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THE LEVEL OF ENVIRONMENTAL KNOWLEDGE OF PHASE C ELEMENTARY SCHOOL STUDENTS REGARDING WASTE MANAGEMENT

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ABSTRACT

Waste issues represent an increasingly complex environmental challenge that requires behavior change through education from an early age. Environmental education at the elementary school level plays a crucial role in developing environmental literacy and sustainable waste management behavior. This study aims to describe the level of environmental knowledge of Phase C elementary school students (Grades V and VI) regarding waste management. A descriptive quantitative approach was employed involving 150 students. The instrument consisted of a 15-item multiple-choice test covering fundamental waste concepts, organic and inorganic classification, environmental impacts, the 3R principles (reduce, reuse, recycle), waste sorting, and environmental care attitudes. Data were analyzed using descriptive statistics, including mean, median, mode, and percentage distribution. The findings indicate a mean score of 12.23 (high category), with 70% of students categorized as high and 30% as moderate, and none in the low category. Correct response rates were very high for conceptual and normative indicators but relatively lower for applicative aspects such as the implementation of 3R principles and waste sorting. These findings suggest that while foundational knowledge is well established, practice-based and systematic habituation strategies remain necessary to transform knowledge into practical waste management skills within the school environment.

Keywords: environmental literacy, waste management, elementary school, 3R, student knowledge

INTRODUCTION

The issue of waste is a global environmental problem that continues to grow in line with population growth, urbanization, and changes in consumption patterns. Global reports indicate that urban solid waste production is projected to continue increasing until 2050 if not accompanied by behavioral changes and effective management systems (Kaza et al., 2018). Poorly managed waste impacts environmental degradation, water and soil pollution, and public health risks (Ferronato & Torretta, 2019). In developing countries, the main challenges lie not only in management infrastructure, but also in low public awareness and participation in waste reduction and sorting (Wilson et al., 2015). Thus, knowledge-based behavioral change is an important component of sustainable waste management strategies.

Within the framework of sustainable development, environmental education is seen as a strategic instrument for building environmental literacy from an early age. UNESCO (2017) emphasizes that Education for Sustainable Development (ESD) aims to shape learners who have the knowledge, skills, values, and attitudes to make responsible decisions regarding the environment. Environmental literacy encompasses not only an understanding of ecological concepts, but also the ability to apply this knowledge in real-world actions (Roth, 1992; Hollweg et al., 2011). International studies show that

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environmental education in primary schools contributes significantly to shaping long-term pro-environmental behavior (Otto & Pensini, 2017).

In terms of cognitive development, elementary school students in Phase C (grades 5 and 6) are in the concrete operational stage towards the formal stage, where they begin to be able to understand cause-and-effect relationships, classification, and more complex concepts of systems (Piaget, 1972). This stage is relevant for introducing waste management concepts such as organic and inorganic classification, the 3R principle (reduce, reuse, recycle), and the ecological impact of consumptive behavior. Research shows that environmental education interventions at this stage of development are more effective because students have the cognitive readiness to understand the consequences of their actions on the environment (Stevenson et al., 2013).

Theoretically, the relationship between knowledge and environmental behavior has been extensively studied in the environmental psychology literature. A classic meta-analysis by Hines et al. (1987) shows that knowledge about environmental issues and action strategies has a significant relationship with responsible environmental behavior. The Theory of Planned Behavior (Ajzen, 1991) asserts that attitudes toward behavior are formed through knowledge-based beliefs, which then influence individual intentions and actions. Further research shows that environmental knowledge contributes to the formation of pro-environmental behavior, although its interaction is also influenced by values and social norms (Kollmuss & Agyeman, 2002; Bamberg & Möser, 2007).

In the context of waste management, various international studies have found that students' level of knowledge correlates positively with waste sorting and reduction practices (Vicente-Molina et al., 2013; Zsóka et al., 2013). Studies on school populations show that school-based programs that integrate conceptual learning and hands-on practice can increase awareness and behavior in waste management (Mogensen & Schnack, 2010). Other studies emphasize the importance of experiential learning in increasing the effectiveness of environmental education (Ardoin et al., 2020).

In Indonesia, a number of studies show a relationship between environmental knowledge and attitudes and waste management behaviors among school students (Sari & Widodo, 2021). However, most studies still focus on attitudes and behaviors without in-depth mapping of knowledge levels as initial descriptive variables. In fact, mapping knowledge levels is very important for identifying gaps in students' understanding before implementing more systematic learning interventions.

Considering the urgency of waste issues and the importance of environmental education at the elementary school level, this study focuses on the level of environmental knowledge of Phase C elementary school students regarding waste management. This study is expected to provide empirical contributions to the development of data-based environmental learning strategies and support the formation of sustainable waste management behaviors from an early age.

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MATERIALS AND METHODS

2.1 Research Type and Design

This study uses a descriptive quantitative approach that aims to describe the level of elementary school students' knowledge about waste management. The descriptive approach is used to describe phenomena as they are without manipulating variables (Creswell & Creswell, 2018). This method is suitable for educational research that focuses on measuring the level of understanding or knowledge of students (Fraenkel et al., 2019).

2.2 Research Subjects and Sample

The research subjects were 150 fifth and sixth grade elementary school students, consisting of boys and girls with a relatively balanced proportion. The selection of higher grades (fifth and sixth) was based on the stage of concrete operational cognitive development towards formal operational development, in which students are able to understand environmental concepts more systematically (Piaget, 1972). The sampling technique used total sampling, where all fifth and sixth grade students were respondents. This technique is used when the population is relatively small and allows all members of the population to be used as research samples (Sugiyono, 2022).

2.3 Research Instrument

The research instrument consisted of a 15-item multiple-choice test based on environmental knowledge indicators, including the definition of waste, types of waste (organic and inorganic), the impact of waste on the environment, the 3R concept (Reduce, Reuse, Recycle), waste sorting and management, and environmental awareness in schools. Multiple-choice tests were chosen because they are effective for measuring cognitive aspects, particularly factual and conceptual knowledge (Anderson & Krathwohl, 2001). Each question had four answer options (A, B, C, D) with one correct answer. A score of 1 was given for a correct answer and 0 for an incorrect answer, so the maximum score was 15.

2.4 Data Collection Techniques

Data was collected through multiple-choice tests. Before the test, the researcher explained the purpose of the study and ensured that student participation was voluntary. The test was conducted within a specified time and supervised by the classroom teacher to maintain objectivity.

2.5 Data Analysis Techniques

Data were analyzed using descriptive statistics, including minimum, maximum, mean, median, mode, standard deviation, and frequency and percentage distributions (Field, 2018). In addition, the percentage of correct answers for each question was calculated to identify the indicators that students mastered the most and the least. Knowledge level categories are determined as follows:

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Table 1. Knowledge Level Categories

Score Range	Category
12–15	High
9-11	Medium
0-8	Low

This categorization refers to an approach to evaluating learning outcomes based on the percentage of material mastery (Arikunto, 2018).

RESULT (14 SIZE)

The research was conducted on November 10-13, 2025, involving 150 fifth and sixth grade students. The research instrument was a multiple-choice test given to students. Students then took the test to assess their level of environmental knowledge. After conducting the research, the author analyzed the data and wrote a report from November 17, 2025, to December 2, 2025.

The instrument used was a 15-item multiple-choice test (A–D) covering: the definition of waste, examples of waste in schools, organic–inorganic classification, the impact of littering, the 3R concept, examples of reduce–reuse–recycle behavior, waste sorting, trash can colors, environmental awareness, and the role of students in maintaining cleanliness.

Based on the answer sheets of 150 fifth and sixth grade students, the average score was 12.23, indicating that their knowledge level was relatively good (approaching 82% correct answers out of a total of 15 items). The median of 12 indicates that at least half of the respondents scored ≥12. The mode of 13 shows that the most frequently occurring score was 13, so the score distribution tended to “cluster” in the upper range. The minimum score of 9 indicates that there are still some students who have gaps in their understanding of several key concepts (especially those that are application-oriented, such as examples of 3R behavior and sorting), although no extremely low scores were found.

Based on the established knowledge level categorization criteria, namely scores of 12–15 (High), 9–11 (Medium), and 0–8 (Low), the results of the study show that the level of elementary school students' knowledge about waste management in general is in the high category. In terms of percentage, 70% of students are in the High category (scores of 12–15), which means that the majority of students have mastered more than 80% of the material tested. Meanwhile, 30% of students were in the Medium category (scores of 9–11), indicating a fairly good level of mastery of the material but still requiring reinforcement in several aspects, particularly in applied indicators such as the implementation of the 3R concept and waste sorting. There were no students in the Low category (0–8), so in general, no fundamental knowledge deficiencies were found.

There were 15 questions given to the students. Question 1 was about the definition of waste, and 98.7% of students answered correctly. Almost all students understood waste to be “unused remnants of human activity.” The incorrect answers were due to the misconception that waste is synonymous with “expensive items” or “clean natural products.” This pattern indicates that the basic definition is well established, possibly because it often appears in thematic learning and daily practices at school. Question 2 is

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about examples of waste at school, and all students answered correctly. This indicates that the concept of waste that is commonly found in the school environment is very contextual, making it easy to understand without a high cognitive load.

Questions 3–5 were about organic–inorganic classification, with 72.0%–75.3% answering correctly. These three items show that the students' understanding of categories is quite good but not yet optimal. Students relied on guessing based on examples of objects, and some students were still confused about mapping examples to categories, especially when the options included common objects.

Questions 6–7 about the consequences and benefits of a clean environment were answered correctly by 94.7%–98.0% of students. These two items scored very high, indicating that students have mastered simple cause-and-effect relationships. This is usually a key message of UKS programs, school culture, and teacher/parent narratives. Questions 8–12 about the essence of 3R and its application were answered correctly by 66.0%–73.3% of students. This shows that some students know the term 3R exists, but are not yet familiar with its full meaning. Furthermore, the understanding of disposing of waste in its proper place is not yet fully understood in terms of sorting waste according to type.

Question 13 about the color of trash bins was answered correctly by around 70% of students. Some students still confused colors and types. Questions 14–15 about caring attitudes and the role of students were answered correctly by 97.3%–99.3% of students. The very high results indicate that the affective-normative aspect has become an ingrained value. Descriptively, students tend to know “what should be done” in the context of social behavior at school.

Overall, the average score of 12.23 and the dominance of the high category (70%) show that students have mastered declarative concepts and normative knowledge. This pattern is common in environmental education at the elementary level because the material is often repeated, closely related to daily experiences, and reinforced by school rules, which tends to result in high scores. These findings are in line with research on health promotion/environmental education in elementary schools, which shows an increase in knowledge after contextual learning interventions and educational media (Setyaningrum et al., 2021).

However, when knowledge shifted from concepts to application, it dropped to 66–73.3%. The literature places the 3Rs and sorting as functional environmental literacy competencies that require practice-based learning, not just definitions. Studies on the determinants of recycling behavior in elementary schools (based on the Theory of Planned Behavior/TPB) confirm that intentions and behavior are influenced by school norms, perceived behavioral control, and resource and technical knowledge barriers (Wardani et al., 2025). In other words, high scores on concepts do not automatically guarantee that students are able to distinguish between reduce–reuse–recycle or perform proper sorting.

Errors in questions about the meaning of 3R and examples of reducing reflect that students have not yet established the term 3R as a stable knowledge schema, and students often confuse reducing behavior with general management behavior. In the context of elementary school learning, English terms (reduce–reuse–recycle) are often understood as

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memorization rather than concepts. When the answer options present bad behaviors such as throwing garbage into rivers or burning it, some students get stuck because their social experiences have exposed them to bad practices in their surroundings, making these options feel familiar. These findings are consistent with environmental education studies that emphasize the importance of hands-on practice to reduce misconceptions and strengthen the transfer of knowledge into behavior. Action research studies on waste management learning in schools highlight that a practical approach (project-based/experiential) helps students build an operational understanding of the 3Rs, rather than just memorization (Simanjuntak, 2024).

In addition, the use of interactive media such as serious games has also been reported to be effective in improving elementary school students' understanding of the 3Rs because it transforms abstract concepts into decision-making scenarios. A study on the development of a 3R serious game for elementary school students shows the same direction, namely that gamification helps engagement and understanding of the 3R concept (Jose, 2025).

Questions 12 and 13 show that sorting based on type and knowledge of trash bin colors is not as strong as the general norm of disposing trash in its proper place. This is in line with the findings of school-based environmental literacy research, namely that success is not only determined by teaching materials, but also by the availability of facilities, consistency of labels/colors, and supervised routines.

The Adiwiyata program for example, emphasizes the integration of environmental activities into policy, curriculum, participation, and supporting facilities. A study of Adiwiyata elementary schools shows that indicators of ecological knowledge, environmental affection, and behavior are influenced by the quality of environmental education and student participation, while also facing obstacles such as uneven awareness and implementation costs (Sunarto, 2023). From this perspective, the 66–70% results for waste sorting/color-coded bins can be interpreted as a signal that schools need to ensure the system operates with standardized bins, clear labels, reinforcement by teachers/duty staff, and follow-up. Without a system, waste sorting education will remain at the cognitive level alone.

Based on the results of the above analysis, it was found that there is a need to strengthen the concept of 3R in a meaningful way by implementing waste sorting and 3R carried out by students directly at school. Furthermore, interactive media in the form of educational videos or educational games on the 3Rs have proven to be promising in increasing knowledge and behavior (Setyaningrum et al., 2021; Jose, 2025). In addition, the Theory of Planned Behavior approach can be used to build class norms, increase behavioral control (availability of facilities), and reduce barriers (Wardani et al., 2025).

CONCLUSION

This quantitative descriptive study shows that the level of knowledge of fifth and sixth grade elementary school students regarding waste management is moderate to high and tends to be evenly distributed. In general, students are very strong in basic and normative knowledge, such as the definition of waste, examples of waste in the school environment,

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the impact of littering, and the attitudes and roles of students in maintaining cleanliness. This is reflected in the high percentage of correct answers on items that are conceptually simple and close to everyday experiences at school. In terms of percentage, 70% of students were in the High category (scores of 12–15), which means that the majority of students had mastered more than 80% of the material tested. Meanwhile, 30% of students were in the Medium category (scores of 9–11). There were no students in the Low category (0–8).

However, an important finding of this study is the relative weakness in the application of concepts, especially those related to the 3Rs (reduce, reuse, recycle) and proper waste sorting. The percentage of correct answers on items that require more operational understanding is lower than that on basic items, indicating that some students are still unable to fully transfer their knowledge into practical skills in real-life situations.

Based on these results, it can be concluded that strengthening school programs needs to focus on more applicable and practice-based learning, particularly for understanding the 3Rs and waste sorting, for example through sorting simulations, simple recycling projects, routine habits in the classroom/cafeteria, and consistent support facilities such as trash bin labels/colors. By strengthening these skills, it is hoped that existing knowledge will be more effectively transformed into real and sustainable waste management behavior in the school environment.

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