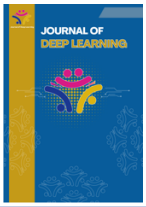

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Development of Learning Materials Based on Meaningful Learning as an Effort to Foster Green Behavior in Elementary Schools

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Abstract

This study aims to develop a learning device based on meaningful learning as an effort to foster green behavior among elementary school students, specifically at SD Negeri Gumpang 01. The background of this research is rooted in the importance of primary education in instilling environmental awareness and responsible behavior from an early age. The meaningful learning approach was chosen because it allows students to connect new knowledge with their existing experiences or prior knowledge, making the learning process more meaningful and contextual to everyday life. The research method employed is research and development (R&D) using a modified Borg & Gall development model. The development process includes needs analysis, planning, product development, expert validation, revision, and limited trials. Data collection instruments consist of expert validation sheets, student and teacher response questionnaires, as well as observations of learning implementation and student green behavior indicators. The results show that the developed learning devices consisting of lesson plans (RPP), student worksheets (LKPD), and teaching materials are highly valid and feasible for classroom use. Furthermore, the implementation of these devices improved students' understanding of environmental issues and encouraged behavioral changes toward green behavior, such as disposing of waste properly, conserving energy, and caring for school plants. Therefore, learning tools based on meaningful learning have proven effective in supporting the formation of green behavior in elementary school settings. This study recommends the systematic integration of environmental education values into daily teaching and learning activities in primary schools.

Keywords: environmental education, green behavior, learning materials, meaningful learning

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1. Introduction

Learning at the elementary school level plays a crucial role in shaping the foundational knowledge, attitudes, and skills of students. One relevant instructional approach to enhance learning effectiveness at this level is meaningful learning. According to Ausubel (1968), learning becomes more effective when students are able to relate new information to concepts or experiences they already possess. This approach not only promotes conceptual understanding but also fosters awareness and active student engagement in addressing real-world problems within their environment (Prihantoro et al., 2025). The Indonesian Ministry of Primary and Secondary Education has implemented a deep learning policy as a nurturing approach with an emphasis on creating a conscious, meaningful, and enjoyable learning atmosphere

and process through holistic and integrated thought, heart, feeling, and exercise (Ministry of Primary and Secondary Education, 2025). Meaningful learning is defined so that students can feel the benefits and relevance of what they learn for life. Students are able to construct new knowledge based on existing knowledge and apply their knowledge in real life. (Ministry of Primary and Secondary Education, 2025). However, in practice, learning tools used by elementary school teachers often remain mechanistic and fail to adequately accommodate real-life contexts and connections to students' lived experiences, particularly concerning environmental issues (Badrun, 2025).

The current environmental crisis has become a global issue that demands an urgent response from all sectors, including education. Phenomena such as climate change, environmental pollution, deforestation, and the decline in water and air quality are consequences of unsustainable human behavior (UNESCO, 2021). Education serves as a key instrument in cultivating environmental awareness and concern from an early age. Therefore, integrating environmental education values into the learning process is of great importance. As the first formal education institution, elementary schools have significant potential to build students' environmental attitudes and behaviors through contextual and meaningful learning activities (Samidjo et al., 2023; Syahmani et al., 2021).

The urgency to instill green behavior from an early age cannot be overlooked. Green behavior encompasses daily actions that reflect concern for environmental sustainability, such as conserving energy, disposing of waste properly, and maintaining cleanliness (Kollmuss & Agyeman, 2002). These behaviors do not emerge instantly but must be shaped through structured and continuous educational processes. Hence, it is essential to develop learning tools that enable students to understand environmental issues holistically and cultivate positive daily habits (Hafida et al., 2020).

Based on this background, this article addresses the critical issue of Developing Learning Tools Based on Meaningful Learning as an Effort to Foster Green Behavior in Elementary Schools. This study posits that the development of meaningful learning-based instructional tools can serve as an effective strategy to transform knowledge into real and sustainable environmentally friendly behaviors. Beyond contributing to improved learning quality, the developed tools are also expected to support the creation of environmentally conscious school cultures and serve as a reference for teachers in designing character-oriented learning experiences (Priyana et al., 2024; Husamah et al., 2025).

2. Method

This study employed a research and development (R&D) approach aimed at producing meaningful learning-based instructional tools that are valid, practical, and effective in fostering green behavior among elementary school students. The R&D approach was chosen due to its relevance in producing educational products and systematically evaluating their quality. The development model used was adapted from Borg and Gall (1983), simplified into six main stages: (1) needs analysis, (2) planning, (3) initial product development, (4) expert validation, (5) product revision, and (6) limited field testing.

The research subjects consisted of 30 fourth-grade students from SD Negeri Gumpang 01 Kartasura in the 2024/2025 academic year, along with two classroom teachers who served as implementation partners. Subjects were selected purposively based on the availability and relevance of

environmental learning contexts in the school. The research site was chosen because the school demonstrated a commitment to strengthening character and environmental education, although it had not yet implemented meaningful learning-based instructional tools in a systematic manner.

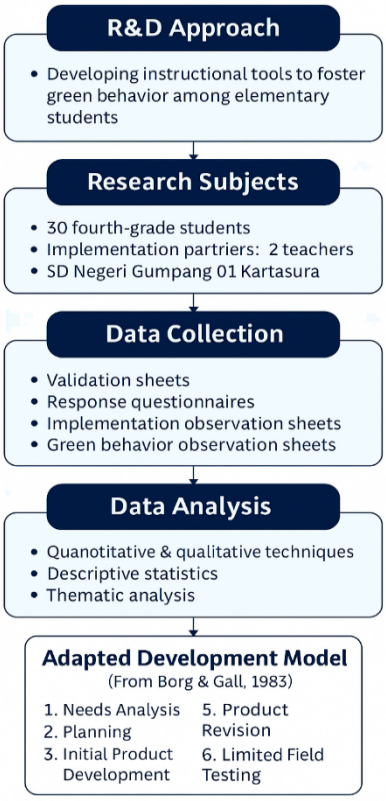

Figure 1. Research Flow

Data collection instruments included: (1) validation sheets for instructional tools completed by subject matter and media experts; (2) teacher and student response questionnaires to evaluate practicality; (3) observation sheets on the implementation of learning; and (4) observation sheets measuring indicators of students' green behavior. The validity of the tools was analyzed quantitatively by calculating the average scores from validators, categorized according to feasibility criteria. Practicality was analyzed based on questionnaire scores and user feedback, while effectiveness was measured by changes in green behavior indicators observed before and after the implementation of the learning process.

Data analysis was conducted using both quantitative and qualitative descriptive techniques. Quantitative data including validation scores, questionnaires, and observation results were analyzed using descriptive statistics, while qualitative data from field notes and teacher responses were analyzed thematically. A triangulation process was employed to enhance data validity by comparing findings across instruments and data sources.

This method was deemed appropriate for addressing the research problem and supporting the development of instructional tools that are not only pedagogically sound but also contextually relevant in promoting environmentally responsible behavior in elementary education.

3. Result and Discussion

The assessment results from two subject matter experts and one media expert showed that the developed instructional tools received an average score of 3.66 out of a maximum score of 4, falling into the “very valid” category. The detailed scores include: content feasibility (3.7), component completeness (3.6), language appropriateness (3.8), clarity of instructions (3.5), and media suitability (3.7). The validated tools consisted of the Lesson Plan (RPP), Student Worksheets (LKPD), and thematic teaching materials based on environmental issues.

After undergoing revisions, the instructional tools were implemented in a limited trial with fourth-grade students at SD Negeri Gumpang 01 over two classroom sessions. Data were collected through student response questionnaires and interviews with the classroom teacher. The questionnaire results

indicated that 87% of students enjoyed using the LKPD because it included engaging activities such as environmental observation and group discussions. Meanwhile, 83% of students stated that they gained a better understanding of the importance of maintaining environmental cleanliness after participating in the learning activities.

Interviews with the classroom teacher revealed highly positive feedback. The teacher expressed that the learning process felt more dynamic as students actively participated and were able to relate the content to their daily experiences. The teacher also noted that the tools helped in managing class time and organizing learning activities more systematically. Classroom observations supported these findings. During implementation, students appeared enthusiastic, asked questions actively, and engaged in group discussions. Some students even brought waste materials from home to practice waste sorting in class. These activities demonstrated that the learning process successfully raised students' environmental awareness through a meaningful and contextual approach.

To assess the effectiveness of the tools in promoting green behavior, observations were conducted before and after the learning process based on three main indicators: proper waste disposal, energy and water conservation, and plant care at school. The results showed significant improvements across all indicators. The percentage of students demonstrating proper waste disposal increased from 66% to 88%, energy and water conservation from 61% to 84%, and plant care from 58% to 81% as show in Table 1 and Figure 2.

Table 1. Pecentage of Effectiveness in Promoting Green Behavior

Indicator	Pre (%)	Post (%)	Improvement (%)
Proper waste disposal	66%	88%	22%
Energy and water conservation	61%	84%	23%
School plant care	58%	81%	23%

The high level of validity achieved indicates that the developed learning tools meet sound pedagogical and technical principles. The language aspect received the highest score, reflecting clarity and alignment with the comprehension level of elementary school students. This finding is consistent with those of Fitriani et al. (2020), Rahmawati et al. (2021), and Anwar & Susilowati (2022), who concluded that quality instructional tools must not only be content-valid but also contextually relevant and communicative.

The practicality of the tools is further supported by previous studies. Ismail et al. (2020) demonstrated that meaningful learning-based LKPD (Student Worksheets) increased students' active participation in contextual learning. Similarly, Sari & Wijayanti (2022) found that worksheets designed with exploratory, environment-based activities fostered learning motivation and affective engagement.

Positive responses from students and teachers indicate high acceptance of the tools. Teachers reported that the structure of the tools facilitated easier planning and implementation of lessons, while students experienced direct benefits from contextual learning activities. These findings are in line with studies by Nurhayati et al. (2020), Arifin et al. (2021), and Fauziyah & Fitria (2023), which emphasize the importance of integrating environmental values in a tangible way to improve students' understanding and concern.

The observed improvement in all green behavior indicators demonstrates that meaningful learning can serve as an effective medium for instilling environmental values. This

is supported by research from Prasetyo & Lestari (2020), Kurniawati et al. (2021), and Wahyuni et al. (2023), who found that instructional tools stimulating students' direct involvement in environmental activities significantly enhanced environmental awareness and pro-environmental actions.

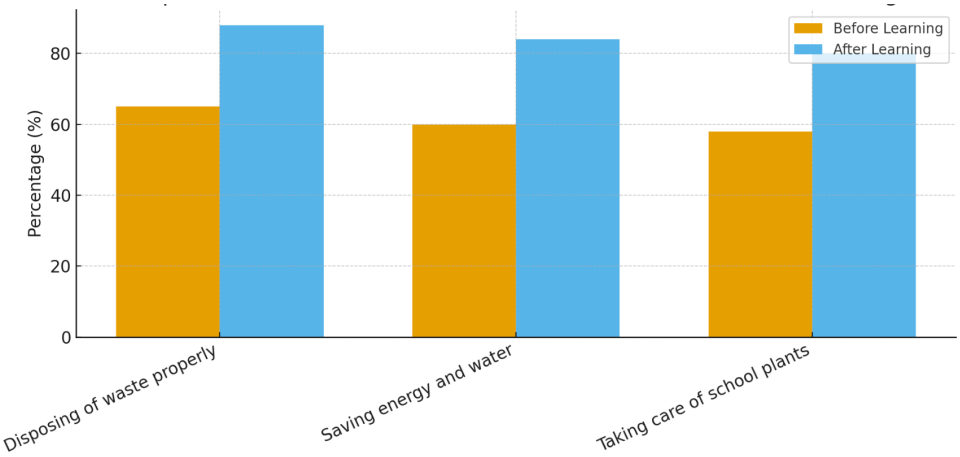

Figure 2. Indicator of Green Behavior

Behavioral changes, such as students voluntarily throwing away trash and watering plants without teacher prompts, reflect learning outcomes that encompass cognitive, affective, and psychomotor domains. These findings align with the theory of Kollmuss & Agyeman (2002), which states that fostering pro-environmental behavior requires the integration of knowledge, emotional engagement, and a supportive social environment.

Although the study yielded promising results, some limitations remain. The implementation was confined to a single class over a relatively short duration. The evaluation of behavioral changes also could not capture long-term impacts. Therefore, further research involving larger sample sizes and extended implementation periods is recommended to comprehensively evaluate the sustainability of green behavior development.

4. Conclusion

Based on the results of the research and discussion, it can be concluded that the development of meaningful learning-based instructional tools has proven to be valid, practical, and effective in fostering green behavior among elementary school students. The tools, consisting of lesson plans (RPP), student worksheets (LKPD), and thematic teaching materials based on environmental issues, were validated with an average score of 3.66 out of 4, indicating a high level of feasibility. Implementation with fourth-grade students showed that 87% of students enjoyed the learning activities, and 83% gained a better understanding of the importance of environmental preservation. Teachers responded positively, highlighting the ease of use and the contextual relevance of the content. Field observations recorded active student engagement across cognitive, affective, and psychomotor domains.

The effectiveness of the tools was also reflected in the significant improvement of green behavior indicators: proper waste disposal increased from 66% to 88%, energy and water conservation from 61% to 84%, and plant care from 58% to 81%. These findings reinforce that meaningful learning can successfully integrate knowledge with real-life actions while instilling environmental

values in a contextual manner. Therefore, the developed instructional tools have strong potential to be replicated on a broader scale as a systematic and sustainable environmental education strategy in elementary schools.

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