

Teachers' Awareness and Practices in Waste Management Integration in Barili 2, Cebu, Philippines

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ABSTRACT

This study investigated the role of high school teachers in fostering students' awareness, attitudes, and behaviors toward responsible waste management in Barili 2, Cebu, Philippines, aiming to develop an effective intervention plan. Recognizing waste mismanagement as a critical global and local issue, the research emphasized the potential of schools in cultivating environmental responsibility, with teachers serving as important figures supported by educational theories. The study profiled teachers, examined their integration of waste management concepts into lessons, assessed school support, and identified challenges faced by stakeholders. Results revealed a significant positive relationship between teachers' integration of waste management concepts and students' awareness levels. Students demonstrated high understanding of the 3Rs (Reduce, Reuse, Recycle) and the environmental impact of waste, reflecting teachers' active engagement in environmental education. Furthermore, a strong positive correlation was observed between teachers' participation in environmental education training and their ability to incorporate waste management concepts ($r = 0.68$ for teachers attending five or more sessions), suggesting that consistent professional development is crucial for effective curriculum integration. Despite these findings, teachers faced significant resource constraints, including limited teaching materials, overcrowded classrooms, and inadequate school infrastructure such as insufficient waste bins and composting areas. Weak policy implementation, with inconsistent enforcement and monitoring, further created a gap between official school policies and daily practices. Furthermore, using a mixed-methods approach with surveys for teachers and students, the study informed the development of a Waste Management Awareness and Behavior Change Intervention Training Plan, designed to enhance teacher capacity and promote responsible waste management practices within the community.

Keywords: *environmental education, intervention plan, student awareness, teacher role, waste management*

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1. Introduction

Effective waste management is increasingly essential in addressing global ecological and public health challenges, as waste mismanagement contributes significantly to environmental degradation and health risks (Ferronato et al., 2019). Consequently, stakeholder involvement, including the education sector, is widely recognized as vital to sustaining effective waste management practices (Debrah et al., 2021).

Furthermore, schools play a crucial role in shaping environmentally responsible behaviors among learners. Specifically, integrating waste management education in schools enhances students' awareness, attitudes, and practices toward environmental conservation (Debrah et

al., 2021; Romualdo et al., 2022; Mpuangnan et al., 2023). In this context, teachers serve as key facilitators and role models, emphasizing the importance of continuous professional development in environmental education (Kaya & Gödek, 2016).

In addition, research shows that students' environmental behaviors are influenced not only by instruction but also by personal attributes, highlighting the need to integrate values formation within educational frameworks (Wirdianti et al., 2019). Accordingly, school-based environmental programs have proven effective in promoting waste segregation, reuse, and

environmental literacy (Khasana et al., 2023; Salsabila et al., 2024).

However, despite strong evidence supporting environmental education, gaps remain in understanding teachers' specific roles, strategies, and challenges in implementing waste management education, particularly in the Philippine context. Meanwhile, waste management continues to be a pressing local issue due to increasing waste generation and limited disposal systems, including in Barili 2, where solid waste management has been identified as a major concern.

Therefore, this study examines high school teachers' experiences and perspectives in promoting responsible waste management. Ultimately, the findings inform the development of a Waste Management Awareness and Behavior Change Intervention Plan aimed at strengthening students' environmental responsibility through teacher-led initiatives.

2. Materials and methods

2.1. Research design

This study utilized a mixed-methods research design combining quantitative and qualitative approaches to examine teachers' awareness and practices in integrating waste management concepts and their relationship to students' awareness in public high schools in Barili 2, Cebu, Philippines. The quantitative component followed a descriptive–correlational design to determine the levels of integration of waste management concepts, school support, and students' awareness, as well as the relationship between teachers' integration practices and their participation in environmental education training. Qualitative data were gathered to identify challenges encountered by school administrators, teachers, and students in implementing responsible waste management.

2.2. Population and sampling

The study was conducted in selected public secondary schools in Barili 2, namely Patupat National High School, Mantalongon National High School, Cagay National High School, Guibugan National High School, Giloctog National High School, and Malolos National High School. The respondents included 177 teachers and school administrators, selected through total enumeration to

ensure comprehensive representation across the participating schools (Table 1).

Table 1. Distribution of the respondents

Schools /code	Administrators	Teachers
Cagay National High School (S1)	TIC	16
Malolos National High School (S2)	TIC	23
Giloctog National High School (S3)	Principal 1	13
Lourdes Empinadon National High School (S4)	Principal 1	69
Guibugan National High School (S5)	Head Teacher	21
Patupat National High School (S6)	Head Teacher	22
Minolos Integrated School	Principal 1	13
Total	7	177

2.3. Data collection and statistical analysis

Data were collected using a researcher-modified survey questionnaire administered to high school teachers and students in selected public secondary schools in Barili 2, Cebu. The instrument consisted of sections on respondents' demographic profile, level of integration of waste management concepts in teaching, level of school support for promoting responsible waste management, students' awareness of waste management issues, and challenges encountered in implementation. Responses for integration, school support, and awareness were measured using a five-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). For data interpretation, weighted mean scores were classified as follows: 4.21–5.00 (*Strongly Agree*), 3.41–4.20 (*Agree*), 2.61–3.40 (*Neutral*), 1.81–2.60 (*Disagree*), and 1.00–1.80 (*Strongly Disagree*).

Quantitative data were analyzed using frequencies and percentages to describe the respondents' profile, and weighted mean to determine the levels of integration of waste management concepts, school support, and students' awareness. The Pearson Product–Moment Correlation Coefficient was employed to examine the relationship

between teachers' level of integration of waste management concepts and their participation in environmental education trainings. Qualitative responses on challenges experienced by school administrators, teachers, and students were analyzed using thematic analysis to identify recurring themes related to responsible waste management implementation.

2.4. Ethical considerations

Ethical considerations were strictly observed throughout the study. Informed consent was secured from all participants, participation was voluntary, and confidentiality and anonymity were maintained. All data were used exclusively for academic purposes, and findings were reported objectively and accurately.

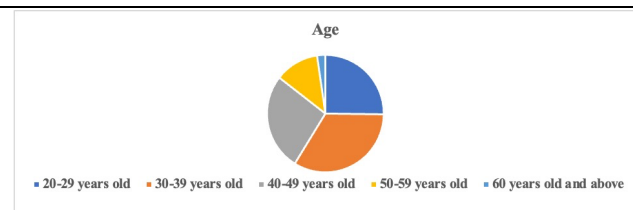
3. Results

3.1. Profile of the Teacher-Respondents

Tables 2 and Figure 1 present the demographic profile of the 131 teacher-respondents in terms of age, gender, years of teaching experience, educational attainment, and participation in environmental education training.

Table 2. Age profile of the teacher-respondents

Age	Frequency	Percentage
20-29 years old	33	25.20
30-39 years old	44	33.60
40-49 years old	35	26.70
50-59 years old	16	12.20
60 years old and above	3	2.30
Total	131	100.00



As shown in Table 2 and Figure 1, most teachers belong to the 30–39 (33.60%) and 40–49 (26.70%) age groups, indicating that the majority of respondents are within the

prime working age. This suggests a relatively experienced and mature teaching force capable of implementing learner-centered and reform-oriented practices. Studies emphasize that teachers within this age range tend to exhibit higher instructional efficacy and confidence, which positively influences curriculum integration and environmental responsibility (Zhang et al., 2021; Khasana et al., 2023).

Figure 1. Age bracket of respondents

Table 3 reveals that the teaching workforce is predominantly female (79.4%), reflecting the gender composition of public secondary schools. This indicates that the perspectives and practices related to waste management education in this study are largely shaped by female educators.

Table 3. Gender profile of teacher-respondents

Gender	Frequency	Percentage
Male	26	19.8
Female	104	79.4
Preferred	1	.8
Not to Say		
Total	131	100.0

In terms of teaching experience (Table 4), the majority of teachers have 1–10 years of service (70.2%), suggesting a relatively young yet adaptable workforce. Early-career teachers are often open to adopting innovative instructional approaches but may require continuous professional development to strengthen self-efficacy and curriculum implementation skills (Agormedah et al., 2022).

Table 4. Years of teaching experience of teachers

Years of Teaching Experience	Frequency	Percentage
1-5 years	43	32.80
6-10 years	49	37.40
11-15 years	11	8.40
16-20 years	7	5.30
21-25 years	6	4.60

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26-30 years	9	6.90	1	5	3.8
31-35 years	4	3.10	2	3	2.3
36 years and above	2	1.50	3	1	.8
	4		4	3	2.3
			5	3	2.3
Total	131	100.00	Total	131	100.0

Table 5 shows that a significant proportion of teachers have pursued graduate studies, with more than half having master's units. This level of educational attainment suggests strong academic preparation, which is positively associated with instructional effectiveness and improved student learning outcomes (Nguyen & Redding, 2018; Oviawe & Omoh, 2021).

Table 5. Educational attainment of teachers

Educationa I Attainment	Frequency	Percentage
College Graduate	51	38.93
Masters with units	69	52.67
Masters Graduate	8	6.11
Doctorate With Units	2	1.53
Doctorate Graduate	1	0.76
Total	131	100.00

Despite strong academic qualifications, Table 6 indicates that 88.5% of teachers have not attended environmental education training. This lack of formal training may limit their capacity to effectively integrate waste management concepts into teaching, highlighting the need for targeted training initiatives (Yücel & Yavuz, 2019; Scott & Sulsberger, 2019).

Table 6. Number of training and seminars related to participation in environmental education training

Number of Training and Seminar	Frequency	Percentage
None	116	88.5

Level of Integration of Waste Management Concepts to Teaching

Table 7 presents the level of integration of waste management concepts into teaching practices. The overall weighted mean of 3.98, verbally interpreted as Agree, indicates that waste management concepts are generally integrated into instruction. Teachers frequently use real-world examples, incorporate waste management into the curriculum, and engage students in practical activities related to waste reduction, reuse, and recycling. However, teacher training and professional development received the lowest rating (WM = 3.57), suggesting that integration is largely practice-driven rather than supported by sufficient formal training.

Table 7. Level of integration of waste management concepts to teaching

Statements	Weighted Mean	Verbal Interpretation
Waste management concepts are explicitly incorporated into the curriculum of most subjects.	4.10	Agree
Teachers regularly use real-world examples of waste management issues to illustrate concepts in their lessons.	4.17	Agree
Students are provided with opportunities to engage in practical activities related to waste reduction, reuse, and recycling.	4.1	Agree

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The school provides adequate resources (e.g., teaching materials, facilities) to support the integration of waste management concepts.	3.96	Agree	school and home.									
<hr/> Overall Weighted Mean <hr/>												
3.98												
Agree												
<i>Legend: 4.21-5.00-Strongly Agree; 3.41-4.20-Agree; 2.61-3.40-Neither Agree Nor Disagree; 1.81-2.60-Disagree; 1.00-1.80-Strongly Disagree</i>												
Teachers receive sufficient training and professional development on integrating waste management into their teaching.	3.57	Agree	<p>These findings imply that while schools provide a supportive environment for environmental education, strengthening professional development programs could further enhance teachers' instructional competence and confidence. Similar studies emphasize that inclusive and innovative educational approaches significantly improve waste management awareness and behaviors (Srijuntrapun et al., 2025; Prawira & Rahayu, 2024).</p> <p>Level of School Support for Promoting Responsible Waste Management</p> <p>Table 8 shows a high level of school support for promoting responsible waste management, with an overall weighted mean of 4.09 (<i>Agree</i>). Strong support is evident in curriculum integration, educational campaigns, student involvement, and resource provision. The highest-rated indicator was curriculum integration, suggesting that waste management is institutionalized within school practices. However, relatively lower ratings for policy clarity and collaboration with external organizations indicate areas for improvement. These findings align with Gada (2024), who emphasized the importance of curriculum integration and community engagement in fostering environmental responsibility.</p> <p>Table 8. The level of school support for promoting responsible waste management among students</p> <hr/> <table border="1"> <thead> <tr> <th>Statements</th> <th>Weighted Mean</th> <th>Verbal Interpretation</th> </tr> </thead> <tbody> <tr> <td>The school provides adequate resources (e.g., bins, materials) for waste segregation.</td> <td>4.10</td> <td>Agree</td> </tr> <tr> <td>The school regularly organizes educational</td> <td>4.16</td> <td>Agree</td> </tr> </tbody> </table>	Statements	Weighted Mean	Verbal Interpretation	The school provides adequate resources (e.g., bins, materials) for waste segregation.	4.10	Agree	The school regularly organizes educational	4.16	Agree
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The school provides adequate resources (e.g., bins, materials) for waste segregation.	4.10	Agree										
The school regularly organizes educational	4.16	Agree										
The school promotes a culture of environmental responsibility that reinforces waste management principles among students.	4.05	Agree										
Table 7. Continued												
Assessments and evaluations effectively measure students' understanding and application of waste management concepts.	3.92	Agree										
Interdisciplinary approaches are frequently used to integrate waste management concepts across different subject areas.	3.96	Agree										
Students demonstrate a good understanding of the importance of proper waste management for environmental sustainability.	3.83	Agree										
The integration of waste management concepts in teaching significantly influences students' waste disposal behaviors at	4.05	Agree										

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campaigns on responsible waste management.			
School staff actively participate in and model responsible waste management practices.	4.1	Agree	
The school has clear policies and guidelines for waste reduction and recycling.	3.9	Agree	
The school collaborates with external organizations to enhance waste management initiatives.	3.94	Agree	
Table 8. Continued			
Students are regularly involved in planning and implementing waste management activities.	4.11	Agree	
The school provides feedback to students on their waste management efforts.	4.04	Agree	
The school integrates responsible waste management concepts into the curriculum.	4.2	Strongly Agree	
The school administration consistently emphasizes the importance of responsible waste management.	4.0	Agree	
Overall Weighted Mean	4.09	Agree	

Legend: 4.21-5.00-Strongly Agree; 3.41-4.20-Agree; 2.61-3.40-Neither Agree Nor Disagree; 1.81-2.60-Disagree; 1.00-1.80-Strongly Disagree

Relationship between integration of waste management concepts and environmental education training

Table 9 shows a positive relationship between the level of integration of waste management concepts and the number of environmental education trainings attended.

Teachers who participated in more trainings demonstrated higher levels of integration, with the strongest correlation observed at the highest level of training exposure ($r = 0.68$). This indicates that professional development plays a crucial role in strengthening teachers' capacity to integrate waste management concepts into instruction. Similar findings highlight the importance of education and training in improving waste management awareness and practices (Adekola et al., 2021; Kuziemska et al., 2021; Qaderi et al., 2021).

Table 9. Relationship on the levels of integration of waste management concepts to the number of trainings/seminar attended related to environmental education training

Number of Trainings/Seminar Attendance	Level of Integration of Waste management Concepts
	Pearson Correlation (r)
0	-0.57
1	0.34
2	0.21
3	0.45
4	0.53
.1	0.68

3. Discussion

3.1. Challenges in promoting responsible waste management

Thematic analysis revealed several challenges affecting the promotion of responsible waste management among students. This study examines the role of teachers in promoting waste management awareness and responsible environmental behavior among high school students in Barili 2, Cebu, Philippines. Despite being academically qualified and actively integrating waste management concepts into classroom instruction, most teachers lack formal training in environmental education. This gap significantly limits the depth and consistency of implementation, reinforcing earlier findings that teacher competence and sustained professional development are critical determinants of effective environmental education (Debrah et al., 2021; Eliyawati et al., 2023).

The results further demonstrate that professional development is a key driver of instructional effectiveness. The strong positive correlation between the number of environmental education training seminars attended and the level of integration of waste management concepts ($r = 0.68$) confirms that continuous training enhances teachers' capacity to deliver meaningful, experiential, and transformative learning. This finding supports experiential and transformative learning theories, which emphasize structured exposure, reflection, and practice as mechanisms for lasting behavioral change (Kaya & Gödek, 2016; Purwianingsih et al., 2022).

However, instructional efforts are undermined by persistent and interconnected challenges. Limited student awareness, heavily influenced by home practices and parental behavior, remains a major barrier to sustaining responsible waste management habits. Inadequate resources, overcrowded classrooms, and insufficient waste management infrastructure further restrict experiential learning opportunities. Additionally, weak policy enforcement and inconsistent monitoring create a disconnect between school policies and actual practices, while peer influence, social media exposure, and competing academic priorities reduce student engagement (Aklyyah et al., 2019; Magdugo et al., 2024; Saifuddin et al., 2023; Zhao et al., 2019).

These findings indicate that while schools and teachers provide a strong foundation for environmental education, their efforts alone are insufficient to produce sustained behavioral change. In line with RA 9003 and DepEd environmental education mandates, the results highlight the need for a comprehensive, multi-stakeholder intervention that prioritizes teacher training, adequate resources, consistent policy enforcement, and active collaboration among schools, families, communities, and local government units. Such an integrated approach is essential to translate awareness into long-term, sustainable waste management behaviors.

5. Conclusion

The study reveals that despite teachers in Barili 2, Cebu, Philippines being experienced and academically qualified, limited formal training in environmental education restricts the effectiveness of waste management

instruction. Nonetheless, teachers actively integrate waste management concepts, positively influencing student behavior, with strong institutional support from schools. The significant positive link between teacher training and instructional integration highlights professional development as a critical driver of success. Persistent challenges related to student awareness, resources, policy implementation, and home influence indicate that sustainable waste management requires strengthened teacher training and a coordinated, multi-stakeholder approach.

Author contributions

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, X.X. and Y.Y.; methodology, X.X.; software, X.X.; validation, X.X., Y.Y. and Z.Z.; formal analysis, X.X.; investigation, X.X.; resources, X.X.; data curation, X.X.; writing—original draft preparation, X.X.; writing—review and editing, X.X.; visualization, X.X.; supervision, X.X.; project administration, X.X.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript." Please turn to the [CRediT taxonomy](#) for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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Conflict of interest

Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results.

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a systematic”; for two authors, replacing “[5] found that...” with “Qian and Zhao^[5] found that...”; for three and more than three authors, replacing “[7] described...” with “Li et al.^[7] described...”.

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