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Development of Environmental Awareness-Based Geography Learning Modules to Improve Environmental Awareness of Grade Xi Students

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Abstract

Environmental education plays a crucial role in shaping students' ecological awareness; however, classroom learning practices are still dominated by conventional approaches that overlook the affective aspects. This study aims to develop and test the effectiveness of context-based Geography learning modules on the topic of Environment as a Sustainable Living Habitat in increasing students' environmental awareness. The research method employs a research and development (R&D) approach, utilizing the ADDIE model, with 104 grade XI students at SMAN 4 Kotabumi serving as research subjects. Data were collected through environmental attitude questionnaires, learning outcome tests, observations, and interviews, then analyzed by instrument validity and reliability tests, paired t-tests, N-Gain, and thematic analysis using SPSS and NVivo software. The results of the study showed that the modules developed were declared very feasible based on expert validation, with an average score of 4.42. The responses of students and teachers demonstrated a high level of attractiveness and relevance, while the t-test results showed a significant increase in environmental care, from an average score of 63.3 in the pretest to 82.3 in the posttest, with an N-Gain of 0.62 (medium to high category). This study concludes that the learning modules developed are effective in improving students' environmental awareness attitudes, as well as providing theoretical contributions in strengthening ecopedagogy-based education and practical contributions in the form of teaching materials that can be implemented in the Independent Curriculum.

Keywords: *Geography Learning Modules; Environmental Concerns; High School Students; Ecopedagogy*

Introduction

21st-century education requires students to have balanced cognitive, affective, and psychomotor competencies, including an attitude of concern for the environment, which is currently a global and local issue. Climate change, environmental degradation, and natural disasters show the urgency of education

that integrates sustainability aspects into the curriculum. (UNESCO, 2020) emphasizes that *Education for Sustainable Development* (ESD) must equip learners with the knowledge, skills, values, and attitudes that enable them to make environmentally responsible decisions. In Indonesia, the Independent Curriculum emphasizes character formation through the Pancasila Student Profile, including the dimensions of cooperation, independence, and critical thinking, which are inseparable from concern for the environment (Ministry of Education and Culture, 2022). In this context, geography learning has an important role because it discusses the mutual relationship between humans and the environment that encourages the formation of students' ecological awareness (Bagoly-Simo, 2022).

However, the reality in schools shows that there is a gap between ideal goals and learning practices. Observations at SMAN 4 Kotabumi show that many students still do not care about the cleanliness of the school environment, such as littering, refusing to water plants, and not carrying out schoolwork. This condition is further exacerbated by the low achievement of student learning outcomes in environmental materials. Learning outcome data shows that more than 70% of grade XI students obtain scores below the Minimum Completeness Criteria, with an average of only 55–60, far below the standard of 75. A comparison of learning outcomes can be seen in Table 1 below:

Table 1. The average learning outcomes of grade XI students of SMAN 4 Kotabumi in several Geography materials (2024/2025)

Learning Materials	XI-6	XI-7	XI-9	Rata-rata	Information
Indonesia's Strategic Position & Natural Resources Potential	78	80	80	79,3	≥ KKM
Biodiversity	78	79	80	79,0	≥ KKM
Environment as a Living Habitat Sustainable	60	55	58	57,7	< KKM

Source: Document of Learning Outcomes for Grade XI Students of SMAN 4 Kotabumi Semester 1 Academic Year 2024/2025

The table shows that student learning outcomes are relatively high in the potential of natural resources and biodiversity, but low in environmental materials. In addition, the results of learning style observations showed that 77.92% of students had kinesthetic tendencies, meaning they more easily understood learning through hands-on experiences, practices, and interactive activities. This fact confirms that learning geography about the environment requires contextual and activity-based module innovation to suit the characteristics of students.

Previous research has shown that the development of innovative teaching materials has a great contribution in fostering students' environmental awareness. (Rahmi et al., 2023) emphasized that the use of teaching materials based on local potential is more effective than conventional methods in improving students' critical thinking skills, as well as caring for the environment. Similar results were shown by Wulandari et al. (2019), who developed *Subject-Specific Pedagogy* based on *Problem-Based Learning* and found that contextual learning experiences are able to foster students' ecological attitudes. while (Minarni, et al., 2023) emphasized the importance of integrating *ecopedagogy approaches* in geography learning because it has proven to be effective in fostering pro-environmental character.

In addition, a number of other studies also confirm the effectiveness of learning modules in strengthening students' affective dimensions. (Sariani and Muryani, 2017) shows that the use of environmental care-based geography modules is able to significantly increase students' attitudes of concern. Research (Dewi et al., 2019) proves that context-based science practicum modules are not only valid and practical, but also effective in fostering environmentally conscious character. However, these studies have not developed many geography learning modules that are specifically associated with local contexts, such as the issue of flooding in Kotabumi, Lampung, which is a disaster-prone area (BPBD Lampung Utara, 2023)

Based on this background, this study aims to develop a geography learning module on *the Environment as a Sustainable Living Habitat* material that is designed contextually and interactively in

accordance with the learning style of grade XI students of SMAN 4 Kotabumi. This module is expected to be able to answer the research gap by presenting teaching materials that not only emphasize the knowledge aspect, but also really shape students' environmental care attitudes, which are the main demands of 21st-century learning through relevant and meaningful learning contexts.

Theoretically, this research contributes to enriching the literature on the development of interactive learning media in geography education and strengthens the study of the role of *ecopedagogy* in fostering the character of caring for the environment. Practically, the results of this research can be a reference for teachers. in developing contextual modules according to the Independent Curriculum and developing learning media, which will ultimately improve the quality of the teaching and learning process (Miswar et al., 2021), as well as provide more applicable learning solutions for schools in disaster-prone areas. Thus, this research has academic significance as well as social relevance in supporting sustainable development goals.

Research Method

Types of Research

This research uses research and development (R&D) methods with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. This model was chosen because of its systematic, flexible nature, and it can minimize product errors at the final stage through evaluation and revision at each stage (Branch, 2009). This approach is relevant to produce learning modules that are contextual, interesting, and in accordance with the needs of students, especially in the Geography learning material "Environment as a Habitat for Sustainable Life". Therefore, this research not only focuses on product manufacturing but also on testing the feasibility, attractiveness, and effectiveness of modules in improving students' environmental care attitudes (Nugroho & Puspitasari, 2019).

Research Time and Location

This research was carried out at SMAN 4 Kotabumi, North Lampung Regency, in the even semester of the 2024/2025 school year. The research location was chosen purposively based on initial observations that showed low student learning outcomes in the subject. environment and the existence of behavior that does not care about school cleanliness. In addition, the research location was chosen because it is relevant to the context of flood problems that often occur in the area, so that local environment-based learning is considered more meaningful.

Research Subjects

The target of the study was all 11th-grade students of SMAN 4 Kotabumi with a total population of 104 students spread across three classes (classes XI-6, XI-7, and XI-9). The research sample was determined using the purposive sampling technique, namely: selecting students in the three classes because they had low learning outcomes in environmental materials, namely in grades XI-7. The total number of research participants was 34 students. This selection is based on learning outcome data that shows that the average score of students is still below the Minimum Completeness Criteria (KKM) in the class, so it is considered representative to test the effectiveness of the module in improving environmental care attitudes (Sugiyono, 2019).

Procedure

The research procedure follows ADDIE's steps. (1) Analysis is carried out to identify student needs, including dominant kinesthetic learning styles, learning outcomes, and environmental care attitudes. (2) Design includes the preparation of context-based module drafts, integration of environmental care values, and

project-based activity design. (3) Development includes the preparation of modules, validation by material experts, linguists, and learning design experts, as well as revisions according to input. (4) Implementation was carried out through a limited trial in small groups (10 students) and continued with field trials on 34 students in grades XI-7. (5) Evaluation is carried out formatively at each stage, and a summative evaluation to assess the effectiveness of the module on students' environmental care attitudes.

Data, Instruments, and Data Collection Techniques

The data collected consists of quantitative and qualitative data. Qualitative data were obtained through environmental awareness questionnaires, learning achievement tests, and student activity observation sheets. The questionnaire instrument was prepared based on the dimension of environmental awareness adapted from the Principles of Nationality, State, and Community Ethics (Adha & Susanto, 2020). Qualitative data were obtained through open interviews with teachers and students regarding responses to the developed modules. The validity of the instrument was tested using the validity of the content through expert assessment, while the reliability of the questionnaire was tested using the Alpha Cronbach coefficient with SPSS software 26.

Data Analysis Techniques

The data from the validation of the module by experts were analyzed descriptively and quantitatively using the feasibility categories (very feasible, feasible, quite feasible, and less feasible). The learning outcome data were analyzed using normality tests, homogeneity tests, and paired t-tests to see the feasibility of the modules. differences in results before and after use of the module. Environmental care attitude data were analyzed using normalized N-Gain and multiple linear regression tests to determine the effectiveness of the module in improving students' environmental care attitudes. Meanwhile, qualitative data from interviews and observations were analyzed using thematic analysis techniques using NVivo 12 software, resulting in a comprehensive picture of student and teacher responses to learning modules.

Results And Discussion

Results

Validation is carried out by material experts, language experts, and learning design experts. The validation results are shown in Table 1 below

Table 1. Results of Module Validation by Experts

Assessment Aspects	Expert Material	Members Language	Members Design	Average	Category
Material suitability	4.4	–	–	4.4	Very proper
Language Compatibility	–	4.2	–	4.2	Proper
Display Design	–	–	4.6	4.6	Very proper
Readability	4.3	4.4	4.2	4.3	Proper
Attractiveness Module	4.6	4.5	4.7	4.6	Very proper
Total Average				4.42	Very proper

Source: Primary Data, 2025

The module obtained an average score of 4.42 (very decent). This confirms that the module has met the feasibility aspects of content, language, design, and attractiveness. These findings support the research (Sultoni et al., 2023) and (Minarni, Kamil, & Ridha, Syahrul, 2023), which states that the ADDIE model produces ecopedagogy-based learning modules that are valid, applicable, and can foster the character of the environment.

Student and Teacher Response Results

Students' responses to the modules were measured using questionnaires given after field trials. The results are shown in Figure 1 below.

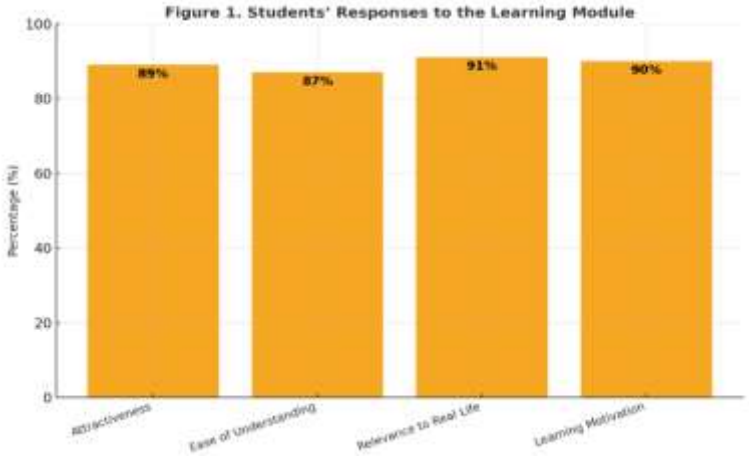

Figure 1. Student Responses to Learning Modules

Most students find the modules interesting, easy to understand, relevant, and motivating. The teacher also emphasized that the modules help with more contextual learning and foster active student engagement.

Module Effectiveness

The effectiveness of the modules was analyzed using paired t-tests on learning outcomes and environmental care attitudes before and after the use of the module.

Table 2. Results of the Student's Environmental Care Attitude T-Test

Aspects	Pretest (Mean)	Posttest (Mean)	t-count	Itself.(p)	Information
Keeping Habits Hygiene	64.7	83.2	7.25	0.000	Signifikan
Concern for Plant	63.5	81.7	6.94	0.000	Signifikan
Waste Management	61.8	82.0	7.81	0.000	Signifikan
Total Attitude	63.3	82.3	8.05	0.000	Signifikan

Source: Primary data, 2025

The results showed a significant increase in environmental care with the average score increasing from 63.3 to 82.3. An N-Gain analysis of 0.62 indicates Medium to high improvement category. This reinforces the findings (Erlina et al., 2025) that interactive modules can build students' character of caring for the environment.

Observation and Interview

Thematic analysis of the observations and interviews revealed three main themes:

1. Active involvement of students, characterized by increased participation in group activities and field practice.
2. Increased ecological awareness, demonstrated by new behaviors such as throwing garbage in place, carrying your own drinking bottles, and watering plants.
3. The relevance of the module to the local context, students feel closer to the material because it discusses the issue of floods that often occur in Kotabumi.

Table 3. Student Interview Excerpts

Theme	Report	Interview Excerpts
Involvement active	Students 14	"Learning is more fun, so we often discuss and practice in the field."
Awareness ekologis	Student 28	"Now I am more aware, so I am used to bringing a drinking bottle so as not to add to plastic waste."
Relevance Contextual	Students 33	"Because the module discusses floods in Kotabumi, I feel directly connected to everyday life."

Source: Primary data, 2025

These results are consistent with the theory of ecopedagogy (Adela & Permana, 2020) that real-life experience-based learning is more effective in fostering ecological awareness.

Discussion

Overall, the results of this study show that context-based Geography learning modules that integrate environmental values are effective in increasing students' environmental care attitudes. The modules developed have proven to be feasible, have received positive responses, and are able to have a significant influence on changes in student attitudes.

These findings reinforce the view (UNESCO, 2020) that education for sustainable development must be based on local contexts in order for students to be more critical and responsible for their environment. In addition, the results of this study are in line with (Torro et al. 2021), which emphasizes the importance of active and participatory learning in increasing ecological awareness.

Thus, this research provides theoretical contributions in the development of environment-based learning models, as well as practical contributions in the form of modules that can be used by teachers to increase students' environmental awareness.

Conclusion

This research has succeeded in developing a Geography learning module on *the Environment as a Sustainable Living Habitat* material using the ADDIE development model. The resulting module was declared very feasible based on the results of the validation by material experts.

Linguists and design experts received positive responses from students and teachers. In addition, the results of the trial showed a significant increase in students' environmental care attitudes, shown through the results of the paired t-test and the N-Gain analysis, which was in the medium to high category.

These findings indicate that learning based on contextual modules not only improves cognitive learning outcomes but is also effective in shaping students' character, especially in the dimension of concern for the environment. Furthermore, learning that is associated with local contexts, such as flood problems in Kotabumi, has proven to be relevant and able to foster students' ecological awareness.

Thus, this research strengthens the theory and practice of environmental education that is oriented towards sustainable development, as well as providing practical contributions in the form of modules that can be widely used by Geography teachers in supporting the achievement of the Pancasila Student Profile, especially in the aspects of cooperation, critical reasoning, and faith and noble ethics.

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