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Needs Analysis as a Foundation for Developing an ESD-Based Science E-Module to Cultivate Elementary School Students' Moral Awareness of Environmental Sustainability

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Abstract: *This study aims to analyze the needs of elementary school students in relation to the development of a Science e-module based on Education for Sustainable Development (ESD) in order to foster green moral awareness. The background of this research lies in the low level of students' awareness of environmental issues and the importance of integrating sustainability values into the learning process, particularly in science education. The research employed a qualitative descriptive method. Data were collected through interviews, observations, and documentation involving fourth-grade teachers and students. The analysis revealed that students require learning media that are interactive, contextual, and capable of building both understanding and a caring attitude toward the environment. These findings serve as a crucial foundation for designing an ESD-based e-module that aligns with the characteristics and learning needs of elementary school students. The development of this ESD-based e-module is expected to provide a solution for enhancing students' understanding of scientific concepts while simultaneously instilling sustainability values from an early age.*

Keywords: *E-modul IPA, Moral Green, ESD*

Abstrak: Penelitian ini bertujuan untuk menganalisis kebutuhan peserta didik terhadap pengembangan e-modul Ilmu Pengetahuan Alam (IPA) berbasis Education for Sustainable Development (ESD) guna menumbuhkan kesadaran moral green pada siswa sekolah dasar. Latar belakang penelitian ini adalah rendahnya kesadaran peserta didik terhadap isu-isu lingkungan dan pentingnya integrasi nilai-nilai keberlanjutan dalam proses pembelajaran, khususnya pada mata pelajaran IPA. Metode penelitian yang digunakan adalah deskriptif kualitatif). Data dikumpulkan melalui wawancara, observasi, dokumentasi kepada guru dan siswa kelas IV SD. Hasil analisis menunjukkan bahwa peserta didik membutuhkan media pembelajaran yang interaktif, kontekstual, dan mampu membangun pemahaman serta sikap peduli terhadap lingkungan. Temuan ini menjadi dasar penting dalam perancangan e-modul berbasis ESD yang sesuai dengan karakteristik dan kebutuhan belajar siswa SD. Pengembangan e-modul berbasis ESD diharapkan mampu menjadi solusi untuk meningkatkan pemahaman konsep IPA sekaligus menanamkan nilai-nilai keberlanjutan sejak dini.

Kata Kunci: *E-modul, Moral Green, ESD*

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INTRODUCTION

The problem of flooding has not diminished over time but has instead increased in volume and scale. This environmental degradation serves as an alarming sign for humanity, reminding citizens to be increasingly vigilant toward nature, which has begun to show its own warnings (Praja, 2021). Environmental damage occurs as a result of society's lack of concern for the surrounding environment (Oktamarina, 2021).

Environmental issues have become increasingly complex and demand the involvement of primary education in instilling sustainability values. Education for Sustainable Development (ESD) emphasizes the development of competencies in critical thinking, ethical reasoning, and concern for environmental issues from an early age(Stefania Giannini, 2022). Through ESD-based learning, students are expected to develop critical thinking in responding to green moral problems (Yolanita, 2024). However, green moral awareness has not yet emerged among students due to the absence of an established curriculum for ESD learning. Consequently, textbooks only focus on subject matter (Eliyawati et al., 2023); teachers still lack an understanding of the concept of sustainable development (Rahmawati et al., 2021); and contextual learning in science education has not yet been fully realized(Firda et al., 2024).

Education is the most strategic approach to instilling and implementing development values. This can be observed from improvements in economic, educational, infrastructure, and sustainable development aspects. Development in this context refers to shaping students' ways of thinking as educational subjects who are prepared for future life, integrated with ESD (Latifah et al., 2018). To create a generation that cares for and loves the environment, it is necessary to instill environmental awareness and character from an early age (Oktamarina, 2021).

To deliver material related to ESD, appropriate learning media are required. High-quality teaching materials should meet several criteria: they should be aligned with learning outcomes, present concepts interactively, stimulate critical and creative thinking, and display an engaging presentation(Yolanita, 2024). However, the current condition shows a lack of ESD-based learning media in elementary schools. This has resulted in students' low level of green moral awareness. Digital technology has transformed teaching methods in educational settings, making interactive, collaborative, and problem-based learning more feasible (Abdul Sakti, 2023). Digital media also provide new opportunities to create more engaging and participatory learning experiences (Putra & Pratama, 2021). One interactive and engaging form of learning media is the electronic module (e-module).

E-modules adapt many elements of printed modules and can even integrate text, images, animations, and videos. They can be accessed anytime and anywhere through digital devices such as laptops, tablets, or smartphones, which are commonly owned by students in this technological era (Usman, 2021). The use of e-modules as self-learning materials encourages students to actively review knowledge gained at school independently and interactively. This helps develop students' attitudes and knowledge according to their abilities, thus providing more meaningful and enjoyable learning experiences (Zulfi Idayanti & Muh. Asharif Suleman, 2024).

Based on these considerations, the development of interactive ESD-based e-modules is an effective alternative solution for increasing green moral awareness. However, a needs analysis is required to ensure that the development results are aligned with students' context and characteristics. Therefore, this study aims to analyze the needs of teachers and students for ESD-based science learning media as a foundation for developing e-modules to foster green moral awareness.

RESEARCH METHOD

This study employed a descriptive qualitative approach, as the research aimed to gain an in-depth understanding of teachers' and students' perceptions, experiences, and needs. This approach enabled the researcher to explore narrative and contextual data (Miles et al., 2014). The research subjects were selected using purposive sampling, namely by choosing based on specific considerations (Sugiyono, 2015), consisting of a teacher with 15 years of teaching experience and 17 students. Data collection techniques included in-depth interviews, observation, and documentation. Data analysis techniques involved reduction, data presentation, conclusion drawing, and verification (Miles et al., 2014). Data reduction consisted of compiling information from interviews, observations, and documentation, followed by data presentation and conclusion drawing.Data validity was ensured through source triangulation and technique triangulation (Miles et al., 2014). Source triangulation involved teachers, students, and documents, while technique triangulation was conducted through observation, interviews, and documentation. Source triangulation was employed to enhance credibility by collecting data and comparing information obtained from different sources.

RESULTS AND DISCUSSION

Needs analysis as the basis for developing an ESD-based Science E-Module to foster elementary school students' green moral awareness is presented as follows:

Learning Centered on Textbooks Without Linking to Sustainability Issues

Based on interviews and classroom observations, it was found that learning activities are centered on textbooks without connecting to sustainability issues.

"Learning only relies on the student worksheet (LKS) without linking it to sustainability issues such as water crises or pollution, since the LKS does not address these topics. We focus on cognitive understanding of the material so that students can achieve good scores in quizzes and tests." – Classroom Teacher

This finding is supported by the research of Eliyawati et al. (2023), which states that green moral awareness has not yet emerged among students due to the absence of an established curriculum for ESD-based learning. As a result, textbooks only focus on subject content. This condition has led to teachers' limited understanding of the concept of sustainable development within ESD (Rahmawati et al., 2021). Furthermore, contextual learning about the environment has not been optimally implemented in science education (Firda et al., 2024).

Teachers Have Not Utilized E-Modules in LearningT

Teachers stated that they have not yet used digital e-modules in science learning. The media employed were limited to textbooks and student worksheets (LKS). In contrast, students expressed greater interest in learning when interactive digital media, images, videos, and educational games were used.

"Actually, children are more interested when learning with something new, especially through digital platforms. Once I played a video, and their enthusiasm was extraordinary. However, due to limited time and technological use, I still rely only on textbooks and worksheets." – Teacher

Interviews with four randomly selected students revealed that they preferred digital-based learning that included images, videos, and games.

Table 1. Students' Statements Table

Student	Statement
Student 1	"I like lessons that include games."
Student 2	"I prefer learning using a phone because we can see images more clearly, unlike in textbooks."
Student 3	"I enjoy learning when watching videos because the material becomes clearer."
Student 4	"I like it when there are games, and we can watch videos and see pictures, especially colored ones."

This finding is consistent with Utama et al. (2023), who noted that students are more interested in computer-based learning when various instructional materials, such as videos, images, and games, are provided to help them better understand the subject matter.

Students Do Not Yet Understand the Importance of Protecting the Environment

The interview results showed that green moral awareness is still low, as evidenced by the fact that most students do not yet understand the importance of environmentally friendly behavior. They rarely engage in activities such as sorting waste, planting trees, or conserving water. Some even still litter carelessly.

"Students do not yet understand the importance of protecting the environment. They still often throw garbage carelessly and show no initiative to pick it up when they see it. They tend to leave the water tap running without turning it off, sometimes causing water to overflow in the sink. They have not yet understood the long-term impact if the environment is not protected." – Teacher

This is consistent with the findings of Ismail (2021), who stated that there is a lack of awareness in maintaining school environmental cleanliness. The development of green moral awareness can be carried out through environmentally oriented learning (Ismail, 2021).

Teachers Require Learning Media That Relates to the Environment

"There is a need for enjoyable learning media that include environmental problems familiar to students. If possible, the media should be interactive so that it will foster learning interest and actions to protect the environment." – Teacher

The needs analysis showed that both students and teachers require learning media that present science material visually, interactively, and engagingly; connect science concepts with environmental issues around students; and encourage students to think critically and act to protect the environment. This aligns with Haka et al. (2024), whose development of the Canva-based electronic module E-JASBIO showed a significant improvement in students' environmental awareness.

Linking Learning to the Surrounding Environment

"Actually, learning will be more meaningful if conducted contextually by linking or engaging students in activities such as planting in the garden, visiting rivers, or other places. However, time, cost, and distance are limiting factors." – Teacher

Teachers stated that students would find it easier to understand science concepts if they are linked to nearby environmental conditions such as the school garden, farmland, or nearby rivers, while also showing the impacts that occur.

Learning Media Containing Videos, Games, and Attractive Colored Images for Independent or Group Use

Teachers expect learning media that contain instructional videos, can be used independently or in groups, include games, and are presented in an attractive format. Challenges faced by teachers include a lack of training in media development, limited digital facilities in schools, and limited time to take students outside the school.

"Actually, children are more interested when learning something new, especially with digital platforms. Students enjoy learning through video playback, and especially when learning involves playing games." – Teacher

This is consistent with Utama et al. (2023), who mentioned that students are more interested when computer-based learning incorporates various instructional materials in the form of videos, images, and games to help them better understand the subject matter.

Conclusion and Suggestions

Based on the results of the needs analysis, it can be concluded that science learning in elementary schools has not yet adequately integrated ESD values. Teachers and students require digital learning media in the form of interactive and contextual e-modules. The development of ESD-based science e-modules is highly important as a means to foster students' green moral awareness from an early age. The e-module is designed to address obstacles such as limited digital facilities and is expected to increase students' interest in developing green moral awareness.

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