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Land Pollution and Environmental Preservation Efforts in Elementary School Education

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Abstract

Land pollution is a growing environmental concern that impacts soil quality, biodiversity, and human health on a global and local scale. This study investigated the efficacy of a structured environmental education intervention in increasing Grade 5 students' understanding of land contamination and environmental awareness. Using a descriptive qualitative classroom-based research design, the intervention was carried out in an elementary school in Surabaya and included video-based instruction, guided discussions, worksheet tasks, collaborative poster making, and written comments. Data were collected and analysed descriptively using worksheet scores, poster assessments, classroom observations, and student reflections. The findings revealed that most students had a strong to exceptional understanding of essential concepts relevant to land contamination, such as its sources, impacts, and prevention measures. Based on worksheet results, twelve out of fourteen students demonstrated good or excellent mastery, whereas poster activities revealed consistent group competence in communicating environmental ideas. Students excelled in organised tasks like true-false and fill-in-the-blank questions, whereas open-ended responses revealed variable levels of written expression. Reflection data revealed improved knowledge and personal responsibility for environmental cleaning. These findings indicate that even a brief, classroom-based intervention can effectively improve primary school pupils' cognitive comprehension and environmental attitudes, emphasising the importance of environmental education in fostering sustainable conduct from an early age.
Keywords: Land Pollution, Environmental Education, Environmental Awareness, Sustainable Behaviour.

Introduction

Land pollution has emerge as a serious environmental concern, threatening soil fertility, biodiversity, and human health on a global and local scale. Although air and water pollution are frequently name in an environmental discussions, soil contamination has equally serious and long-term effects for ecosystem stability and sustainable development. Soil is essential for agricultural production, nutrient cycle regulation, and ecological balance; thus, its degradation has a considerable negative impact on environmental sustainability. Pollutants such as pesticides, heavy metals, burned aluminium, hydrocarbons, plastics, and domestic trash can build up in soil, disturbing microbial activity and changing soil structure (Rodríguez Eugenio et al., 2018). In response to growing environmental challenges, classroom-based environmental education has gained popularity as a strategy for increasing students' awareness, attitudes, and behaviours through structured learning activities such as visual media, hands-on tasks, and project-based learning (Thao et al., 2016). However, much of the previous research has concentrated on general waste management or sustainability issues rather than soil or land pollution, and many studies have not adequately integrated local environmental settings into

education. This gap emphasises the need for classroom-based interventions that clearly address land degradation at the primary school level, while also connecting global environmental knowledge to local environmental problems.

Land contamination is strongly link to rapid population increase, inadequate waste management systems, and unsustainable consumption patterns in emerging countries like Indonesia. Open dumping, uncontrolled landfills, home waste burning, and incorrect household waste disposal are still common practices in both urban and rural regions (Report, 2020). These activities exacerbate soil deterioration and increase environmental exposure concerns, especially for youngsters, who are more exposed to environmental hazards. Soil pollutants can enter the human body via contaminated food, water, and dust, raising the risk of respiratory ailments, skin disorders, and long-term chronic health issues (Steffan et al., 2018). (Münzel et al., 2023) also report that extended exposure to contaminated settings may result in neurological and cardiovascular diseases. Given the longevity of these situations, preventive initiatives addressing human behaviour and environmental awareness are urgently required, in addition to technical and regulatory remedies.

According to recent scientific studies, soil pollution is a persistent environmental issue due to slow degradation and difficulty in removal through natural processes (Rodríguez Eugenio et al., 2018). (Brevik et al., 2020) stress the intimate relationship between soil quality and human health, stating that degraded soils diminish agricultural production while increasing exposure to dangerous compounds via food and water channels. These conditions pose major concerns to food security and environmental sustainability, especially in areas that rely primarily on local agriculture. Toxins can linger in soil for decades and infiltrate the food chain via crops and water supplies, posing major ecological and human health hazards (Münzel et al., 2023). Soil contamination is define as the long-term accumulation of dangerous compounds in soil due to human activities such as intensive agriculture, industrial processes, and poor waste disposal. These pollutants frequently stay in soil, disrupting ecological processes. Pesticide residue contamination in soil causes long-term threats to ecosystems and human health since these chemicals can stay in soil and infiltrate the food chain via crops and groundwater (Zhou et al., 2025). The destiny of chemical pollutants in soil is determine by complicated interactions between soil qualities, climate, and land use, making remediation challenging and emphasising the importance of preventive measures (Petruzzelli et al., 2025). As a result, land pollution poses issues that go beyond technological solutions and necessitate preventive measures. (Rodríguez Eugenio et al., 2018) refer to soil contamination as a "hidden reality" due to its sluggish development and potential for long-term unrecognised effects. These toxins can remain in soil for decades, making removal difficult and costly. (Brevik et al., 2020) stress that degraded soils diminish agricultural output while increasing human exposure to hazardous compounds via food and water channels. Heavy metals, pesticides, and synthetic chemicals are especially challenging to regulate because of their toxicity, mobility, and long-term persistence, necessitating resource-intensive mitigation techniques (Correia, 2025). This emphasises the necessity of preventive measures that decrease contamination at its source, rather than depending exclusively on repair. Soil science education remains under-represented in national curricula, despite its importance for land stewardship and sustainable development (Charzyński et al., 2022). It is vital to include soil subjects within environmental education. Global assessments also stress the harm that soil contamination poses to food security, ecological services, and human well-being, emphasising the importance of prevention and education in addition to remedial efforts (*Global Assessment of Soil Pollution*, 2021). In Indonesia, as in many other countries, widespread improper waste disposal and a lack of public awareness exacerbate land pollution, implying that implementing proven global educational strategies tailored to local

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contexts could help foster environmental knowledge and responsible behaviour among young learners. Although Indonesia has implemented national and regional rules to address solid waste management, problems such as policy coordination, enforcement, and local capacity continue to hinder their efficacy (Info, 2025).

Previous research has investigated the mechanisms by which soil contamination affects human health, identifying multiple exposure pathways such as the transfer of pollutants from soil to crops, groundwater, and airborne dust, all of which pose health risks to communities living near contaminated areas (Steffan et al., 2018). These exposure pathways are especially worrying for youngsters, who have developing immune systems and frequently encountered soil throughout their daily activities. (Münzel et al., 2023) show that extended exposure to contaminated settings increases the risk of cardiovascular and neurological problems, supporting the concept that soil contamination is a substantial public health concern rather than just an environmental issue. Despite the strength of the scientific evidence, most extant research concentrate on environmental, chemical, or biological consequences, with little emphasis on preventive efforts through formal education. In the field of environmental education, empirical classroom-based interventions that explicitly address soil or land pollution are still scarce, particularly at the elementary school level, with existing studies frequently focussing on general sustainability themes or solid waste management rather than soil contamination specifically (Thao et al., 2016). Other research on environmental education have indicated similar increases in student knowledge, but have not systematically explored affective dimensions such as attitudes, values, or behavioural intentions connected to environmental stewardship (Ardoin et al., 2020). Research on environmental literacy in developing countries is limited, with few studies testing how locally contextualised classroom interventions influence cognitive and affective learning outcomes related to land pollution in countries like Indonesia (Charzyński et al., 2022); (Parker & Prabawa-sear, n.d.). This gap in the literature emphasises the importance of doing research that integrates global scientific knowledge with local environmental realities through structured, context-specific educational interventions at the primary level.

In response to these environmental and health issues, environmental education has gained widespread recognition as an effective technique for raising awareness and promoting behavioural change. (Thao et al., 2016) discovered that environmental education programs applied in elementary schools increased students' comprehension of trash management and encouraged environmentally responsible behaviour. Their findings indicate that early exposure to environmental issues can help create good attitudes towards sustainability. (Parker & Prabawa-sear, n.d.) argue that culturally appropriate environmental education increases student involvement by connecting environmental issues to everyday experiences. When students can connect learning content to their surroundings, it becomes more meaningful and effective. These studies show that early educational interventions have a significant impact on long-term environmental attitudes and practices.

Despite the growing body of research on land pollution and environmental education, there is little empirical evidence to show how short, classroom-based instructional interventions affect primary school students' conceptual understanding, attitudes, and behavioural responses to land pollution. Many past studies have focused on environmental policy, large-scale education programs, or secondary and higher education settings. As a result, less emphasis was used on how environmental education is handled in actual elementary school classrooms. Studies on real classroom methods and student learning processes at the primary level are limited. The paucity of classroom-based evidence hinders our knowledge of how young learners interact with environmental concepts. As a result, further research is needed to better understand how environmental education works in primary school.

Furthermore, research that clearly links global land contamination issues to students' local experiences in Indonesian primary schools is scarce. Few studies have looked into how integrated instructional activities like films, worksheets, group poster projects, and student reflections help with cognitive and affective learning outcomes. Research that targets information acquisition, attitude formation, and behavioural awareness at the primary level is still in its early stages. This gap emphasises the necessity for empirical research that demonstrates the efficacy of integrated environmental education initiatives. Classroom-based research is especially valuable for studying how instructional practices affect young learners. Addressing this gap can provide practical insights for enhancing environmental teaching in primary schools.

To close this gap, the current study will investigate the efficacy of a structured environmental education intervention in enhancing Grade 5 students' comprehension of land contamination and environmental consciousness. The study included 14 Grade 5 children from an elementary school in Surabaya and focused on classroom-based training. This study aims to assess students' conceptual grasp of the causes, impacts, and prevention of land contamination. It also seeks to investigate students' attitudes and behavioural responses to environmental cleanliness after the intervention. Furthermore, the study examines how different learning activities promote both cognitive and affective learning outcomes. The research is directed by the following questions. (1) How does a structured classroom intervention influence Grade 5 students' understanding of land pollution? (2) How do students respond cognitively and affectively to environmental education activities? (3) What learning objectives result from worksheet assignments, poster activities, and student reflections?

The study's originality stems from its focus on a small-scale, classroom-based intervention at the primary school level, which integrates global environmental issues with pupils' local circumstances and provides practical evidence for effective environmental education implementation.

Method

Research Design

This study used a descriptive qualitative classroom-based research approach to investigate students' understanding, attitudes, and behavioural responses to land contamination after a structured environmental education intervention. A qualitative descriptive approach was used since the study's major goal was to thoroughly investigate students' learning experiences, perspectives, and observable behaviours rather than to test causal linkages or assess statistical impacts. This approach is especially useful for educational research that aims to capture how students interpret environmental concepts, express attitudes, and participate in learning activities in a natural classroom context. Data were collected during regular instructional sessions to ensure that student responses reflected real-world learning experiences rather than artificial or experimental settings. The descriptive qualitative method enabled the researcher to record cognitive understanding, emotive responses, and behavioural engagement as they occurred throughout the class. By emphasising detailed descriptions of student activities, interactions, and thoughts, this strategy gave a thorough knowledge of how environmental education changed students' awareness and responsibility for land contamination.

Participants

The study included 14 Grade 5 pupils enrolled in an elementary school in Surabaya throughout the academic year 2025-2026. The participants included both male and female students aged 10 to 11 years. To provide equitable learning opportunities and minimise selection

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bias, all children in the class were included in the study based on predetermined inclusion criteria, including Grade 5 enrolment and attendance during the intervention period. Participation was optional, and all students chose to take part in the learning activities; no student was force or excluded from the study. The number of participants matched a typical classroom size, allowing the study to concentrate on extensive observations of student learning processes and interactions. Students were separated into three small groups for collaborative activities, including the poster design challenge, to enhance cooperative learning, peer interaction, and shared accountability.

Instruments

Several instruments were utilised to collect information on students' learning outcomes about land pollution. The major instrument was a student worksheet created by the researcher using the learning objectives, relevant literature on land contamination, and the Grade 5 curriculum. To test various levels of conceptual knowledge, the worksheet included diverse task styles such as short-answer questions, fill-in-the-blank items, true-false statements, cause-and-effect identification, and a reflective inquiry. To ensure content validity, the worksheet items were checked to ensure they were consistent with the major ideas of land pollution and environmental preservation covered in the lecture. Although the instrument did not go through official psychometric validation or large-scale pilot testing, it was intended to represent age-appropriate language, cognitive level, and curriculum relevance for primary school pupils. In addition to the worksheet, a poster assessment criterion was creatsed to rate group projects based on message accuracy, relevance to land pollution issues, creativity, and cooperation. This rubric was systematically implement across all groups to ensure rating dependability. Classroom observation notes were also utilised to record student participation, engagement, cooperation, and behavioural responses to learning activities. The use of several data sources (worksheets, poster assessments, and observations) allowed for data triangulation, which increased the confidence and trustworthiness of the findings. Overall, these assessments gave detailed evidence of students' cognitive, affective, and behavioural learning outcomes after the educational intervention.

Procedures

The educational intervention took place during regular classroom instruction and followed a pre-set sequence of activities lasting roughly 90 minutes. The class began with an introduction and a brief icebreaker game to engage and prepare students for learning. The students next viewed two short instructive videos in Bahasa Indonesia, each around four minutes long, for a total of eight minutes. The movies addressed the topic of land contamination and provided visual examples of its sources, effects, and prevention techniques to help pupils understand. This was followed by a 20-minute teacher-led PowerPoint presentation and guided discussion in which students answered questions and discussed their perspectives on environmental challenges and responsible behaviour.

Following the talk, students did individual worksheet tasks for approximately 25 minutes to demonstrate their understanding of the lesson topic, which included definitions, causes, effects, and preventive measures for land contamination. Students then collaborated in small groups for around 25 minutes to produce campaign posters advocating environmental preservation practices such as proper waste disposal, reduced plastic use, and avoidance of rubbish burning. The program ended with a quick reflection activity in which students shared their perspectives and personal responsibilities for environmental cleanliness. The organised allocation of time across activities resulted in balanced participation in visual learning, discussion, individual assessment, and collaborative work, which aided both cognitive and affective learning outcomes.

Data Analysis

Data were examine descriptively to summarise student-learning results. Worksheet responses were examine to determine levels of conceptual knowledge based on accuracy and completeness. Student scores were then divide into four mastery levels (A, B, C, and D) to provide a clear picture of performance. The poster scores were sum up using the assessment rubric to measure group performance in terms of message clarity and relevance. The observation notes were qualitatively examine to discover patterns of student engagement, participation, and cooperation. Student reflection responses were also examine to identify manifestations of environmental awareness and responsibility.

Ethical Considerations

To ensure the well-being of the students, ethical issues were observe throughout the study. All learning activities were part of regular classroom instruction, and no student was barre from participating. Students were not required to undertake any chores other than those assigned to them in class. No personal or sensitive information was gathered, and student identities were keep private in all documents. The assessment results were only use for research and learning evaluation purposes. Students were encouraged to participate freely in discussions and activities in a welcoming and non-threatening classroom setting.

Results

This section covers the study's findings based on worksheet assessments, poster evaluations, classroom observations, and student reflections gathered during the classroom intervention. The findings are present descriptively and divided it into subsections to ensure clarity and logical flow. Quantitative and qualitative data are use to create a holistic picture of students' learning outcomes, involvement, and behavioural responses. In addition to presenting the data, the findings are analysed in relation to prior studies on environmental education at the primary school level to place the results in a larger research framework.

The overall pattern of student performance in this study is consistent with previous studies showing that structured, activity-based environmental education can improve students' environmental knowledge and awareness (Thao et al., 2016);(Ardoin et al., 2020)). Similar to findings from other nations' elementary classrooms, pupils in this study displayed great understanding when learning activities were visually support and link to real-life circumstances. The beneficial consequences of cooperative poster work and student participation are consistent with studies demonstrating the efficacy of project-based and collaborative learning techniques in developing environmental responsibility and social skills. In the Indonesian setting, these findings back with prior research indicating that locally relevant environmental education can promote responsible behaviour and environmental awareness among young students(Parker & Prabawa-sear, n.d.). By comparing the current findings to the previous research, this study provides additional empirical evidence that classroom-based environmental education interventions can improve both cognitive and affective learning outcomes in primary school settings.

Student Worksheet Performance

An individual worksheet with five components used to assess students' understanding of land pollution: short-answer questions, fill-in-the-blank items, true-false assertions, identifying causes and effects, and a reflection question. Each component evaluated based on accuracy and completeness, with a maximum total score of 20 points. The worksheet was create to examine students' conceptual comprehension and fundamental reasoning regarding land contamination. Students' performance was divide into four mastery levels: Excellent (A), Good

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(B), Fair (C), and Needs Significant Support (D). These categories were utilised to summarise the overall learning results. The distribution of mastery levels provides an overview of students' performance after the intervention.

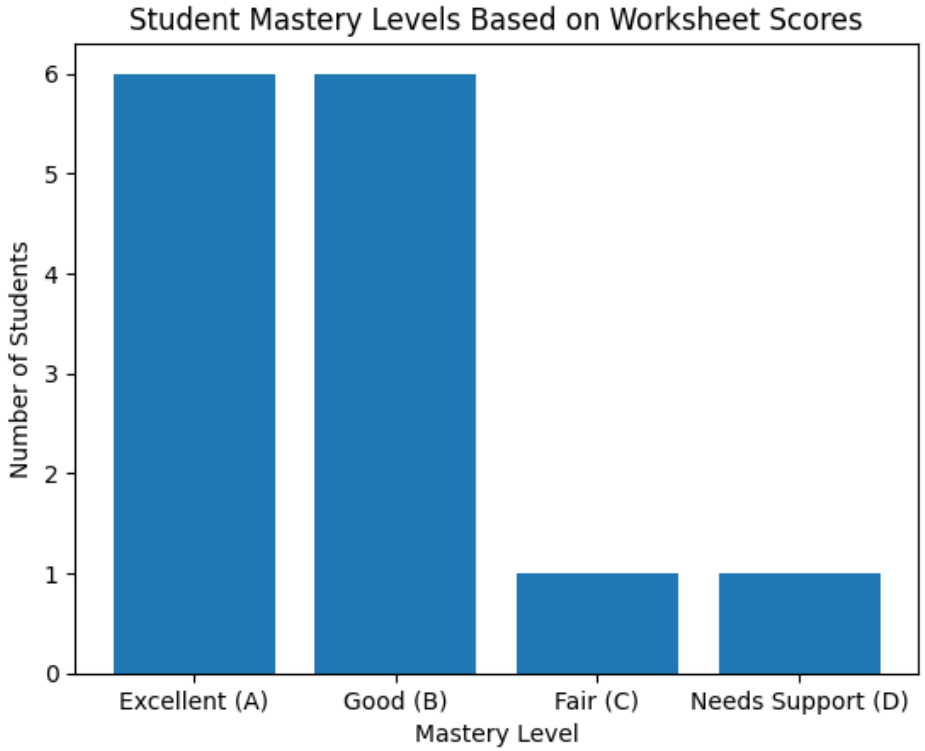


Figure 1. Student mastery levels based on total worksheet scores

Figure 1 displays the distribution of student competence levels based on total worksheet scores after the instructional intervention. Twelve of the fourteen students obtained exceptional (A) or good (B) mastery, suggesting that the majority of learners had a thorough comprehension of the topics connected to land contamination. This predominance of students in higher mastery categories indicates that the worksheet activities were generally accessible and helpful in increasing students' conceptual comprehension. One student demonstrated a fair level of competence, indicating partial understanding but highlighting the need for extra instructional support for some students. Another student required extensive assistance, indicating individual disparities in learning aptitude, writing expression, or prior knowledge. Overall, the score distribution indicates that, while student performance varied, the majority of students completed the activities correctly and demonstrated important learning results. These findings provide a quantitative snapshot of student accomplishment, supplementing qualitative assessments of involvement and participation during the class.

The analysis of individual worksheet components revealed that most students fared well on structured items. The true-false part had a high rate of correct replies, demonstrating that students could identify valid assertions about land contamination ideas. Similarly, most children completed the fill-in-the-blank items correctly, using suitable environmental language like soil, plastic, recycle, and garbage. In the matching test, the majority of students correctly identified the causes of land pollution and their accompanying environmental effects. Performance on short-answer questions varied, with some students providing detailed comments and others delivering abbreviated responses. Responses to the reflection question varied in length and content across pupils.

Poster Assessment Results

Students took part in a group poster project aimed at transmitting themes about minimising land contamination. The class was divide into three groups, with each group creating one campaign poster. The poster project required students to collaborate and graphically express environmental messages. A rubric was use to evaluate poster performance, with criteria including message correctness, relevance to land pollution prevention, innovation, and teamwork. Each criterion contributed to the highest possible score of four points. The rubric was implement uniformly in all groups.

Table 2. Poster assessment scores for each student group

Group	Poster Score (4)
Group 1	3 / 4
Group 2	3/ 4
Group 3	3 / 4

Table 1 shows the poster assessment results for each student group after the collaborative learning activity. All three groups achieved the same score of 3 out of 4, demonstrating a consistent level of performance across groups. This uniform marking indicates that students from various groups were equally capable of applying their knowledge of land degradation principles in a visual and creative manner. The posters conveyed realistic environmental information, such as proper garbage disposal, limiting plastic use, avoiding waste burning, and maintaining environmental cleanliness. The lack of severe fluctuation in scores suggests that group collaboration promoted balanced engagement and knowledge among students. These findings indicate that the poster activity was helpful in promoting cooperative learning and allowing students to transform conceptual knowledge into practical and communicative representations. Overall, the poster scores give quantitative evidence that group-based activities can improve environmental understanding while also encouraging collaboration and creativity.

Classroom Observations Findings

Classroom observations was held during the intervention to track student involvement and participation in learning activities. Observation notes emphasised student attention, engagement, cooperation, and task accomplishment. During the video presentation, the majority of pupils were attentive and followed the information offered. Students were observe silently watching a video and reacting to visual cues. During the guided conversation, several students responded to teacher questions and provided opinions about sources of land pollution. Students' participation levels varied, but the majority were actively engage during the debate.

During worksheet completion, students worked independently and stayed focused on their duties. Most students finished the worksheet in the allotted time. In the poster exercise, students worked in groups to share resources and debate poster content. Students contributed by designing, scripting, and colouring the posters. Cooperation, turn-taking, and collaborative decision-making were among the observed behaviours. These observations provide descriptive information about students' participation in the learning activities.

Student Reflection Responses

Student reflections were gather using a worksheet item that asked students to share their ideas about land pollution and activities they could take to save the environment. Each student completed an individual reflection response. The majority of pupils responded in writing with brief descriptions of minor environmental cleaning initiatives. Common comments included

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putting trash in bins, keeping the environment clean, not littering, and urging others not to burn junk. Some students provided multiple actions in their reflections. The length and clarity of the reflections differed among the students. However, all children were able to express at least one environmentally friendly deed.

Discussion

Interpretation of Results

The findings of this study show that the structured environmental education intervention was effective in helping Grade 5 pupils grasp land degradation and related environmental responsibilities. The worksheet results revealed that the majority of students scored Excellent or Good mastery levels, indicating their ability to identify the sources, impacts, and preventative options for land contamination. Strong performance on structured activities, such as true-false and fill-in-the-blank questions, indicates that pupils accurately recognised, remembered, and applied significant environmental concepts. These results show that the instructional activities were effective in enhancing students' cognitive comprehension of the issue. Although students' replies to open-ended questions and reflection items varied in length and detail, they all expressed at least one environmentally friendly action. This finding implies that the intervention promoted not only information acquisition but also basic affective engagement in environmental stewardship.

The poster activity highlighted students' capacity to integrate conceptual understanding into visual and collaborative outcomes. Consistent poster results across groups show that students were able to communicate environmental topics clearly and coherently through group projects. The collaborative nature of the activity allowed students to share ideas, negotiate meaning, and co-create representations of land pollution mitigation. Classroom observations demonstrated active participation and sustained engagement during poster making, indicating that students were lead by hands-on and creative learning experiences. In addition, cooperative behaviours such as sharing materials and discussing poster content were common. These data suggest that the intervention improved behavioural, social, and communication abilities as well as cognitive learning outcomes.

Comparison with Previous Studies

The study's findings are consistent with earlier research indicating the efficacy of environmental education in primary schools. (Thao et al., 2016) found that structured environmental education programs at the elementary level greatly increased students' awareness of solid waste management and promoted environmentally responsible behaviour. Similarly, the current study discovered that after a brief instructional intervention, students had a better conceptual understanding of land pollution and expressed intentions to engage in environmentally responsible behaviours such as proper waste disposal and environmental cleanliness. These similarities suggest that environmental issues, when provided through structured and participatory activities, might help young learners acquire knowledge and build attitudes. Furthermore, the good learning outcomes seen in both research indicate that elementary students are open to environmental knowledge when provided in an age-appropriate and meaningful way. The consistency of these effects lends confidence to the current findings and emphasises the importance of environmental education as an effective pedagogical strategy in primary education.

More particular, research on soil and land pollution shows that young learners can understand complicated environmental issues when education is properly scaffolder. According to (Rodríguez Eugenio et al., 2018), soil pollution is a "hidden reality" with long-term ecological

and health implications. They emphasise the need for early educational interventions to raise awareness and prevention. While much of the existing research focusses on soil pollution from a scientific, technical, or policy standpoint, few studies look at how these concepts are introduce in elementary school. As a result, there is no scientific information about how young students understand soil pollution through classroom instruction. The current study addresses this gap by demonstrating that primary school students can identify causes, impacts, and preventative measures for land contamination when accompanied by visual materials, conversation, and hands-on activities. These findings show that soil-related environmental ideas do not need to be save for higher education levels, but can be effectively introduced in early childhood.

(Parker & Prabawa-sear, n.d.) argues that culturally relevant and classroom-based environmental education is critical for generating meaningful learning and student involvement in Indonesia. The current study contributes to this viewpoint by including locally observable environmental issues such as domestic waste disposal, plastic accumulation, and waste burning into classroom learning activities. By linking global issues like soil deterioration and contamination to students' everyday experiences, the intervention made abstract environmental concepts more concrete and approachable. This contextualisation allowed students to gain a deeper understanding of how land contamination affects their immediate environment and personal life. Furthermore, this method is consistent with (Brevik et al., 2020)argument that understanding soil health is critical for long-term environmental sustainability and human well-being. These findings demonstrate that contextualised environmental education has the potential to effectively linked the gap between global scientific knowledge and local reality.

Overall, the findings indicate that primary school kids can engage with soil and land contamination issues when learning is contextualised, graphically supported, and is linked to real-world practices. Unlike previous studies that have primarily focused on trash management or general sustainability themes, this study expands on existing research by experimentally investigating land pollution learning consequences in a primary school context. The use of worksheets, poster creation, and reflection exercises allowed students to exhibit both cognitive knowledge and affective engagement. These findings suggest that land pollution education can help to build both factual knowledge and environmental responsibility. As a result, the study contributes to the expanding body of evidence supporting early environmental education as an important technique for raising awareness, values, and preventive behaviours related to soil and land pollution. Such findings emphasise the significance of including land contamination topics into primary school curricula as part of a larger sustainability education effort.

Implications

The outcomes of this study have significant theoretical and practical implications for elementary school environmental education. First, the findings show that even a brief, classroom-based instructional intervention can significantly improve students' environmental knowledge and awareness when learning activities are well structured and contextually appropriate. These findings are strongly consistent with constructivist learning theory, which holds that learners actively construct knowledge through interaction, reflection, and engagement with meaningful experiences rather than passively receiving information. The intervention enabled students to develop comprehension through active involvement and social interaction by engaging them in video observation, guided conversation, worksheet completion, and collaborative poster production. Furthermore, the instructional design adheres to the principles of experiential learning theory, as students were encouraged to observe real-world environmental challenges, reflect on their significance, and creatively apply concepts through group projects. The adoption of multimodal instructional tactics facilitated varied learning styles while also encouraging deeper cognitive and emotive involvement. As a result, learning became

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more accessible, relevant, and memorable, validating the belief that active, experience-based instruction is necessary for effective primary environmental education.

Second, the results imply that incorporating environmental subjects into regular classroom instruction can help pupils develop a sense of responsibility for their surroundings. Students were able to connect their environmental knowledge to their personal acts and social responsibilities thanks to opportunities for reflection and teamwork. Students began to internalise environmental ideals through group projects and reflection activities, which may influence their behaviour outside of the classroom. These findings emphasise the significance of including environmental education in the primary school curriculum as a foundation for sustainable conduct. Schools can help shape environmentally responsible individuals by exposing students to environmental issues early and consistently. As a result, environmental education should be regard as an essential component of comprehensive primary education.

Limitations

Despite the excellent findings, the study had numerous limitations that should be address. First, the study used a limited sample size of fourteen pupils from a single primary school, limiting the findings' applicability to different educational environments, grade levels, and student demographics. Learning outcomes might vary based on school culture, teacher practices, and students' socioeconomic and cultural backgrounds. Furthermore, the intervention was only apply for a brief amount of time, making it difficult to make conclusions on long-term knowledge retention or sustained behavioural change. Because no follow-up assessments were conduct, it is unclear whether students' environmental awareness and attitudes remained consistent over time. As a result, the findings are primarily focuses on immediate learning outcomes rather than long-term educational consequences.

Further constraints arise from the descriptive nature of the data collection methods. The study relied on worksheets, classroom observations, poster assessments, and student reflections, which, while useful for capturing classroom-learning processes, have validity and reliability issues. The learning instruments were design expressly for this study and did not go through traditional pilot testing or statistical validation procedures. Classroom observations may have also been influence by observer bias because the teacher-researcher was closely involved in the educational process. Similarly, student reflections necessitated subjective interpretation, which could have influenced the uniformity of analysis among responses. Furthermore, the study lacked a control group, making it difficult to evaluate the intervention's effectiveness to other instructional approaches. External influences, such as family practices or community environmental norms, were not included. These methodological constraints must be carefully examined when interpreting the findings and applying them to larger educational environments.

Suggestions for Future Research

Future research could improve on this work by involving larger and more diverse samples from other schools, increasing the generalisability of the findings. Studies undertaken in various geographic regions and sociocultural contexts would provide a more comprehensive picture of how environmental education interventions work across settings. Longitudinal research methods are also advice for determining if advances in environmental understanding and attitudes persist over time. Such research could determine if early environmental education translates to long-term behavioural change as pupils advance through the grades. Long-term data would provide more compelling proof of the effectiveness of environmental education.

Future research might also look into the effect of family and community involvement in promoting classroom-based environmental education. Investigating how family behaviours, community activities, and school-community collaborations affect pupils' environmental behaviour would provide significant insights. Researchers may also look into integrating

environmental education with other topics, such as social studies or science, to encourage interdisciplinary learning. The use of digital technologies, project-based learning, and outdoor learning activities can be known as alternative or supplementary teaching methodologies. These recommendations would help to gain a more comprehensive understanding of effective approaches to environmental education in elementary schools.

Conclusion

This study sought to determine whether a systematic, classroom-based environmental education intervention could increase Grade 5 students' comprehension of land degradation and develop good environmental attitudes. The results show that the intervention was helpful in improving students' conceptual understanding of the causes, effects, and prevention of land contamination. Students' strong performance on worksheet exercises, as well as accurate representations in-group posters, show that they can identify important environmental problems and offer effective preventive measures. These results demonstrate clear evidence of cognitive learning benefits that are consistent with the study's stated aims. In addition to increasing students' understanding, the intervention helped to build their environmental consciousness and responsibility. Written reflections demonstrated a greater awareness of everyday environmental activities, such as proper garbage disposal and maintaining cleanliness in shared settings. The utilisation of collaborative learning activities, notably poster production, allowed students to use their knowledge in creative ways and effectively express environmental concerns. These activities also contributed to social learning by encouraging teamwork, shared responsibility, and peer contact. Despite the study's small sample size and short length, the findings indicate that even quick instructional interventions can result in important educational benefits. The findings emphasise the importance of age-appropriate and contextually relevant environmental education at the primary school level. Overall, this study demonstrates that including multimodal learning activities into classroom instruction is an effective way to promote knowledge, awareness, and responsibility for land contamination among young students, so contributing to larger environmental preservation efforts.

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