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Greeneration: An Innovative Learning Resource for Students' Environmental Awareness

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Abstrak

Isu lingkungan seperti polusi, penggundulan hutan, dan perubahan iklim semakin memburuk. Namun, kesadaran dan kepedulian siswa terhadap lingkungan masih relatif rendah. Banyak siswa kurang memahami dampak aktivitas manusia terhadap alam, karena pembelajaran sering kali bersifat teoritis dan gagal menghubungkan konsep lingkungan dengan pengalaman hidup nyata. Greeneration, sebagai pendekatan pembelajaran yang inovatif, memanfaatkan lingkungan sebagai sumber belajar yang memberikan siswa pengalaman langsung. Penelitian ini bertujuan untuk mengeksplorasi dampak penggunaan Greeneration sebagai sumber belajar terhadap kesadaran lingkungan siswa, dengan harapan dapat menawarkan solusi yang relevan dalam konteks pendidikan saat ini. Penelitian ini menggunakan pendekatan kuantitatif dengan desain eksperimen, yang melibatkan siswa dari SMA Kuntum Cemerlang di Kota Bandung. Pengumpulan data dilakukan melalui kuesioner yang dirancang untuk mengukur perubahan sikap siswa sebelum dan sesudah intervensi. Temuan menunjukkan bahwa penerapan Greeneration secara signifikan meningkatkan kesadaran dan kepedulian lingkungan siswa, dengan peningkatan rata-rata 30% dalam skor sikap lingkungan setelah intervensi. Hasil ini diharapkan dapat berkontribusi pada pengembangan kurikulum yang lebih responsif terhadap lingkungan dan mendorong penerapan metode pembelajaran inovatif yang menginspirasi siswa untuk mengambil peran aktif dalam pelestarian lingkungan.
Kata kunci: Greeneration, Inovasi Pembelajaran, Kesadaran Lingkungan.

Abstract

Environmental issues such as pollution, deforestation, and climate change are increasingly worsening. However, students' awareness and concern for the environment remain relatively low. Many students lack an understanding of the impact of human activities on nature, as learning is often theoretical and fails to connect environmental concepts with real-life experiences. *Greeneration*, as an innovative learning approach, utilizes the environment as a learning resource that provides students with direct experiences. This study aims to explore the impact of using *Greeneration* as a learning resource on students' environmental awareness, with the hope of offering relevant solutions in the current educational context. The research employs a quantitative approach with an experimental design, involving students from *Kuntum Cemerlang High School* in Bandung City. Data collection was conducted through a questionnaire designed to measure changes in students' attitudes before and after the intervention. The findings indicate that the implementation of *Greeneration* significantly enhances students' environmental awareness and concern, with an average increase of 30% in environmental attitude scores after the intervention. These results are expected to contribute to the development of a more environmentally responsive curriculum and encourage the implementation of innovative learning methods that inspire students to take an active role in environmental preservation.
Keywords: Greeneration, Learning Innovation, Environmental Awareness

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INTRODUCTION

Environmental issues such as pollution, deforestation, and climate change are increasingly escalating. However, students' awareness and concern for the environment remain relatively low. Many students struggle to understand the impact of human activities on nature because learning is often theoretical and fails to connect environmental concepts with real-life experiences. Environmental education has now become a crucial aspect in shaping young generations' awareness of the pressing environmental issues. In a global context, challenges such as climate change, pollution, and biodiversity loss require serious attention from all parties, especially in the field of education.

Environmental education must be integrated into the curriculum to equip students with the knowledge and skills needed to address environmental challenges. This highlights that education is not only a means of knowledge transfer but also a tool for shaping students' character and social responsibility toward the environment (Corpuz & San Andres, 2022). Innovations in learning resources are one of the strategies that can be used to enhance students' environmental awareness. Greeneration, as a form of innovative learning, utilizes the environment as a learning resource that provides students with direct experiences. Environmental-based learning can increase students' motivation and interest in understanding environmental issues. Greeneration is expected to serve as an effective tool in fostering environmental awareness among students.

Previous studies have shown that environmental-based learning innovations have a positive impact on students' environmental awareness. For example, research by (Smith & Brown, 2021) found that the use of experiential learning outside the classroom can enhance students' awareness and engagement in environmental issues. Additionally, a study by (Johnson & Lee, 2020) emphasized the importance of integrating technology into nature-based learning to strengthen students' ecological understanding. In the context of innovations like Greeneration, research by (Tan et al., 2022) showed that an interactive, environment-based approach can enhance critical thinking skills and foster positive attitudes toward sustainability. Therefore, this study will further explore the effectiveness of Greeneration as an educational innovation in shaping students' environmental awareness.

The urgency of this research is also supported by the fact that many students still lack an understanding of the importance of environmental conservation. A study by (Hudha et al., 2021) More than 60% of students lack sufficient knowledge about local and global environmental issues. This highlights the need for a new educational approach that not only relies on conventional methods but also actively engages students in the learning process. Greeneration offers a more interactive and contextual approach, which is expected to enhance students' understanding of the importance of environmental conservation. Furthermore, this study aims to explore how Greeneration can contribute to developing students' environmental awareness. Environmental awareness is influenced not only by knowledge but also by direct experiences and involvement in conservation activities.

This study presents a novelty in the application of Greeneration as an innovative nature-based learning resource that has not yet been systematically integrated into formal education to enhance students' environmental awareness. Unlike previous studies that focused more on environmental education theory or conventional teaching methods, this study examines the effectiveness of an experiential learning approach that utilizes the surrounding environment as a learning medium. The findings of this research are expected to contribute to the development of more contextual, applicable, and behavior-oriented learning strategies to foster students' environmental responsibility.

Schools have the potential to develop nature-based learning resources, such as learning in school gardens, urban forests, rivers, or other green areas. However, this approach is still

rarely implemented due to limited teaching strategies, lack of facility support, or insufficient teacher understanding of environmental-based learning methods. Through this research, valid data will be obtained on the effectiveness of Greeneration in improving students' environmental awareness. These findings will make a significant contribution to the development of a more sustainability-responsive education curriculum and provide recommendations for educators to implement more innovative and relevant teaching methods aligned with contemporary needs. The objectives of this research are not only to explore the effectiveness of Greeneration as an innovative learning method but also to provide recommendations for the development of an education curriculum that is more responsive to sustainability issues and to create a younger generation that is aware of the importance of maintaining ecosystem sustainability.

METHOD

This study employs a descriptive quantitative and quasi-experimental design with a case study approach to analyze the impact of utilizing innovative learning resources on students' environmental awareness at SMA Kuntum Cemerlang. The research aims to explore whether innovative learning resources can enhance students' environmental awareness and concern. The population in this study consists of all students enrolled at SMA Kuntum Cemerlang for the 2023/2024 academic year, specifically those taking Geography in Grade XI. This population was selected because, at the high school level, students have a basic understanding of environmental issues and are capable of utilizing technology and learning resources more effectively. The sample in this study consists of 24 students who did not use Greeneration and 18 students who used Greeneration. Environmental awareness refers to an individual's belief or commitment to the importance of preserving and protecting the environment. The psychological process of environmental awareness influences human behavior through several stages:
(1) Cognitive processes,
(2) Affective processes,
(3) Motivational processes, and
(4) Behavioral processes (Helmi, 1999).
To measure the level of students' environmental awareness, several indicators are used as references: (Helmi, 1999)

Table 1. Research Instrument Grid for Environmental Awareness Attitude

No	Variable	Indicator
1	Greeneration	One form of learning innovation utilizes the environment as a learning resource, providing students with direct experience.
2	Environmental Awareness Attitude	Participating in classroom cleaning duty
		Caring for and maintaining plants around the school
		Disposing of waste in designated bins
		Avoiding burning trash in the schoolyard
		Practicing the 3Rs (Reduce, Reuse, and Recycle)
		Recycling non-organic waste

Adapted from various sources (Darmiatun, 2013; Daryanto & Darmiatun, 2013; Fitri, 2007; Hariyanti, 2017; Narwanti, 2011). From the table above, it can be seen that to measure students' environmental awareness, six indicators are used as references. These indicators encompass various behaviors that reflect environmental concern, such as participating in classroom cleaning duties, caring for plants, disposing of waste properly, practicing the 3Rs, and recycling non-organic waste. The selection of the experimental and control classes was conducted randomly (random sampling) to minimize bias in the study and ensure that both groups had relatively similar characteristics before the treatment was applied. To measure the impact of using innovative learning resources on students' environmental awareness, an environmental awareness attitude questionnaire was utilized. This questionnaire assessed students' level of concern regarding environmental issues. The collected data from the questionnaire were analyzed using descriptive statistical tests and difference tests to determine significant differences between groups. Statistical assumption tests included normality and homogeneity tests. The difference test was conducted using an independent sample t-test. Data processing was performed with the assistance of SPSS 26 software.

RESULT AND DISCUSSION

1.1 Greeneration

School greening is an essential step in supporting sustainable development while providing long-term benefits for both the environment and the school community. This initiative goes beyond simply planting trees or ornamental plants; it also includes maintenance, planning, and management of green spaces in schools to offer ecological, social, and educational benefits.

Additionally, 11th-grade students have recently studied sustainable development, inspiring the integration of experiential learning methods into lessons. This approach prevents student fatigue from continuous classroom-based learning while also implementing the Sustainable Development Goals (SDGs), specifically Pillar 13 (Climate Action) and Pillar 15 (Life on Land). The experiential learning method was applied in the 11th-grade Geography lesson on Natural Resources.

Activities Conducted by Students:

1. Conducting interviews with teachers about natural resources in the school.
2. Creating a video blog documenting the interview process.
3. Contributing to the conservation and enhancement of biological resources by planting bisbul fruit trees.

Tools and Materials:

1. Smartphone
2. Books and other writing tools
3. Trees/plants
4. Shovel
5. PVC/Pipes
6. Soil drill

Implementation Techniques:

1. Observing Energy Use in Schools (24 September 2024)
   a. Objective: Students will conduct observations to identify various energy sources used in the school environment.
   b. Implementation Procedure:
      1) Students are divided into small groups to conduct observations in various areas of the school, such as classrooms, laboratories, and the cafeteria.

Figure 1. Observation in School Areas

2) Each group records the types of energy used (electricity, gas, water) and how they are utilized.
3) After the observation, students will analyze the collected data to understand energy usage patterns and potential savings.

2. Interview on Sustainable Energy (24 September 2024)
   a. Objective: To explore the perspectives of school members on the importance of sustainable energy use.
   b. Implementation Techniques:
      1) Students prepare relevant interview questions, such as the benefits of renewable energy and challenges in its implementation.

Figure 2. Interview with Teachers

1) The interview is conducted with teachers, staff, and classmates to obtain diverse perspectives.
2) The interview results will be recorded and compiled into a report that includes the background, objectives of the interview, and conclusions from the findings.

3. Tree Planting Activity (30 September 2024)
   a. Objective: Implement SDGs Pillar No. 13 and 15 on climate change and terrestrial ecosystems through real action.
   b. Implimentation Techniques:
      1) Students will prepare by selecting a planting location within the school area that requires greening.

Figure 3. Tree Planting in the School Area

      2) Before planting, students receive education on the benefits of trees for the environment.

Figure 4. Education on the Benefits of Trees for the Environment

      3) The tree planting activity will be carried out simultaneously, involving all 11th-grade students and teachers as mentors.
      4) Presentation of Research Findings (7 Oktober 2024)
         a. Objective: To present the results of observations and interviews to the school community to raise awareness about the importance of sustainability.
         b. Implementation Technique:
            1) Students prepare presentations using media such as PowerPoint, activity documentation videos, and research result posters.

Figure 5. Activity Documentation Video

2) Each group will present their findings during a scheduled session in the school hall.
3) An interactive discussion will be held after the presentation to explore the topics in greater depth.

1.2 Students' Environmental Awareness

Table 2. Environmental Awareness and Concern Data

No	Indicator	Persentase
1	Participating in classroom cleaning duty	70,51
2	Caring for and maintaining plants around the school	69,65
3	Disposing of waste in designated bins	84,13
4	Avoiding burning trash in the schoolyard	77,87
5	Practicing the 3Rs (Reduce, Reuse, and Recycle)	78,73
6	Recycling non-organic waste	72,7

Overall, students' environmental awareness and concern show relatively good results, although there are variations across different measured indicators. The activity of "disposing of waste in designated bins" scored the highest at 84.13%, reflecting that the habit of maintaining cleanliness is well-internalized among students. This indicates the effectiveness of cleanliness campaigns in the school environment, reinforced through written regulations and daily habits instilled by teachers and the surrounding environment.

The indicators of "practicing the 3Rs (Reduce, Reuse, Recycle)" and "avoiding burning trash in the schoolyard" also received relatively high attention, with percentages of 78.73% and 77.87%, respectively. These figures suggest that students have a fair understanding of sustainable waste management principles, although there is still room for improvement—especially in the consistent application of the 3R concept in their daily lives.

The lowest percentage (69.65%) was recorded for "caring for and maintaining plants around the school," indicating that students may still lack awareness of the importance of greening efforts in maintaining the school's ecosystem balance. This low engagement could be due to a lack of student involvement in greening programs or limited awareness of the direct benefits of plants in their surroundings. To address this, a more

active approach is needed, such as integrating greening programs into extracurricular activities or implementing project-based learning to enhance student participation in environmental conservation efforts.

These gaps among the indicators suggest that students' environmental awareness tends to be more focused on practical activities like waste management. Meanwhile, activities requiring more effort, such as plant care, seem to attract less interest. Therefore, additional initiatives—such as direct student involvement in school greening projects or training on the ecological benefits of plant maintenance—are necessary. These measures are expected to balance students' attention toward various aspects of environmental awareness and responsibility.

1.2.1 Environmental Awareness and Concern Based on Gender

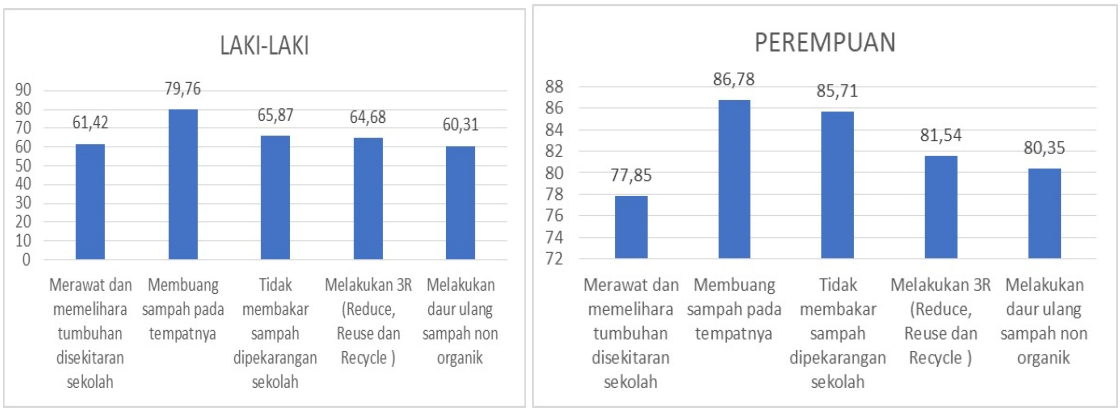

Figure 6. Analysis of Environmental Awareness Indicators Based on Gender

There is a significant difference in environmental awareness between male and female students. The data shows that female students exhibit a higher level of environmental awareness across all measured indicators. For instance, in the activity of "disposing of waste in the proper place," female students scored 86.78%, while male students only reached 79.76%. A similar trend is observed in the activity of "practicing 3R (Reduce, Reuse, Recycle)," where 81.54% of female students participated compared to only 64.68% of male students.

This difference suggests that female students tend to be more consistent in adopting environmentally friendly habits, which may be influenced by several factors. Previous studies indicate that females generally have higher social awareness and environmental responsibility than males, possibly due to differences in mindset, value education, and social roles developed from an early age. Additionally, males are often more interested in exploratory and competitive activities, making conventional environmental education approaches less engaging for them. To address this, more suitable learning strategies should be implemented for male students, such as game-based methods, environmental challenges, or collaborative projects that can enhance their engagement. Moreover, experiential learning approaches, such as simulations and environmental experiments, could serve as effective alternatives.

1.2.2 Environmental Awareness Based on Class Level

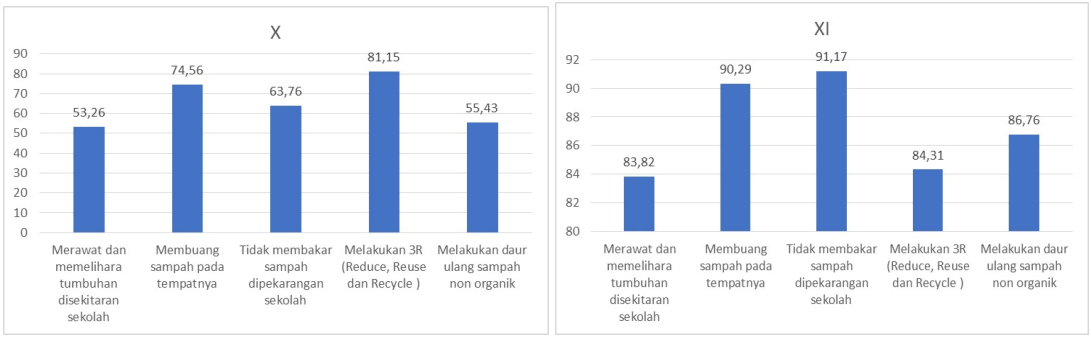

Figure 7. The Level of Environmental Care Attitude Based on Grade Level

Grade XI students demonstrate a higher level of environmental awareness compared to Grade X students across all indicators. For example, in the activity "not burning trash in the schoolyard," Grade XI students have a percentage of 91.17%, significantly higher than Grade X students, who only reach 63.76%. A similar trend is observed in the activity of "recycling non-organic waste," where Grade XI students achieve 86.76% compared to 55.43% in Grade X. This difference may be attributed to the higher level of understanding and maturity among Grade XI students. These results indicate that environmental awareness tends to increase with age or educational level. This presents an opportunity to strengthen environmental education from an early stage, particularly for Grade X students, so that they become more trained and conscious of the importance of preserving the environment. Through an education-based approach combined with real-life practice, Grade X students are expected to reach the same level of awareness as Grade XI students in a shorter period.

The utilization of the environment as an innovative geography learning resource through the Greeneration program shows great potential in enhancing environmental awareness and student engagement. (Smith, 2021). This program not only focuses on tree planting but also encompasses in-depth educational aspects, such as understanding sustainability and the impacts of climate change (Brown, 2020). In this context, students are encouraged to actively participate in reforestation activities, providing them with practical experience and reinforcing the theoretical learning they receive in class (Williams, 2019). Such activities can enhance students' understanding of the importance of environmental conservation and provide them with opportunities to apply their knowledge in real-world contexts (Thompson, 2022). The Greeneration program serves as a bridge between theory and practice, allowing students to directly observe the positive impact of their actions on the environment.

1.3 Innovation of Geography Learning Resources on Environmental Awareness Attitudes

1) Normality Test

Table 3. Normality Test for Classes Not Using Greeneration

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
VAR00005	.171	23	.078	.886	23	.013

a. Lilliefors Significance Correction

The normality test results for the class that did not use the Greeneration program indicate that the students' Environmental Awareness Attitudes data follow a normal distribution. The normality test showed a significance value of 0.078 for the Kolmogorov-Smirnov test and 0.013 for the Shapiro-Wilk test. Since both values are greater than 0.05, it can be concluded that the data are normally distributed. Based on this normality test, the students' perception of Environmental Awareness Attitudes in Grade X can be analyzed using parametric statistical methods for further testing. The presence of a normal distribution in this data also indicates that students' perceptions are evenly distributed without extreme tendencies toward very high or very low ratings. Normality testing is a crucial initial step in data analysis before proceeding with further tests such as correlation or regression analysis. By ensuring that the data are normally distributed, researchers can apply stronger parametric statistical methods to draw reliable conclusions. Overall, the normality test provides an initial overview of the characteristics of the collected data and helps determine the next analytical steps.

Table 4. Normality Test for Classes Using Greeneration

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
VAR00006	.132	17	.200*	.944	17	.375

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The normality test results for the class that implemented the Greeneration program indicate that the students' Environmental Awareness Attitudes data also follow a normal distribution. The normality test showed a significance value of 0.200 for the Kolmogorov-Smirnov test and 0.375 for the Shapiro-Wilk test. Since both values are greater than 0.05, it can be concluded that the data are normally distributed. Given that the data for both Grade X and Grade XI have significance values above 0.05, they can be analyzed using parametric statistical methods. These results indicate that the distribution of students' perceptions in Grade XI follows a structured pattern, allowing for more accurate interpretation of statistical analysis results. In this study, meeting the normality assumption for student data in the Greeneration program regarding Environmental Awareness Attitudes is a crucial foundation for selecting an appropriate statistical analysis method. With normally distributed data, researchers have the flexibility to apply parametric statistical methods such as an independent t-test or correlation analysis. Parametric statistical methods are known to be more robust and effective in identifying significant relationships or differences between the studied variables. Moreover, ensuring normality allows statistical analyses to yield more representative results that accurately reflect the actual conditions of the collected data. This is essential to ensure that interpretations—whether related to relationships between variables or comparisons between groups—are conducted with a high level of accuracy and reliability.

2) Homogeneity Test

Table 5. Homogeneity Test of Student Data on Environmental Awareness Attitudes

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
VAR00007	Based on Mean	9.973	1	38	.003
	Based on Median	7.331	1	38	.010

	Based on Median and with adjusted df	7.331	1	26.702	.012
	Based on trimmed mean	8.832	1	38	.005

The homogeneity test results for student data on Environmental Awareness Attitudes indicate that the significance values in Levene's Test for Equality of Variances are 0.003 based on the mean, 0.010 based on the median, and 0.005 based on the trimmed mean. Since all these values are greater than 0.05, it can be concluded that the variance between groups using the Greeneration learning resource and those not using it does not differ significantly. In other words, the data exhibit homogeneity of variance.

Ensuring homogeneity of variance is crucial to confirm that comparisons between groups are not influenced by large differences in variability within the data. Conducting a homogeneity test is an essential step before proceeding with further analysis, as failing to meet this assumption could lead to invalid statistical results. By confirming that the data are homogeneously distributed, researchers can confidently apply the appropriate statistical methods to draw accurate conclusions regarding environmental awareness attitudes among the studied groups.

3) Independent sample t test

Table 6. Independent Sample t-Test for Greeneration Learning Resource

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
VAR00007	Equal variances assumed	9.973	.003	-7.403	38	.000	-23.18632	3.13209	-29.52690	-16.84573
	Equal variances not assumed			-8.326	29.431	.000	-23.18632	2.78497	-28.87861	-17.49402

The results of the Independent Sample t-Test show that the significance value in Levene's Test for Equality of Variances is 0.003. This indicates that the variance between the group using the Greeneration learning resource and the group not using it is homogeneous, meaning there is no significant difference in data variability between the two groups.

Furthermore, the t-test for mean differences between the two groups yielded a significance value of 0.000 with a t-value of -7.403 at 38 degrees of freedom (df), which is smaller than 0.05. This confirms a statistically significant difference in students' Environmental Awareness Attitudes between the class using Greeneration and the class not using it.

The mean difference obtained is -23.18632, with a 95% confidence interval ranging from -29.52690 to -16.84573. These results indicate that, statistically, students in the class using the Greeneration learning resource have a higher perception of environmental awareness

compared to those in the class that did not use it, with a statistically significant difference. This finding underscores the effectiveness of the Greeneration program in fostering students' environmental awareness and highlights the potential of innovative learning resources in enhancing sustainability education. Innovative learning resources in geography education can have a significant impact on students' environmental awareness, especially at SMA Kuntum Cemerlang, which integrates nature-based learning media as part of its instructional approach (Smith, 2021). One of the innovations implemented is the utilization of the environment as an innovative geography learning resource through the Greeneration program, which demonstrates great potential in enhancing environmental awareness and student engagement (Williams, 2019). This program not only focuses on tree planting but also encompasses in-depth educational aspects, such as understanding sustainability and the impacts of climate change. Students are encouraged to actively participate in reforestation activities, providing them with practical experience and reinforcing the theoretical learning they receive in class. (Thompson, 2022). This is expected to enhance students' awareness and concern for the increasingly prevalent environmental issues (Lee, 2020). A nature-based approach in geography learning can facilitate students' understanding of environmental sustainability, ultimately encouraging them to be more aware and actively engaged in conservation efforts (Anderson, 2018). Therefore, integrating nature-based learning resources not only enhances students' understanding of the material but also strengthens their environmental awareness and responsibility (Liu, 2019).

SIMPULAN

Greeneration is an effective innovative learning resource in enhancing students' environmental awareness. The findings of this study highlight that Greeneration, as an environment-based learning innovation, significantly contributes to fostering students' concern for the environment. This approach serves as a strategic step in geography education, as it leverages nature as a direct learning resource, making lessons more engaging and meaningful. Moreover, the study underscores the critical role of integrating environmental education into formal learning, emphasizing the need for a curriculum that is more responsive to sustainability issues. These findings provide valuable insights for curriculum development, encouraging a more holistic and action-oriented approach to environmental education in schools.

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