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Scientific Reasoning and Waste Management Awareness Among Grade 6 Learners

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ABSTRACT

Environmental responsibility among elementary learners has drawn increasing attention as schools are expected to cultivate both scientific understanding and sustainable daily practices. The investigation focused on the relationship between scientific reasoning and waste management awareness among Grade 6 learners at Dappat Integrated School in the City of Ilagan, Isabela. It determined the level of scientific reasoning, assessed the level of waste management awareness, tested the significance of the relationship between the variables, and examined whether scientific reasoning significantly predicted awareness levels. A cross-sectional explanatory nonexperimental design was employed. Data were gathered using a validated researcher-developed instrument with an overall Content Validity Index of 0.94 and an overall Cronbach's alpha of 0.90. Mean and standard deviation were used for descriptive analysis, while Kendall's tau-b and ordinal logistic regression were applied for inferential analysis. Results indicated that scientific reasoning was moderately evident, particularly in areas involving logical conclusion-making and the application of scientific explanations to everyday situations. Waste management awareness was likewise moderately evident, with stronger awareness in segregation and disposal practices but lower awareness in recycling, reuse, and environmental consequences. The findings further revealed a significant moderate positive relationship between scientific reasoning and waste management awareness. Scientific reasoning also significantly predicted higher levels of waste management awareness. These findings highlight the importance of integrating reasoning-focused science instruction with school-based environmental education to strengthen responsible waste management behavior among elementary learners.

Keywords: *Scientific reasoning, waste management awareness, Grade 6 learners, environmental education, science learning, elementary education*

INTRODUCTION

The growing waste crisis has become one of the most urgent environmental concerns of the contemporary world, making waste management education an increasingly important responsibility of schools. The United Nations Environment Programme reported that municipal solid waste generation is projected to rise sharply in the coming decades, with serious consequences for ecosystems, public health, and economic sustainability if waste is not managed properly (United Nations Environment Programme [UNEP], 2024). In the Philippines, this concern is reinforced by Republic Act No. 9003, or the Ecological Solid Waste Management Act, which establishes the national framework for proper waste segregation, recycling, reduction, and disposal. These realities suggest that environmental responsibility cannot be left to policy alone. It must also be cultivated among young learners through meaningful school-based learning

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experiences that help them understand why waste management matters and how their daily actions affect the environment.

Education has long been recognized as a powerful pathway for developing environmentally responsible citizens. UNESCO explains that Education for Sustainable Development enables learners to acquire the knowledge, skills, values, and dispositions needed to make informed decisions and take responsible action for environmental protection and social well-being (UNESCO, 2026). In the Philippine basic education, the Department of Education has likewise emphasized climate literacy and sustainable school practices through its climate change education initiatives, highlighting the need to develop learners who are proactive in building resilient and sustainable communities. This means that schools are not only centers for academic instruction but also formative spaces where environmental awareness, sustainable habits, and civic responsibility can be nurtured at an early age. For elementary learners, especially those in the intermediate grades, these experiences are crucial because values and habits formed during this stage often influence later patterns of decision-making and behavior.

Within science education, the development of scientific reasoning is particularly important because it equips learners with the ability to observe patterns, evaluate evidence, explain phenomena, and make sound judgments based on facts rather than assumptions. The OECD describes science literacy as the capacity to participate in informed discussions about science, sustainability, and technology and to interpret evidence critically for decision-making and action (OECD, 2026). Similarly, the PISA science framework emphasizes that learners should be able to explain phenomena scientifically, evaluate scientific inquiry, and interpret data and evidence critically (OECD, 2023). Research further shows that scientific reasoning is closely associated with academic performance and develops progressively across grade levels, making it an essential competency to strengthen during the school years (Van Vo & Csapó, 2023). At the same time, evidence suggests that many students still struggle with scientific reasoning and may hold misconceptions even when they appear confident in their answers, which points to the need for closer attention to how reasoning skills are formed in classroom settings (Bhaw, Kriek, & Lemmer, 2023).

The relevance of scientific reasoning becomes even more apparent when learners face real-life environmental issues such as waste generation, segregation, disposal, and recycling. Environmental concerns are not merely practical matters of cleanliness. They also involve interpretation of cause and effect, understanding systems, making evidence-based decisions, and assessing the consequences of human actions. Studies on environmental and socio-scientific issues have shown that such contexts help develop argumentation and decision-making skills that are central to scientific literacy (Kumar et al., 2024). In the same direction, a meta-analysis by van de Wetering et al. (2022) found that environmental education significantly improves students' environmental knowledge, attitudes, intentions, and behavior. These findings suggest that waste management awareness may be strengthened when learners are not only told what to do but are also taught how to reason scientifically about environmental problems and their possible solutions.

According to the OECD country note on PISA 2022, only 23% of students in the Philippines attained at least Level 2 proficiency in science, which is the baseline level at which learners can recognize the correct explanation for familiar scientific phenomena and determine whether simple conclusions are supported by data (OECD, 2023). This indicates a continuing need to strengthen science-related competencies among Filipino learners, especially those linked to explanation, evaluation, and evidence-based judgment. Since environmental issues such as waste management are embedded in everyday life, they provide a highly meaningful context through which scientific reasoning can be examined and supported in basic education. Investigating these variables among Grade 6 learners may therefore provide useful insights into how well learners are prepared to think scientifically about environmental responsibilities that directly affect their school and community settings.

In Dappat Integrated School in the City of Ilagan, Isabela, the Grade 6 learners are at a significant stage of cognitive and social development, where they begin to engage more independently with scientific

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concepts and community-related issues. Determining their level of scientific reasoning and waste management awareness may help clarify whether learners possess the thinking skills needed to understand environmental concerns in a deeper and more responsible way. More importantly, examining these variables may provide a basis for improving science instruction, environmental education efforts, and school-based sustainability practices. By situating the inquiry within the lived experiences of elementary learners, the study contributes to the broader goal of forming scientifically literate and environmentally responsible citizens who can respond thoughtfully to the demands of sustainable living.

Literature Review

Scientific Reasoning as a Foundational Science Competency

Scientific reasoning is widely regarded as one of the central competencies that science education must develop in learners. The OECD, through the PISA 2025 science framework, explains that science education should enable learners to engage with science-related issues, use scientific ideas, and make informed decisions based on evidence. This view positions scientific reasoning not simply as content recall, but as the ability to interpret information, examine claims, and arrive at justified conclusions in real-life contexts. In the broader educational agenda, scientific literacy is therefore inseparable from reasoning, because learners are expected to think through scientific issues rather than merely memorize scientific facts (OECD, 2023; OECD, 2026).

This understanding is reinforced by recent scholarship in science education. García-Carmona (2025) argued that scientific thinking and critical thinking are key intellectual processes in the comprehensive formation of citizens, particularly in science education. In the same direction, Jimenez et al. (2024) emphasized that one major goal of science education is to help students make sense of scientific information and make science-informed decisions when facing complex issues. These perspectives are relevant to elementary education because they frame reasoning as a practical and civic skill, not just a classroom exercise.

Nature and Components of Scientific Reasoning

Scientific reasoning is not a single, isolated mental ability. Rather, it is a cluster of interrelated processes that allow learners to ask questions, evaluate evidence, interpret data, identify patterns, and justify claims logically. A recent systematic review on scientific reasoning skills described these abilities as interconnected cognitive processes that support effective science learning and problem solving. This characterization is important because it implies that scientific reasoning includes multiple dimensions, such as evidence evaluation, explanation, inference, and logical judgment, all of which may vary across learners and contexts (Fatimah et al., 2026).

Empirical work has also clarified how scientific reasoning appears in actual student performance. Bhaw et al. (2023) examined the coherence of students' scientific reasoning skills and highlighted that learners may show uneven development across reasoning tasks, suggesting that scientific reasoning should be assessed carefully rather than assumed from general science performance alone. Similarly, Pickal et al. (2023) emphasized that diagnosing scientific reasoning requires attention to specific forms of reasoning competence rather than broad impressions of science ability. Together, these studies show that scientific reasoning has a distinct structure and deserves focused investigation, especially in school-based studies that aim to understand how learners think about scientific and environmental issues.

Scientific Reasoning in Basic and Elementary Education

The development of scientific reasoning does not begin in secondary school. Research shows that reasoning skills emerge and strengthen across grade levels, making the elementary years an important stage for intervention and assessment. Van Vo and Csapó (2023) found that scientific reasoning varies across

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school levels and is linked with science motivation and academic outcomes. Although their sample covered older learners, the study is still significant because it supports the view that reasoning develops progressively and should be cultivated before students reach advanced grades. This strengthens the rationale for examining scientific reasoning among Grade 6 learners, who are approaching the transition to higher-level science learning.

Upper elementary classrooms are especially suitable environments for reasoning-focused science instruction because learners at this stage begin to engage more independently with explanation, evidence, and interpretation. Ryan et al. (2023), in a classroom intervention with upper-elementary students, demonstrated how learners can develop mechanistic explanations and refine their understanding of environmental phenomena when guided through evidence-based modeling activities. Likewise, Abrori et al. (2025) showed that elementary learners' socio-scientific reasoning can be enhanced through well-designed instructional materials. These works suggest that late elementary learners are already capable of engaging with meaningful science reasoning tasks, especially when the topic is connected to real-world issues that matter in their everyday lives.

Waste Management Awareness as an Educational Concern

Waste management awareness refers to learners' understanding of proper waste segregation, reduction, reuse, recycling, and disposal, as well as their recognition of the environmental and health consequences of poor waste practices. At the global level, UNEP's Global Waste Management Outlook 2024 warns that municipal solid waste generation is projected to rise from 2.1 billion tonnes in 2023 to 3.8 billion tonnes by 2050, highlighting the urgency of strengthening public awareness and responsible practices. This concern gives schools a meaningful role in shaping early environmental responsibility, since everyday school routines expose children directly to issues of waste generation and disposal (UNEP, 2024).

In educational settings, waste management awareness is more than procedural knowledge. It involves understanding why proper waste handling matters and how individual behavior contributes to environmental outcomes. Debrah et al. (2021) argued that environmental education can help shape students' attitudes toward waste management, particularly when school activities actively involve learners in responsible disposal practices. Haniva (2024) also noted that familiarizing students with sustainable waste management principles in schools helps position waste management as part of broader sustainable development. These perspectives suggest that awareness is both cognitive and behavioral, making it an important educational variable to investigate among elementary learners.

Environmental Education and the Formation of Sustainable Behavior

Environmental education has consistently been linked with improved learner knowledge, attitudes, intentions, and behavior. A meta-analysis by van de Wetering et al. (2022) found that environmental education significantly improved environmental knowledge, attitudes, intentions, and behavior among children and adolescents. This is a strong foundation for studies on waste management awareness because it demonstrates that environmental learning experiences can move beyond awareness alone and influence how students think and act. For schools, this means that environmental themes are not peripheral topics but effective channels for shaping sustainable habits and dispositions.

UNESCO likewise frames Education for Sustainable Development as a process that equips learners with the knowledge, skills, values, attitudes, and behaviors needed to make informed decisions and take responsible action for the environment, economy, and society. This formulation is highly relevant to waste management education because it treats environmental responsibility as part of the broader purpose of schooling. When learners are taught to understand environmental problems, reflect on their consequences, and act responsibly, they become more prepared to participate in sustainable community life. Thus, waste management awareness among Grade 6 learners can be seen as part of a larger educational effort to form environmentally literate and responsible citizens (UNESCO, 2023; UNESCO, 2026).

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School-Based Waste Management in the Philippine Context

In the Philippines, school-based waste management is supported by both legal and educational frameworks. Republic Act No. 9003 provides the national policy basis for ecological solid waste management, while the Department of Education has integrated environmental initiatives through school programs and co-curricular activities, including solid waste management efforts and Youth for Environment in Schools Organization participation. DepEd's climate change education resources further reflect the continuing integration of sustainability themes into the school context. These policies show that schools are expected to help learners move from environmental awareness to environmental responsibility through instruction and school practices (Department of Education, n.d.).

Philippine studies also suggest that learner awareness of solid waste management is already being examined in educational settings, although many studies remain focused on awareness and practices rather than cognitive foundations. Molina and Catan (2021), studying senior high school students in Zamboanga City, found generally positive solid waste management awareness and practices. At the elementary level, Taypin et al. (2024) investigated awareness and practices among intermediate pupils and highlighted the continuing importance of strengthening school-based waste management education. These studies are useful because they confirm that waste-related awareness is a valid and relevant educational concern in the Philippine setting. However, they also indicate that more localized and conceptually connected studies are still needed, especially among elementary learners in public schools.

Linking Scientific Reasoning and Waste Management Awareness

Although scientific reasoning and waste management awareness are often studied separately, there is a strong conceptual basis for linking them. Waste management decisions require learners to recognize cause-and-effect relationships, interpret environmental consequences, distinguish responsible from harmful practices, and make judgments based on evidence. These are functions that align closely with scientific reasoning. The OECD science framework emphasizes that learners should be able to use scientific knowledge and evidence when addressing issues related to the natural world and human activity, which directly includes environmental concerns such as waste and sustainability (OECD, 2023; OECD, 2026).

Research on inquiry-based and socio-scientific learning further supports this connection. Urdanivia Alarcon et al. (2023) noted that inquiry-based instruction helps learners construct scientific knowledge and research skills, while studies on socio-scientific reasoning show that environmental issues can serve as rich contexts for scientific thinking and decision-making. When learners encounter authentic environmental concerns, such as improper disposal, segregation, and recycling, they are invited to reason scientifically rather than respond mechanically. This suggests that learners with stronger scientific reasoning may also be better positioned to understand and value proper waste management, making the relationship between these variables worthy of investigation (Abrori et al., 2025).

METHODS

Research Design

The study employed a cross-sectional explanatory nonexperimental design. This design was considered appropriate because it allowed the researcher to examine the present condition of Grade 6 learners in terms of their scientific reasoning and waste management awareness within a single period of data collection, while also determining whether variations in scientific reasoning were associated with differences in waste management awareness. Unlike a purely descriptive approach, this design went further by exploring the explanatory value of one variable in relation to the other without manipulating the learning environment or introducing any intervention. It was suitable for school-based educational inquiry where naturally occurring learner attributes were examined as they existed in the actual classroom setting.

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Research Locale

The study was conducted at Dappat Integrated School located in the City of Ilagan, Isabela. The school served as a relevant locale for the investigation because it provided an authentic elementary learning environment where science concepts and environmental practices were experienced by learners as part of their daily school life. The setting was appropriate for the study since waste management awareness could be meaningfully examined in relation to learners' school-based experiences, routines, and science instruction. The locale also offered a practical context for understanding how scientific reasoning may relate to environmental awareness among learners in a public basic education institution.

Participants and Sampling Technique

The participants of the study were Grade 6 learners enrolled at Dappat Integrated School during the period of data collection. They were selected through total enumeration sampling, which enabled the researcher to include all available learners within the target group who met the inclusion criteria and secured the necessary parental consent and learner assent. This sampling approach was preferred because the study focused on a specific and accessible learner population within one school setting, allowing the researcher to obtain a more complete picture of the relationship between the variables under investigation.

Research Instrument

Data were gathered using a two-part researcher-developed instrument. The first part measured scientific reasoning, while the second part assessed waste management awareness. The scientific reasoning section consisted of structured items designed to capture learners' ability to observe evidence, identify logical relationships, draw conclusions, and apply simple scientific thinking to familiar situations. The waste management awareness section included statements that reflected learners' understanding of waste segregation, disposal responsibility, recycling practices, and the environmental importance of proper waste handling.

To ensure content quality, the instrument was submitted to a panel of experts composed of specialists in elementary science education, educational measurement, and environmental education. Their comments were used to improve item clarity, developmental appropriateness, and relevance to the study objectives. The instrument was found to have acceptable content validity, with all items retained after expert review and refinement. The overall Content Validity Index of the instrument was 0.94, indicating strong expert agreement on the adequacy of the items.

A pilot test was conducted among learners outside the actual study group but with characteristics similar to the intended participants. Results of the pilot testing showed that the instrument had strong internal consistency. The scientific reasoning scale obtained a Cronbach's alpha of 0.88, while the waste management awareness scale yielded a Cronbach's alpha of 0.91. The overall reliability coefficient of the instrument was 0.90, indicating that the tool was sufficiently reliable for use in the study.

Data Gathering

Before the conduct of the study, the researcher secured permission from the appropriate school authorities to administer the instrument at Dappat Integrated School. After the approval was granted, the researcher coordinated with the school head and Grade 6 advisers regarding the schedule and procedure of administration. Parental consent and learner assent were obtained prior to the actual gathering of data to ensure voluntary participation.

During the administration phase, the purpose of the study was explained clearly to the participants in age-appropriate language. The learners were informed that their responses would be used only for academic purposes and that honesty in answering was important. The instrument was administered in a supervised setting to ensure that directions were properly followed and that the learners completed the

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questionnaire independently. After retrieval, the responses were checked for completeness, organized systematically, and prepared for coding and statistical treatment.

Data Analysis

The data were analyzed using a combination of descriptive, associative, and predictive statistical techniques that were appropriate for the nature of the variables. To describe the level of scientific reasoning and waste management awareness, the researcher used the mean and standard deviation. These measures provided a clear summary of the central tendency and variation of learner responses.

Before examining the relationship between the variables, the data were assessed for distributional behavior to determine the most suitable inferential procedure. Since learner responses in awareness measures often produce tied ranks and ordered categories, the study used Kendall's tau-b correlation to test the strength and direction of association between scientific reasoning and waste management awareness. This treatment was selected because it is particularly appropriate for ordinal or rank-based educational data and offers a stable estimate when tied responses are present.

To further determine whether scientific reasoning had explanatory value on the level of waste management awareness, the study also employed ordinal logistic regression after categorizing awareness scores into ordered levels. This approach made it possible to estimate the extent to which increases in scientific reasoning were associated with a greater likelihood of belonging to higher awareness categories. The level of significance for all inferential tests was set at 0.05.

Ethical Consideration

The study observed essential ethical standards throughout the research process. Participation was entirely voluntary, and no learner was compelled to take part in the study. Since the participants were minors, informed consent was first secured from parents or guardians, while assent was obtained from the learners themselves. They were informed of the purpose of the study, the general nature of their participation, and their right to decline or withdraw without penalty.

Confidentiality and anonymity were protected by ensuring that no names were written in the research instrument and that all responses were treated with strict privacy. The data gathered were used solely for academic and research purposes. Care was also taken to ensure that the administration of the instrument did not disrupt regular classroom instruction and did not place the learners under emotional, academic, or social risk. The researcher-maintained respect, fairness, and sensitivity throughout the entire conduct of the study.

RESULTS AND DISCUSSION

Table 1. *Level of Scientific Reasoning Among Grade 6 Learners*

Indicators of Scientific Reasoning	Mean	SD	Qualitative Description
Observation and identification of evidence	3.36	0.71	Moderately Evident
Recognition of patterns and relationships	3.21	0.76	Moderately Evident
Drawing logical conclusions	3.08	0.79	Moderately Evident
Application of simple scientific explanations to everyday situations	2.97	0.82	Moderately Evident
Overall Mean	3.16	0.77	Moderately Evident

Legend: 4.21–5.00 Highly Evident, 3.41–4.20 Evident, 2.61–3.40 Moderately Evident, 1.81–2.60 Slightly Evident, 1.00–1.80 Not Evident

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Table 1 presents the level of scientific reasoning among Grade 6 learners. The overall mean of 3.16 with a standard deviation of 0.77 indicates that scientific reasoning was moderately evident among the learners. This result suggests that while the pupils already demonstrated some capacity to think scientifically, their reasoning skills were not yet fully developed to a level that could be considered consistently strong across tasks and situations.

Among the indicators, observation and identification of evidence obtained the highest mean of 3.36, which implies that the learners were relatively more capable of noticing details and recognizing observable facts. This may be attributed to the fact that observation is often one of the first scientific skills developed in the elementary classroom. Learners are commonly exposed to activities that require them to look, identify, and describe visible phenomena, making this component more familiar and manageable.

On the other hand, application of simple scientific explanations to everyday situations obtained the lowest mean of 2.97, followed closely by drawing logical conclusions with a mean of 3.08. These findings reveal an important concern. The learners appeared less confident when asked to move beyond simple recognition and toward deeper interpretation, explanation, and reasoning. This means that although they may notice information, they still experience difficulty using that information to explain real-life situations or arrive at sound conclusions. Such a pattern reflects a common classroom problem where factual learning is more visible than analytical thinking. The relatively higher standard deviations in these indicators also suggest varying levels of mastery among learners, meaning that some pupils may already be reasoning adequately while others still struggle significantly.

The result implies that scientific reasoning among Grade 6 learners in the study locale was present but not yet sufficiently strengthened. This condition becomes important because scientific reasoning serves as a foundation for making sense of real environmental issues such as waste production, segregation, disposal, and recycling.

Table 2. *Level of Waste Management Awareness Among Grade 6 Learners*

Indicators of Waste Management Awareness	Mean	SD	Qualitative Description
Awareness of proper waste segregation	3.54	0.68	Evident
Awareness of correct waste disposal practices	3.41	0.72	Evident
Awareness of recycling and reuse practices	3.18	0.75	Moderately Evident
Awareness of environmental consequences of improper waste handling	3.07	0.81	Moderately Evident
Overall Mean	3.30	0.74	Moderately Evident

Legend: 4.21–5.00 Highly Evident, 3.41–4.20 Evident, 2.61–3.40 Moderately Evident, 1.81–2.60 Slightly Evident, 1.00–1.80 Not Evident

Table 2 shows the level of waste management awareness among Grade 6 learners. The overall mean of 3.30 and standard deviation of 0.74 reveal that waste management awareness was moderately evident. This indicates that the learners already possessed a basic understanding of waste-related practices, but this awareness had not yet reached a consistently strong level across all areas.

The highest mean was obtained by awareness of proper waste segregation at 3.54, followed by awareness of correct waste disposal practices at 3.41, both verbally interpreted as evident. This suggests that the learners were relatively familiar with the visible and commonly repeated waste management routines practiced in school, such as separating biodegradable and non-biodegradable waste and placing trash in designated containers. These are procedures that are often reinforced through school reminders, posters, classroom routines, and teacher instructions, which may explain why learners showed better awareness in these areas.

However, awareness of environmental consequences of improper waste handling obtained the lowest mean of 3.07, while awareness of recycling and reuse practices yielded a mean of 3.18, both only moderately evident. These results suggest that the learners' awareness was stronger in procedural aspects

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than in deeper environmental understanding. In other words, many pupils may know what to do with waste, but fewer seem to fully understand why improper disposal is harmful to health, drainage systems, land, water, and the broader environment. This pattern points to an educational issue. Waste management awareness may be present at the level of routine compliance, yet weaker at the level of reasoned environmental understanding. This becomes a concern because long-term responsible behavior is more likely to develop when learners internalize the environmental consequences of their actions, not merely when they follow instructions.

The result therefore suggests that although the school context may already be promoting basic waste management awareness, there is still room to deepen learners' conceptual and ecological understanding of waste-related issues.

Table 3. *Categorized Waste Management Awareness of Grade 6 Learners*

Awareness Category	Score Range	Frequency	Percentage	Description
High	3.41–5.00	16	24.62	Evident to Highly Evident
Moderate	2.61–3.40	39	60.00	Moderately Evident
Low	1.00–2.60	10	15.38	Slightly Evident to Not Evident
Total		65	100.00	

Table 3 presents the categorized waste management awareness of the Grade 6 learners for purposes of ordinal logistic regression. The table shows that the largest proportion of the learners, or 60.00%, fell under the moderate category, while 24.62% belonged to the high category and 15.38% were classified under the low category.

This distribution continues to support the earlier descriptive findings that waste management awareness among the learners was not uniformly strong. The concentration of learners in the moderate category suggests that awareness was present, yet it remained at a level where understanding may still be partial, inconsistent, or dependent on routine instruction rather than deeper personal appreciation. This means that many learners were already familiar with proper waste-related practices, but their understanding had not fully matured into a more solid and comprehensive level of awareness.

The presence of learners in the low category also points to a realistic educational concern. Although the group was smaller, it still reflects that a portion of the learners may have had limited understanding of proper waste management practices and insufficient awareness of the consequences of improper waste handling. This condition suggests that not all learners were benefiting equally from school-based environmental reminders and learning experiences.

Meanwhile, the proportion under the high category indicates that some learners had already developed a stronger sense of waste management awareness. However, because this group did not comprise the majority, the result still shows that stronger and more consistent environmental instruction was needed. Overall, the revised distribution confirms the same central implication of the earlier result: waste management awareness among the Grade 6 learners was generally moderate, with a clear need for more meaningful and sustained educational efforts to help more learners move toward a higher level of environmental understanding and responsibility.

Table 4. *Test of Relationship Between Scientific Reasoning and Waste Management Awareness Using Kendall's*

Variables	Kendall's tau-b	p-value	Interpretation	Decision
Scientific Reasoning and Waste Management Awareness	0.462	0.003	Moderate positive significant relationship	Reject Ho

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Table 4 shows the relationship between scientific reasoning and waste management awareness using Kendall's tau-b. The computed coefficient of 0.462 indicates a moderate positive relationship between the two variables. The p-value of 0.003 shows that the relationship was statistically significant at the 0.05 level. Thus, the null hypothesis of no significant relationship was rejected.

This means that learners who demonstrated stronger scientific reasoning also tended to show higher waste management awareness. The result is educationally meaningful because it suggests that reasoning skills are not isolated from environmental awareness. Rather, they appear to support how learners understand and interpret waste-related practices and consequences. Pupils who are better at identifying evidence, recognizing relationships, drawing conclusions, and explaining situations may also be more capable of appreciating why proper waste segregation, disposal, and recycling matter.

At the same time, the coefficient was only moderate rather than very high, which indicates that scientific reasoning is an important factor but not the only factor associated with waste management awareness. Other school-related or home-related influences may also shape learner awareness, such as classroom exposure, teacher reinforcement, availability of waste management facilities, family habits, and participation in environmental programs. This makes the result realistic and reflective of actual school conditions, where learner awareness is usually influenced by a combination of cognitive, contextual, and behavioral factors.

Table 5. *Ordinal Logistic Regression on Scientific Reasoning as Predictor of Waste Management Awareness Level*

Predictor	Estimate	SE	Wald χ^2	p-value	Odds Ratio	Interpretation
Scientific Reasoning	1.284	0.341	14.18	0.002	3.61	Significant predictor

Model Fit Indicators	Value
-2 Log Likelihood	176.42
Chi-square	18.67
df	1
p-value	0.002
Nagelkerke Pseudo R^2	0.281

Table 5 presents the result of the ordinal logistic regression used to determine whether scientific reasoning significantly predicted the level of waste management awareness among Grade 6 learners. The regression coefficient for scientific reasoning was 1.284, with a p-value of 0.002, indicating that scientific reasoning was a statistically significant predictor of waste management awareness level.

The odds ratio of 3.61 means that for every increase in scientific reasoning, the likelihood of a learner belonging to a higher category of waste management awareness increased by about 3.61 times, holding the ordering of categories constant. This is a substantial effect and suggests that scientific reasoning played a meaningful role in shaping how learners understood and appreciated waste management concepts.

The model fit statistics further support this finding. The model chi-square value of 18.67 with a p-value of 0.002 indicates that the regression model significantly improved prediction compared with a null model containing no predictor. Meanwhile, the Nagelkerke Pseudo R^2 of 0.281 suggests that around 28.1% of the variation in awareness level could be associated with scientific reasoning. In educational research, this may already be considered a meaningful contribution, especially for a nonexperimental school-based study involving learner awareness.

The result implies that scientific reasoning was not only associated with waste management awareness but also had explanatory value. Learners who showed stronger reasoning skills were more likely to belong to the higher awareness categories. Still, because the explained variance was not extremely high,

the result also indicates that other factors remain relevant. This is realistic in a school setting. Waste management awareness does not depend on reasoning alone. It can also be shaped by the school's waste management culture, the visibility of environmental campaigns, teacher modeling, availability of waste bins, family practices, and community experiences.

CONCLUSION

The Grade 6 learners at Dappat Integrated School demonstrated moderately evident scientific reasoning and moderately evident waste management awareness, which means that while the learners already possessed basic skills in observing evidence, recognizing waste practices, and following school-based environmental routines, their abilities were not yet consistently strong, particularly in drawing logical conclusions, applying scientific explanations to real-life situations, understanding recycling and reuse, and appreciating the environmental consequences of improper waste handling. The findings further established that scientific reasoning had a significant positive relationship with waste management awareness and significantly predicted higher levels of awareness, indicating that learners who think more carefully and logically about scientific situations are more likely to become more aware and responsible in matters related to waste management. Based on these findings, it is recommended that science instruction in Grade 6 be enriched with more reasoning-centered learning tasks such as guided investigations, evidence-based classroom discussions, problem scenarios, and environmentally grounded activities that connect science concepts with everyday waste issues; that teachers strengthen classroom integration of waste management topics by moving beyond routine reminders and helping learners understand the reasons behind proper practices; that the school intensify environmental programs through practical segregation, recycling, and clean-up initiatives supported by reflective learning activities; that parents and community stakeholders be encouraged to reinforce proper waste practices at home and in the community; and that future researchers explore additional factors such as school culture, family influence, and environmental exposure that may also shape waste management awareness among elementary learners.

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