnostic research design. This design is appropriate because it allows the researcher to describe the current levels of the variables and examine their relationship without manipulating respondents' natural settings (Best & Kahn, 2016). Moreover, it is a structured, problem-oriented research design used to examine current conditions, identify relevant patterns or relationships, and describe the strength of the determinant factor influencing the outcome (Wisenthige, 2023; Samanth, 2024). This study was conducted in three selected public junior high schools in Don Marcelino, Davao Occidental, Philippines. This locale is chosen for its diverse urban-rural student population and the pressing need to address local challenges, such as improper waste disposal and limited ecological awareness. As a developing area, Don Marcelino provides an ideal setting to investigate how environmental literacy and solid waste management practices influence young learners' pro environmental behavior.

The respondents in this study were Junior High School students from various remote public schools in Don Marcelino, Davao Occidental, enrolled during the School Year (SY) 2025-2026. Junior High School students were selected because they are at a critical developmental stage where

environmental consciousness and civic responsibility are actively integrated into the curriculum. Engaging Students at this level enables the study to assess foundational waste management practices that are likely to persist into adulthood, particularly within the unique ecological contexts of remote coastal or mountainous communities.

From an estimated total population of 400 students, a representative sample of 200 was selected using the Rao soft Sample Size Calculator with a 95% confidence level and a 5% margin of error. The study employed simple random sampling, a probability sampling technique in which every member of the population has an equal chance of being selected (Thomas, 2020). This method was appropriate because the population is relatively homogenous in their educational settings and in the local waste management infrastructure available to them. Utilizing this technique eliminates selection bias and ensures that the sample provides an unbiased representation of the students' waste segregation literacy and management practices, despite the remote geographic context of the selected sites.

The survey technique was used in gathering data. It is a method for collecting data through questionnaires to obtain standardized information about respondents' attitudes, perceptions, or behaviors. It is particularly useful in descriptive and correlational studies, as it enables researchers to describe trends and examine relationship among variables. It is advantageous for data collection from large, diverse populations, produces quantifiable data analysis, supports generalization, enables rapid data collection, and ensures replicability through standardized procedures. Three survey questionnaires were adapted and modified for this study, and the validators used a five-point Likert scale to assess the instruments. Specifically, a Likert scale was used to evaluate participants' responses across the three research instruments.

The first instrument, the waste segregation literacy questionnaire, was adapted from Cowie & Gumbley (2024). It consists of 15 items, designed to assess students' knowledge, attitudes, and practice as well as the perceived ease of use of technological tools in the classroom, with a Cronbach's alpha of 0.712.

The second instrument, the solid waste management practices questionnaire, was adapted from (Gantang 2022). It consists of 30 items, designed to assess student waste segregation, waste disposal, and recycling/reuse, with a Cronbach's alpha of 0.585.

The third instrument, the student pro-environmental behavior toward environmental science questionnaire, was adapted from Abun & Agout (2017). It consists of 13 items designed to assess students' conservation lifestyle, land stewardship, social environmentalism, and environmental attitudes, with a Cronbach's alpha of 0.893.

In this study, the data analysis techniques used were descriptive, correlation, and multiple linear regression. Descriptive analysis summarizes data using measures such as the mean and standard deviation, providing a clear overview of patterns and distributions without determining relationships between variables (Gravetter & Wallnau, 2021). In this study the mean statistic was used to summarize and describe the levels of student waste-segregation literacy, solid waste management practices, and pro-environmental behavior toward environmental science. Moreover, the standard deviation was used to measure the spread, or variability, of the data around the mean. The correlation analysis is used to determine the strength and direction of relationships between variables without establishing causation (Creswell & Cresswell, 2023). The Pearson Product-moment correlation was used to determine the strength and direction of the relationship between waste segregation literacy, solid waste management practices, and student pro-environmental behavior. Lastly, multiple linear regression analysis is a statistical method used to examine the influence of variables and predict outcomes by identifying the strength and significance of predictors (Field, 2024). Specifically, this analysis was applied to determine how the independent variables, waste segregation literacy and solid waste management practices, predicted the dependent variable of pro-environmental behavior. Moreover, the standardized beta coefficient is used to determine which predictor variable has the strongest influence on the outcome variable and to compare the relative effects of predictors in the regression model (Roustaei, 2024).

The provided matrix served as the framework for interpreting the descriptive levels of the study's variables, ensuring a systematic analysis of waste segregation literacy, solid waste management practices, and pro-environmental behavior, thereby facilitating a meaningful understanding of the data.

To measure and interpret the standard deviation, the following standard scheme is followed:

Range of Mean	Descriptive Level	<i>Waste Segregation Literacy</i>	<i>Solid Waste Management Practices</i>	<i>Students Pro-environmental behavior</i>
3.26 – 4.00	Very High	Very Good	Very Good	Very Strong
2.50 – 3.25	High	Good	Good	Strong
1.75 – 2.49	Low	Poor	Poor	Weak
1.00 – 1.74	Very Low	Very Poor	Very Poor	Very Weak

Standard Deviation Value Ranges and Interpretation:

Range	Description	Interpretation
SD < 0.50	Highly Consistent Responses	Strong and uniform perception
SD = 0.51 – 1.00	Moderately Consistent Responses	Acceptable consistency
SD = 1.01 – 1.50	Low Consistency Responses	Differing views or experiences
SD > 1.5	Very Low Consistency Responses	High variability and lack of consensus

The significance of correlations was tested at a 0.05 confidence level. For the interpretation scale of r-value, the following schemes are used:

Computed r	Descriptive Interpretation
+/- 1.00	Perfect Correlation
Between +/- 0.75 – +/- 0.99	High correlation
Between +/- 0.51 – +/- 0.74	Moderately high correlation
Between +/- 0.31 – +/- 0.50	Moderately low correlation
Between +/- 0.01 – +/- 0.30	Low Correlation
0.00	No Correlation

The degree of influence and the overall predictive effects of technology integration and inquiry-based learning on problem -solving skills in science were analyzed using multiple linear regression, with unstandardized and standardized beta coefficients, assuming a linear relationship among variables.

For the Scale of Beta (β) Coefficient Strength, the following scheme is used:

β Value Range	Strength of Influence
+ 0.00 - + 0.09	Very Weak
+ 0.10 - + 0.29	Weak
+ 0.30 - + 0.49	Moderate
+ 0.50 - + 0.69	Strong
+ 0.70 and above	Very Strong

Ethical considerations were strictly observed in this study on students' pro-environmental behavior in the remote schools of Don Marcelino, Davao Occidental. Prior to data collection, the research and its instruments were reviewed and approved by the Holy Cross of Davao College –

Society for Moral Integrity and legal ethics (HCDC-SMILE). Permission to conduct the study was subsequently obtained from the Department of Education (DepEd) Division of Davao Occidental SDS Office, the District PSDS, and the respective school principals.

Participation of the student-respondents was entirely voluntary, with informed assent and parental consent secured after the purpose, scope, and procedures of the study were thoroughly explained. The study adhered to key ethical principles, including informed consent, privacy and confidentiality, justice, transparency, and risk minimization. All data were handled in accordance with the Data Privacy Act of 2012, ensuring that personal identifiers were removed and that information was stored in password-protected files used solely for research purposes. The researcher ensured fairness in respondent selection through simple random sampling, maintained professional integrity, considered the cultural sensitivity of the local community, and committed to responsible sharing the findings to improve waste management literacy and environmental education.

III. RESULTS AND DISCUSSION

Table 1 is the descriptive table. It contains variables, namely, waste segregation literacy, solid waste management practices, and pro-environmental behavior with their respective indicators. It also includes the sample size, computed means, standard deviations, and the corresponding descriptive interpretations.

TABLE 1
DESCRIPTIVE STATISTICS (N = 193)

Variables	Standard Deviation	Mean	Descriptive Level
Waste Segregation Literacy	0.31	3.57	Very High
<i>Knowledge</i>	<i>0.37</i>	<i>3.58</i>	<i>Very High</i>
<i>Attitude</i>	<i>0.41</i>	<i>3.55</i>	<i>Very High</i>
<i>Practice</i>	<i>0.40</i>	<i>3.57</i>	<i>Very High</i>
Solid Waste Management Practices	0.32	3.57	Very High
<i>Waste Segregation</i>	<i>0.35</i>	<i>3.59</i>	<i>Very High</i>
<i>Waste Disposal</i>	<i>0.44</i>	<i>3.52</i>	<i>Very High</i>
<i>Waste Recycling/Reuse</i>	<i>0.36</i>	<i>3.59</i>	<i>Very High</i>
Students' Pro-environmental Behavior towards Environmental Science	0.44	3.56	Very High
<i>Conservation Lifestyle</i>	<i>0.42</i>	<i>3.64</i>	<i>Very High</i>
<i>Land Stewardship</i>	<i>0.57</i>	<i>3.52</i>	<i>Very High</i>
<i>Social Environmentalism</i>	<i>0.52</i>	<i>3.52</i>	<i>Very High</i>
<i>Environmental Citizenship</i>	<i>0.54</i>	<i>3.56</i>	<i>Very High</i>

Table 1 shows that the waste segregation literacy variable had a mean of 3.57, indicating very high literacy. This indicates that the students' literacy regarding sorting waste is very good. All indicators are also described as very high. The standard deviation of 0.31, indicating highly consistent responses, suggests a strong, relatively uniform perception among respondents.

Regarding solid waste management practices, the variable had a mean of 3.57, indicating very high performance. This indicates that waste segregation, disposal, and recycling are widely

practiced, as perceived by respondents. All indicators are also described as very high. The standard deviation of 0.32, indicating highly consistent responses, reflects a strong, uniform perception of solid waste management practices.

Furthermore, the students' pro-environmental behavior variable had a mean of 3.56, indicating very high levels. This suggests that respondents' pro-environmental behavior is very strong. All indicators are also described as very high. The standard deviation of 0.44, described as highly consistent responses, indicates a strong and uniform perception among respondents.

The data indicate that students possess a very high level of literacy in waste segregation, solid waste management practices, and pro-environmental behavior. These results demonstrate that participants consistently engage in ecological preservation and maintain a uniform perception regarding their environmental responsibilities.

The table shows a correlation table. It contained the variables involved in the study, showing the relationships between waste segregation literacy, solid waste management, and students' pro-environmental behavior. It also included the r-value, p-value, decision on H_0 , and its corresponding interpretation.

TABLE 2
CORRELATION TABLE (N=193)

Variables	Students' Pro-environmental Behavior towards Environmental Science			
	r-value	p-value	Decision on H_0	Interpretation
Waste Segregation Literacy	0.36	<0.001	Reject H_0	Moderately Low Positive, Significant
Solid Waste Management Practices	0.67	<0.001	Reject H_0	Moderately High Positive, Significant

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

Specifically, Table 2 shows that correlation between waste segregation literacy and pro-environmental behavior variables yielded a p-value of 0.001, which is less than the 0.05 level of significance. Hence, the null hypothesis was rejected, indicating a statistically significant relationship between the variables mentioned. The corresponding r-value of 0.36 indicates a moderate positive correlation. This implies that as waste-segregation literacy increases, students' pro-environmental behavior also tends to improve.

On the other hand, the correlation between solid waste management practices and pro-environmental behavior variables yielded a p-value of 0.001. This value is less than the 0.05 significance level. Thus, the null hypothesis was rejected. This indicates a significant correlation between the variables cited. The corresponding r-value of 0.67 indicates a moderate positive correlation. This implies that as solid waste management practices improve, there is a corresponding increase in students' pro-environmental behavior.

The results demonstrate that both waste segregation literacy and solid waste management practices are significantly and positively related to students' pro-environmental behavior. These findings suggests that as students gain a better understanding of waste sorting and consistently engage in waste management activities, their overall commitment to ecological preservation increases.

Table 3 presents a regression table. It contained the factors and the criterion variable. unstandardized and standardized beta coefficients, standard error, t-value, significance, decision on null hypothesis, and interpretation.

TABLE 3
REGRESSION TABLE (N=193)

Students' Pro-environmental Behavior towards Environmental Science							
Variables	Unstandardized		Standardized		Sig.	Decision on H_0	Interpretation
	B	Std. Error	Beta	t			
(Constant)	0.25	0.30	—	0.81	0.414	—	—
Waste Segregation Literacy	0.03	0.08	0.03	0.43	0.664	Fail to Reject	Not Significant
Solid Waste Management Practices	0.89	0.08	0.65	10.40	<0.001	Reject	Positive Significant Influence

$R = 0.66$ | $R^2 = 0.44$ | $F = 76.6$ | $p = 0.001$

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

Specifically, Table 3 shows that the waste segregation literacy variable had a standardized beta coefficient of 0.03. This indicates that the influence of waste segregation literacy on the criterion variable is very weak. With the corresponding p-value of 0.664, the null hypothesis was accepted. It indicates that the influence of waste segregation literacy on pro-environmental behavior toward environmental science is not significant. This Implies that for every unit change

in waste segregation literacy, there is no corresponding change on pro-environmental behavior.

Moreover, the solid waste management practices variable obtained a standardized beta coefficient of 0.65. It indicates that solid waste management practices have a strong influence on the criterion. The corresponding p-value obtained is 0.001; thus, the null hypothesis was rejected. It indicates that solid waste management practices positively and significantly influence pro-environmental behavior toward environmental science variables. This implies that for every 1-unit change in solid waste management practices, there is a corresponding 0.65-unit change in pro-environmental behavior.

The table also shows an R² value of 0.44. This indicates that the collective influence of determinant variables on the criterion variable is moderate. The corresponding p-value of 0.001 is less than 0.05 significance level. Thus, the null hypothesis was rejected. This indicates that the combined influence of waste segregation literacy and solid waste management practices on students' pro-environmental behavior toward environmental science is statistically significant. This implies that for every unit change in the combined influence of the determinant variables, there is a corresponding 0.44 unit change in the criterion variable.

The results indicate that while solid waste management practices exert a strong, positive, and statistically significant influence on student pro-environmental behavior, waste segregation literacy alone does not significantly drive these actions. Collectively, however, environmental literacy and management practices are significant determinants of students' overall commitment to ecological responsibility.

Summary of Findings

Based on statistical results, it was specifically found that waste segregation literacy and solid waste management practices significantly correlate with students' pro environmental behavior in environmental science. Solid waste management practices, rather than waste segregation literacy, have a significant influence on students' pro-environmental behavior in environmental science. Waste segregation literacy and solid waste management practices have a significant collective influence on students' pro-environmental behavior in environmental science, though waste segregation literacy does not have a significant influence.

The study reveals that both waste-segregation literacy and solid waste management practices are significantly correlated with students' pro-environmental behavior in environmental science. This finding affirms that of Aman et al. (2023), who found that literate and practiced learners tend to develop stronger commitment and persistence, thereby enhancing their ability to engage in meaningful ecological participation. Furthermore, this finding supports the idea of He et al. (2022), who reported that fostering behavioral habituation through consistent practices improves students' environmental stewardship.

However, the current finding contradicts the study by Halдар et al. (2024), arguing that even when individuals have high literacy and environmental commitment, they often fail to engage in consistent ecological participation due to systemic barriers and situational constraints.

The findings of this study indicate that waste segregation literacy and solid waste management practices have a significant collective influence on students' pro-environmental behavior, though literacy does not show a significant individual influence. The result affirms the findings of Prihatin et al. (2024), which report that behavioral enactment significantly influences student engagement, suggesting that students with higher levels of solid waste management practices are more actively involved in their ecological responsibilities. Similarly, the current finding supports the study by Samsudin et al. (2026), which claims that higher levels of student participation in environmental education programs directly strengthen environmental care behavior, as active involvement allows students to solve real-world problems rather than just memorizing concepts.

In contrast, the current finding negates the study of Velasco et al. (2025), arguing that behavioral enactment alone does not always translate into sustained ecological engagement. Additionally, this result is inconsistent with Kurniawan et al. (2026), who argued that high levels of mandated participation do not inherently strengthen environmental care behavior. The findings of this study prove that active practice is a strong driver of pro-environmental behavior among students; the conflicting views of other authors suggests that the long-term success of these practices depends on moving beyond simple habit toward a genuine, personal commitment to environmental care.

Conclusion

Based on the findings, it was concluded that solid waste management has a significant positive influence on students' pro-environmental behavior in environmental science, whereas waste segregation alone does not have significant effect. Hence, the Social Cognitive Theory, which emphasizes that human behavior is shaped by the reciprocal interaction among personal, behavioral, and environmental factors, was partially supported.

Recommendations

Based on the conclusion, the following are recommended:

1. Future research may explore other variables not covered in this study to account for the remaining unexplained variance in students' pro-environmental behavior. Qualitative studies may also be undertaken to identify barriers that prevent high literacy from leading to significant behavioral changes.

School administrators, policymakers, and teachers may collaboratively promote student engagement by implementing regular practice-based programs and providing robust infrastructure. These initiatives should focus on experiential, hands-on waste management to bridge the gap between knowledge and daily action.

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