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Enhancing Environmental Care Character through Project-Based Learning using Recycled Materials in Elementary Schools

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ABSTRACT

Strengthening character education in elementary schools, particularly environmental care, remains a critical challenge. This study explores the use of Project-Based Learning (PjBL) with recycled materials to foster students' environmental awareness, shifting the focus from cognitive outcomes to character development. The study employed Classroom Action Research based on Kurt Lewin's model, consisting of planning, action, observation, and reflection. Participants were 23 fourth-grade students (10 boys and 13 girls) at a public elementary school. Data were collected through observations, questionnaires, interviews, and documentation, and analyzed using qualitative and descriptive quantitative approaches. The implementation of PjBL using recycled materials led to a consistent improvement in students' environmental care character. The average score increased from 50.4% before the intervention to 66.5% after the first cycle, and reached 85.1% by the end of the second cycle, indicating substantial positive changes in students' attitudes and behaviors toward environmental responsibility. Hands-on, collaborative, and contextual learning activities effectively promoted student engagement and character formation. Integrating recycled materials into PjBL proved to be a practical and impactful strategy for developing environmental care character, aligning well with contemporary educational goals emphasizing sustainability and early character education.

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1. INTRODUCTION

Education plays a fundamental role in shaping the character and personality of the younger generation and functions as a strategic agent of change for societal improvement (Palettei et al., 2021). In the context of rapid technological and social transformation, education is not only expected to develop students' cognitive competencies but also to foster strong moral values and responsible character. Quality education is increasingly viewed as a key determinant in producing high-quality human resources capable of contributing positively to environmental sustainability and social well-being (Apriyansyah & Kurniawaty, 2022). However, contemporary environmental challenges indicate

that awareness and responsibility toward environmental preservation remain relatively low, despite long-standing global concerns regarding environmental degradation (Prasetyo, 2017).

Environmental problems are largely the result of unsustainable human behavior that disrupts ecological balance (Angga et al., 2023). One of the most pressing issues today is the continuous accumulation of plastic and scrap waste, which poses serious environmental and health risks. Recent environmental statistics reveal a significant increase in waste generation in urban areas such as Surabaya, highlighting the urgency of effective waste management strategies (Irfandha et al., 2024). In response to this challenge, the practice of transforming used materials into new and functional products has gained increasing attention as a sustainable solution (Rusi et al., 2024). Used goods—items that are no longer utilized but remain safe and functional—can be repurposed provided they are free from hazardous substances and unsuitable materials such as glass (Arsana et al., 2019). These materials can be environmentally harmful if neglected, yet highly beneficial when managed creatively and responsibly (Nur, 2018).

Elementary schools represent a strategic setting for introducing environmental responsibility through meaningful learning experiences. The utilization of used goods as learning media offers opportunities to reduce waste while simultaneously promoting creativity and innovation among students (Pratiwi, 2020). Consequently, the implementation of innovative learning models that actively engage students in hands-on activities is essential for strengthening character education (Susanto, 2019). One instructional model that aligns well with these objectives and with the current independent curriculum is Project-Based Learning (PjBL) (Fathurrohman, 2015). PjBL emphasizes meaningful, student-centered learning through project implementation that involves problem identification, planning, execution, monitoring, evaluation, and reflection (Mulyasa, 2023).

Through PjBL, students actively engage with real-life problems in their surrounding environment, allowing learning to extend beyond theoretical knowledge toward practical application and value internalization (Lestari, 2022). Collaborative project work encourages students to manage tasks, allocate time effectively, and develop social responsibility within group settings (Dahri, 2022). Moreover, PjBL has been recognized as an effective approach for fostering environmental awareness and care, as it situates learning within authentic environmental contexts (Putri et al., 2023). Character education, particularly environmental care, requires collaboration among schools, families, and communities to ensure that values are consistently reinforced from an early age (Trilisiana, 2023).

Environmental care character refers to attitudes and behaviors aimed at preventing environmental damage and actively participating in environmental restoration (Rijal, 2022). Key indicators of this character include responsible waste management, reduction of plastic use, energy conservation, and proper waste segregation (Rijal, 2022). Developing environmental care character in elementary school students is critical, as early exposure significantly influences long-term habits and responsibility toward nature (Ramli et al., 2021; Silvi et al., 2020). Students who demonstrate environmental concern tend to be more responsible and conscious of the long-term consequences of their actions (Suaedi & Tantu, 2016). Early environmental education, therefore, contributes to the formation of sustainable behaviors that persist into adulthood (Azis et al., 2022).

One promising solution to strengthen students' environmental care character is the integration of PjBL with projects based on the utilization of used goods. By engaging students directly in transforming waste materials into useful products, learning becomes contextual and action-oriented. Such experiences can enhance students' awareness of recycling practices and environmental preservation (Purba et al., 2022). Improper management of used goods can exacerbate environmental problems; conversely, effective utilization can foster positive character development related to environmental responsibility (Azizah et al., 2022). Through this approach, students' environmental care character can be observed through changes in attitudes and behaviors related to waste management and environmental conservation efforts (Yudiyanto, 2019).

Previous studies have demonstrated that the application of the PjBL model can improve students' environmental care character. Research findings indicate notable increases in students' environmental

concern following PjBL implementation, with improvements observed across multiple learning cycles (Nasution, 2021; Suharni et al., 2021). Other studies have also confirmed the effectiveness of PjBL in enhancing recycling skills and environmental awareness among students (Permadi, 2016; Aisyah, 2023). Nevertheless, many existing studies have not specifically emphasized the use of used goods sourced directly from students' immediate environments, such as their homes or schools.

Therefore, this study seeks to address this gap by developing and implementing a Project-Based Learning model that utilizes used goods readily available in students' surroundings. The application of this approach is expected to strengthen environmental care character among fourth-grade elementary school students. Preliminary observations and interviews with teachers indicate that students' environmental care character remains relatively low due to the limited integration of environmental values into classroom learning. Accordingly, this study aims to improve students' environmental care character through the implementation of used goods–based PjBL and to contribute to the development of instructional models that effectively integrate academic learning with character education and environmental sustainability.

2. METHOD

This study employed a Classroom Action Research (CAR) design, as this method is particularly appropriate for addressing authentic classroom problems through systematic and reflective practices. CAR enables teachers and researchers to collaboratively improve the learning process in a gradual, continuous, and context-specific manner. The CAR model adopted in this research follows the framework proposed by Kurt Lewin, as cited by Rangkuti (2016), which consists of iterative cycles. Each cycle includes four essential stages: planning, action, observation, and reflection. In this study, two cycles were deemed sufficient, as meaningful and significant improvements were observed by the end of the second cycle, indicating that the implemented actions had effectively addressed the identified problems and that additional cycles were unnecessary.

The participants in this research were 23 fourth-grade students from class IV/B at SDI Darul Hikmah, located in Krian Sub-district, Sidoarjo Regency. The sample comprised 10 male and 13 female students. The research was conducted over a two-month period, from December 2023 to January 2024. Data were collected using several instruments, including: (1) observation sheets to assess the implementation of the teaching modules, (2) questionnaires administered to both teachers and students, (3) student interview guides, and (4) documentation records. The observation instruments were used to evaluate the execution of the learning activities, while the questionnaires were designed to measure students' environmental care character.

Prior to data collection, all research instruments underwent validity and reliability testing using the SPSS statistical software. An instrument item was considered valid if the significance value (Sig. 2-tailed) was less than 0.05 and the calculated correlation coefficient (r-count) exceeded the r-table value. With a sample size of 23 respondents, the r-table value was set at 0.413. Reliability was determined using Cronbach's Alpha coefficient, with values of $\geqslant 0.70$ indicating acceptable reliability. The validity and reliability tests were conducted in a different class to ensure objectivity and avoid bias. The sequence of activities across the four stages in each research cycle is illustrated in Figure 1.

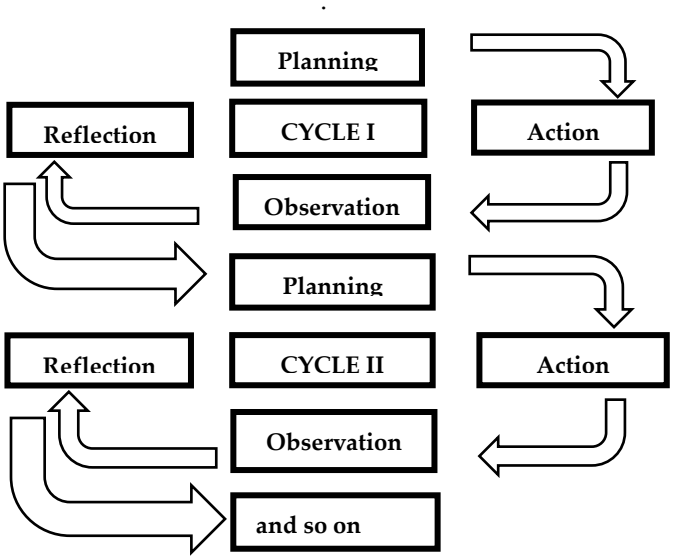

Figure 1. Kurt Lewin Model in several Cycles (Rangkuti, 2016)

The categorization of students' responses related to environmental care character was determined using percentage score criteria developed and modified by the researchers based on the total number of questionnaire items and the available response options. Observation sheets were employed to evaluate the implementation of the learning modules using predefined percentage criteria. Interviews were conducted to explore students' responses and perceptions following the implementation of the Project-Based Learning (PjBL) model utilizing used goods in IPAS learning. Documentation data were collected in the form of photographs, images, and video links capturing the learning activities at SDI Darul Hikmah. Data analysis was carried out using both descriptive qualitative and descriptive quantitative techniques. All collected data were analyzed to examine improvements in students' environmental care character through the implementation of the used goods–based PjBL model. The procedural steps of the PjBL model using used goods are presented in Table 1, while the environmental care character assessment instrument developed by the researchers is presented in Table 2.

Table 1. Steps of the PjBL Model (Mulyasa, 2023)

No	Steps of the PjBL Model	Description
1.	Setting up questions or project assignments	Students observe and ask questions about problems related to used goods and materials.
2.	Design a project plan	Students design a project that answers the question.
3.	Develop a schedule as a concrete step of a project	Students draw up a schedule for each stage of the project.
4.	Monitor project activities and progress	The teacher periodically checks on the progress of students' projects and provides guidance as needed.
5.	Testing results	Students test the results of their projects and present them.
6.	Evaluating activities	The teacher and students evaluate the project and reflect on their experience of scrap management and environmental awareness.

Table 2. Environmental Care Character Assessment Instrument (Rijal, 2022)

Variable	Indicator	Sub Indicator
Environmental Care Character	Plastic waste reduction	Students can reduce plastic waste.
	Waste management according to its type	Students can separate and dispose of organic and inorganic waste according to their place.
	Utilization of used goods	Students can utilize used items into new projects or works.
	Utilization of used goods projects as a medium for learning while playing	Students can utilize the projects that have been made into learning media as well as tools for play.

3. FINDINGS AND DISCUSSION

This class action research was conducted in class IV/B at SDI Darul Hikmah. The implementation of Cycle I and Cycle II consists of the following stages: (1) planning, (2) action, (3) observation, and (4) reflection.

3.1. Pre Cycle

Prior to the research, on November 19, 2024, an initial observation was conducted to see the environmental care character of class IV/B students. Based on the results of these observations, class IV/B teachers at SD Islam Darul Hikmah have never linked learning with increasing students' environmental care character, so students in class IV/B still lack care for the environment, especially in the classroom area. There are many used items and inorganic waste that are just thrown around the classroom. Seeing students who still lack care, the researcher overcomes this problem by inviting class IV/B students to utilize used goods through the PjBL model to increase the character of environmental care in themselves. Before taking action, the research instrument has been validated by 3 experts, namely the supervisor and 2 validators with good and very good categories and the instrument has been tested in class IV/C with the aim of testing the validity and reliability of the questionnaire instrument. The results of the validity and reliability test are 0,821 with a high category, so that it has met the appropriate category to be used as a research instrument later. Researchers also distributed questionnaires in class IV/B to find out the initial data on the character of environmental care before the first cycle. The following is documentation when distributing questionnaires of environmental care character in class IV/B which is shown in **Figure 2**.

Figure 2. Distribution of Student Environmental Care Character Questionnaire Sheets

Based on the average results of distributing questionnaires in class IV/B, namely 50.4% (less concerned) with the target set by the researcher, which is to increase around 76% - 100% with a very good category. After being seen from the percentage results before cycle 1 was carried out, some students had a category of less environmental care, caused by the lack of connection between improving student character and daily classroom learning. To be able to increase the percentage of environmental care character of IV/B students who still have a low and students who have got a high percentage so

that it can be maintained, the researcher will carry out research actions consisting of 2 cycles, namely cycle I and cycle II.

3.2. Cycle 1

Cycle I was conducted in two meetings, in class IV/B at SDI Darul Hikmah. The first meeting was held on December 4, 2024, while the second meeting was held on December 6, 2024. The process of implementing cycle I was carried out with a total time allocation of 4 JP (4 x 35 minutes).

3.2.1 Planning

In the results of Cycle I planning, this module is designed to support students in improving their environmental care character through relevant projects. Before being applied, the instrument has been validated by 3 experts and tested by conducting a validity test and a reliability test in class IV/C at SDI Darul Hikmah. The following is documentation of the validity and reliability tests shown in Figure 3.

Figure 3. Validity and Reliability Test of Questionnaire Sheet

3.2.2 Action

Meeting 1

The implementation of the action of the first meeting of cycle I was held on December 4, 2024 with a time allocation of 1 day (2 x 35 minutes), the material of Chapter 3. Before the learning begins, students fill out a questionnaire sheet on the character of environmental care. The action was carried out by researchers and students of class IV/B. Researchers as teachers carry out activities from syntax 1 to syntax 3 in a structured manner and according to a series of activities that have been written in the teaching module.The following is a picture documentation from the meeting I showed in Figure 4.

Figure 4. Meeting 1

Meeting 2

The implementation of the action of the second meeting of cycle I was held on December 6, 2024 with a time allocation of 1 day (2 x 35 minutes), Chapter 3 material. The activities at meeting 2 consist of syntax 4 to syntax 6, namely making style projects from recycled materials or used goods with the aim of increasing awareness of the importance of protecting the environment by being linked to learning in welding. Figure 4 shows meeting II. Figure 5 shows meeting 2.

Figure 5. Utilization of used items in the creation of style projects

3.2.3 Observation

In Cycle 1, researchers observed that the results of the student and teacher environmental care character questionnaire sheets, as well as the student interview sheets, showed that most students demonstrated an increase in environmental care character. They began to understand the value of utilizing used goods as an effort to reduce waste and preserve nature. The following is documentation of the project results in Figure 6 and documentation of students who have separated inorganic and organic waste in Figure 7.

Figure 6. Project Results

Figure 7. Students dispose of garbage according to its type

However, despite the improvement in their environmental care character, there are still some students who have not fully utilized used goods for their projects. Some students tend to choose materials that are more accessible, namely, buying new items. There was also one student who experienced difficulties when looking for used goods. This could be due to a lack of knowledge or habits that have not fully changed regarding the utilization of used goods. The following is Table 3. Average of Each Indicator on Questionnaire Results, and Table 4. Overall Average Results of Student Questionnaires**.**

Table 3. Average of Each Indicator on Student Questionnaire Results

Variable	Indicator	Percentage before cycle I	Percentage after cycle I
Environmental Care Character	Plastic waste reduction	54.7% (Care)	69.3% (Care)
	Waste management according to its type	46.2% (lack of care)	64.9% (Care
	Utilization of used goods	49.1% (lack of care)	63.5% (Care)
	Utilization of used goods projects as a medium for learning while playing	51.5% (Care)	67.8% (Care)

Table 4. Overall Average Results of Student Questionnaires

Variable	Overall Average Percentage (Before Cycle I)	Category Percentage	Overall Average Percentage (After Cycle I)	Category Percentage
Environmental Care Character	50.4%	lack of environmental care	66.5%	care for the environment

Overall, cycle 1 showed positive results in improving students' environmental care character. However, there are still some students who need to be more encouraged to be consistent in using used goods. This will be the focus of attention in the next cycle, with the hope that students can be more optimal in applying the values of sustainability and environmental care in their projects.

3.2.4 Reflection

After implementing Cycle 1, we identified several areas that need improvement to achieve a more optimal goal in enhancing the environmental awareness character of IV/B students. Based on the results and reflections of the first cycle, the researcher decided to improve the approach in Cycle II, focusing on making better use of used items in their projects, as well as providing sufficient time for students to find used items in advance for project needs. To ensure that students maximize the use of used goods in the project in Cycle II, the researcher will provide more in-depth information about the importance of utilizing used goods and creative ways to process them. Secondly, the researcher will provide a long enough time for students to find used goods that will be needed later when making projects. In addition, the researcher will also ensure that the items the students bring are really used items. With these steps, the researcher hopes that all students can be more consistent in utilizing used goods in their projects.

3.3. Cycle II

Cycle II was carried out in two meetings, in class IV/B at SDI Darul Hikmah. The first meeting was held on January 17, 2025, while the second meeting was held on January 22, 2025. The process of implementing cycle I was carried out with a total time allocation of 4 JP (4 x 35 minutes), which focused on increasing students' environmental care character. The actions taken in cycle II are in accordance with the improvement plan from the results of observations and reflections on cycle I.

3.3.1 Planning

Based on the observations and reflections that have been carried out in cycle I, the researcher compiled an activity plan for the learning module with a greater focus on utilizing used goods better, preparing additional information for students related to used goods projects, and later, researchers provide a long enough time so that students can find used goods in advance for project needs. This module is designed to be as effective as possible in order to improve the character of environmental care, with the achievement of all indicators in the excellent category.

3.3.2 Action

Meeting 1

The implementation of the action of the first meeting of cycle II was held on January 17, 2025 with a time allocation of 1 day (2 x 35 minutes) of material on the effect of force on objects. Researchers also link learning with the surrounding environment which will relate to the utilization of used goods at meeting 2, so that students better understand the meaning of learning that utilizes the surrounding environment. The following is documentation during meeting I in cycle II shown in Figure 8**.**

Figure 8. Meeting of cycle II

Meeting II

The implementation of the 2nd meeting action of cycle II was held on January 22, 2025 with a time allocation of 1 day (2 x 35 minutes). At meeting 2 in cycle II, the researcher has special actions so that later it can further improve all environmental care characteristics in IV / B students. The teacher checked the tools and materials brought by the students, making sure all of them were used items. Meeting 2 is carried out according to the activities in the module from syntax 4 to syntax 6. The following is documentation showing the teacher (researcher) checking the used goods brought by each group in Figure 9 and Figure 10.

Figure 9 and Figure 10. Used Goods Check

3.3.3 Observation

In this observation in Cycle II, researchers began to see and observe the results of implementing Cycle II, as well as the outcomes of the completed research instruments. The following is **Table 5**. Average of Each Indicator on Questionnaire Results, and **Table 6**. Overall Average Results of Student Questionnaires**.**

Table 5. Average of Each Indicator on Questionnaire Results

Variable	Indicator	Percentage before cycle I	Percentage after cycle I	Percentage after cycle II
Environmental Care Character	Plastic waste reduction	54.7% (Care)	69.3% (Care)	84.6% (very caring)
	Waste management according to its type	46.2% (Lack of care)	64.9% (Care)	84.2% (very caring)
	Utilization of used goods	49.1% (Lack of care)	63.5% (Care)	85.6% (very caring)
	Utilization of used goods projects as a medium for learning while playing	51.5% (Care)	67.8% (Care)	85.7% (very caring)

Table 6. Overall Average Results of Student Questionnaires

Variable	Overall Average Percentage (Before Cycle I)	Overall Average Percentage (After Cycle I)	Overall Average Percentage (After Cycle II)
Environmental Care Character	50.4% (lack of environmental care)	66.5% (Caring for the environment)	85.1% (Very Careful of the environment)

Overall, cycle II showed very good results in improving the environmental care character of class IV/B students. The results of increasing the environmental care character of students in class IV/B are supported by several documents that show the success of the used goods project and the improved character in themselves. The following is documentation of students' success in making a project on the effect of force on objects with the basic material of the project from used goods Figure 11. The next documentation is that there are students who have separated the garbage and disposed of it according to its type Figure 12.

Figure 11. Cycle II Project Results

Figure 12. Students Separate Garbage

The results of the questionnaire of students' environmental care character filled in by the IV/B class teacher also showed an increase as the cycle progressed. Before cycle I, 49.1% of students were in the "less caring" category. After cycle I, the percentage increased to 75%, which fell into the "care" category. The peak, after cycle II, 88.3% of students in the "very caring" category, showing significant positive changes in their environmental care attitudes and behaviors. The results of the implementation observation sheet also showed good results, namely cycle I of 92.2%, and cycle II of 96.9% including in the category A (Very Good) All. The results of interviews with several students also showed harmony with the increase in their questionnaires. In each activity, researchers also conducted documentation in the form of photos and some videos to support the results of other instruments.

3.3.4 Reflection

After cycle I and cycle II were carried out, the results showed that the utilization of used goods through the PjBL model could effectively improve students' environmental care character. During the learning process, students are given the task of making projects from used or unused materials. Through this experience of making used goods projects, students not only learn about the concept of utilizing used goods, but also can be used as a medium for learning IPAS as well as for playing which later students are also trained to appreciate and preserve the environment in everyday life. In the first cycle, although there were some challenges in optimizing students' understanding of the given project, in the second cycle, there was a significant increase in the depth of students' understanding of the importance of protecting the environment, which had an effect on increasing students' environmental care character. This improvement is reflected in the results of the questionnaire measuring students' environmental care character, where students' scores increased significantly in the second cycle. The questionnaires filled out by the teachers have also shown that students have improved in their environmental care character. The results of student interviews after students carried out the activities in cycle II are also in line with the increase in the results of their environmental care character

questionnaire. Not only that, the observation sheet for the implementation of the teaching module has taken data that the category of the teacher or researcher is very good, which indicates that each syntax of the PjBL model and the utilization of used goods activities is well implemented. Each activity also has documentation to support other instruments.

Discussion

The findings of this study reinforce existing evidence that the Project-Based Learning (PjBL) model is effective in fostering students' environmental care character. The improvement observed in students' attitudes and behaviors aligns with previous research indicating that PjBL promotes meaningful learning by connecting academic content with real-life contexts. In the context of IPAS learning, PjBL enables students to understand the interrelationship between scientific concepts and the natural environment, thereby strengthening their ecological awareness (Suryandari et al., 2018). This contextual approach allows students to experience learning as an active process rather than passive knowledge acquisition, which is essential for character development.

The results of this study are consistent with the findings of Nasution (2021), who reported a significant increase in environmental care character among fourth-grade students following the implementation of PjBL. Through iterative learning cycles involving observation and questionnaires, students demonstrated heightened awareness and concern for environmental issues. Similarly, Rijal (2022) emphasized that PjBL integrated with recycling projects using used goods not only enhances students' understanding of environmental concepts but also encourages direct participation in conservation activities. This active engagement helps students internalize environmental values more effectively than traditional instructional approaches.

The use of used goods as project materials in this study proved to be particularly impactful. By engaging students in recycling-based projects, learning activities became more concrete, relevant, and engaging. Students were not only exposed to environmental theories but were also involved in real actions that contributed to environmental preservation. This hands-on involvement encouraged greater student participation and motivation, as reflected in their increased responsibility toward managing waste and utilizing resources more efficiently. These findings support the argument that experiential learning plays a crucial role in shaping pro-environmental character traits among elementary school students (Siswanto et al., 2019).

Furthermore, previous studies have shown that managing used goods through project-based activities contributes to the development of creativity and social responsibility. Nugroho et al. (2023) and Siregar et al. (2021) found that students involved in recycling projects not only produced innovative products but also developed a stronger sense of accountability toward their surrounding environment. This aligns with the outcomes of the present study, where students demonstrated improved collaboration, creativity, and environmental awareness throughout the project implementation. The transformation of waste materials into useful products served as a powerful medium for instilling values of sustainability and responsibility.

The strengthening of environmental care character through PjBL also reflects the importance of structured and continuous character education. Character formation requires consistent habituation and reinforcement through learning activities that integrate moral values into daily practice. Hidayat et al. (2022) emphasized that programmed character education is essential for developing a generation with integrity and social responsibility, particularly in the face of increasingly complex moral and environmental challenges. This study demonstrates that PjBL offers a strategic framework for embedding environmental values within the learning process, enabling students not only to understand ethical principles but also to apply them in real-life situations.

A key contribution of this research lies in its emphasis on the utilization of used goods sourced directly from students' immediate environments. Unlike many previous studies, this research highlights how everyday waste materials can be transformed into effective learning resources that support character development. By providing students with opportunities to work on projects closely

related to environmental conservation, the learning process fostered empathy, responsibility, and a sense of ownership toward environmental protection.

Overall, the findings confirm that the implementation of the PjBL model utilizing used goods provides an active, meaningful, and character-oriented learning experience. Students not only gained academic knowledge but also developed habitual attitudes and behaviors that support environmental sustainability. Therefore, this study substantiates that used goods–based PjBL is an effective instructional approach for enhancing environmental care character among elementary school students and can serve as a valuable reference for educators seeking to integrate sustainability and character education into classroom learning.

4. CONCLUSION

This study concludes that the utilization of used goods through the Project-Based Learning (PjBL) model is effective in improving elementary school students' environmental care character, as evidenced by a substantial increase in questionnaire results from 50.4% (less environmental care) before the intervention to 66.5% after the first cycle and 85.1% (very high environmental care) after the second cycle, particularly in indicators such as plastic waste reduction, waste sorting, and the creative use of used goods as learning and play media. These findings confirm that PjBL provides meaningful, action-oriented learning experiences that support the internalization of environmental values. However, this study is limited by its implementation over only two action research cycles and a relatively short observation period, which restricts the ability to assess the long-term sustainability of students' character development. Future research is therefore recommended to involve longer-term observations, additional cycles, and broader participant samples to examine the durability and transferability of environmental care behaviors. Additionally, future studies may explore the integration of used goods–based PjBL across different subjects and educational levels. The findings highlight the importance of curriculum development that systematically integrates character and environmental education through PjBL, as well as the need for teacher training in project-based and sustainability-oriented instructional strategies to strengthen character education practices in schools.

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