Gunung Djati Conference Series, Volume 60 (2025)
Conferences Series Learning Class
ISSN: 2774-6585
Website: https://conferences.uinsgd.ac.id/

Biodiversity Book Product in Improving Critical Thinking

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Abstrak

Penelitian ini menciptakan buku nonteks tentang keanekaragaman hayati Sumatera yang dapat meningkatkan kemampuan berpikir kritis dan pemecahan masalah siswa. Penelitian dan pengembangan berbasis ADDIE ini menargetkan siswa kelas X di SMA Negeri 1 Paranginan. Metode yang digunakan meliputi lembar validasi ahli, kuesioner, dan tes berpikir kritis. Penelitian ini menemukan bahwa buku nonteks tentang keanekaragaman hayati Sumatera bersifat praktis, aplikatif, dan bermanfaat dalam meningkatkan kemampuan berpikir kritis siswa. Hasil evaluasi menunjukkan bahwa nilai N-gain kemampuan berpikir kritis (KBK) siswa kelas eksperimen adalah 75,7% (efektif).

Kata kunci: Keanekaragaman Hayati Sumatera, Kemampuan Berpikir Kritis

Abstract

This study will develop a Sumatra biodiversity non-textbook to improve students' critical thinking and problem-solving skills. This ADDIE-based research and development targets grade X students at SMA Negeri 1 Paranginan. Methods include expert validation sheets, questionnaires, and critical thinking tests. The study found that Sumatra's biodiversity non-textbook is practical and beneficial for boosting students' critical thinking skills. Evaluation results show that the experimental class students' N-gain in critical thinking ability (KBK) is 75.7% (effective).

Keywords: Sumatran Biodiversity, Critical Thinking Skills,

1. INTRODUCTION

One of the most important skills students can acquire is critical thinking, which can be developed by being more involved in the learning process (Simarmata & Djulia, 2019). The ability to think critically is an essential skill in education focused on sustainable development. According to Arwita and Nuriza (2021), the issues that the 4.0 industrial revolution presents also necessitate the availability of human resources that are intrinsically motivated, possess a sustainable mindset, and have the capacity to generate innovative solutions that are conducive to sustainability. According to observations conducted in the tenth grade at SMA Negeri 1 Paranginan, the extent to which pupils engage in critical thinking remains relatively low. This is clear in the teacher-centered learning process, where professors typically deliver material directly to students, while students take notes and retain information without many opportunities to ask questions or express their thoughts. Because the majority of students merely replicate the responses of their classmates who are regarded as having greater knowledge, group discussions are not completely effective. Because of this condition, the pupils are unable to develop the skills needed to assess problems, relate concepts to real-world events, and draw conclusions from available data.

Additionally, interviews with biology professors have confirmed that students are less able to provide logical reasons or alternative answers when presented with contextual problems. It was noted by the instructor that a significant number of pupils continued to fixate on the example problems that were provided without making any effort to identify alternate answers. The fact that this is the case suggests that students in the tenth grade at Paranginan 1 State Senior High School have not yet developed their critical thinking and problem-solving skills to their full potential, which are qualities that should be considered 21st-century competences. As a result, there is a need to enhance the learning process to inspire students to be more engaged, creative, and better trained in developing their critical thinking and problem-solving skills.

Data collected on tenth-grade learning outcomes at Paranginan 1 State Senior High School showed that most pupils scored below the Learning Target Completion Criteria (KKTP), which is set at 75. Although they can answer straightforward questions that require memorization, they struggle with analytical or application challenges. A clear indication that students' critical thinking and problem-solving skills have not yet reached their full potential is the poor learning outcome scores, which fall below the KKTP of 75. Therefore, learning innovations and the development of teaching materials are needed to encourage students to be more active, analytical, and skilled in critical thinking and problem-solving, thereby improving learning outcomes in line with established standards.

The initial observations also revealed that the principal learning resource utilized by both teachers and students was a textbook published by a single publisher. This was found to be the case: the learning process was dominated by the textbook. The assignments given by teachers were typically drawn from pre-existing textbooks. The questions in these textbooks were not useful for evaluating students' thinking skills, and they lacked both motivation and opportunities for critical thinking. In addition, the textbooks were too long, causing students to quickly become bored and lose interest in reading. The learning process should captivate students' attention and interest to ensure that the learning objectives are achieved to the greatest extent. Less engaging learning will make students bored, thereby impacting their learning outcomes (Khairani et al., 2023). In addition, learning objectives can be achieved more efficiently with sufficient instructional materials. According to Rozalia et al. (2018), increasing the use of teaching materials creates a more communicative and dynamic learning environment and reduces teacher domination during the learning process. Teaching materials include

not only textbooks/packages, modules, and media, but also non-textbook materials that support student learning. (Rofi'ah et al., 2021) Non-textbooks are books considered additional or enrichment materials that can support learning at any level of education. However, these books are not the primary textbooks students use in their learning.

2. RESEARCH METHODS

This research is a research and development (R&D) study. The development model used in this study is the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The non-textbook on Sustainable Development Goals (SDGs)-based biodiversity in Sumatra was developed using the ADDIE model procedures.

This ADDIE development consists of five steps, namely: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The following are the systematic stages as follows;

Analysis

Conducting an analysis to gather information related to student needs and analyzing the need to develop a non-textbook on biodiversity in Sumatra based on the SDGs for learning objectives, as well as reviewing literature related to the developed non-textbook.

Design

Identifying objectives and creating a draft of a non-textbook on biodiversity in Sumatra based on the SDGs to improve critical thinking skills in 10th-grade high school students, as well as designing the test instruments to be developed.

Development

At this stage, the designed non-textbook is validated by experts to ensure its quality, content suitability, and suitability as a learning medium.

Implementation

Implementing the non-textbook based on the SDGs in biodiversity learning for 10th-grade high school students in real-life classroom situations.

Evaluation

The final stage, which grades the resulting non-textbook on biodiversity in Sumatra based on the SDGs.

3. RESULTS AND DISCUSSION

This state-of-the-art research has novelty value, because there has been no research and development of non-textbooks on biodiversity in Sumatra, and is given SDGs-based innovation to improve students' critical thinking and problem-solving skills, and is expected to contribute to the implementation of SDGs goals and targets in education and environmental aspects. This book was developed using the ADDIE model, covering the stages: Analysis, Design, Development, Implementation, and Evaluation.

The eligibility of non-textbooks based on learning aspects was reviewed and validated by two Biology Lecturers, FMIPA, Unimed, as a validator team of learning experts, on the indicators of material content, constructive requirements and didactic requirements. The results of the assessment by the validator team of learning experts are summarized in Table 1.

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Table 1. Summary of Learning Expert Validation Results

Indicators	Experts (%)		Average per Indicator (%)	Criteria
	I	II		
Material Content	100	90,0	Very Eligible	Sangat Layak
Constructive Requirements	88,0	80,0	Very Eligible	Sangat Layak
Didactic Requirements	91,4	91,4	Very Eligible	Sangat Layak
Overall Indicators	91,4	87,1	Very Eligible	Sangat Layak

Based on tabel 1 that the results of the assessment of the learning expert team on non-textbooks, on the material content indicator obtained an average percentage score of 95.0% (very appropriate), on the constructive requirements indicator obtained an average percentage score of 84.0% (very appropriate), on the didactic requirements indicator obtained an average percentage score of 91.4% (very appropriate) and for all indicators obtained an average percentage score of 89.3% or classified as very appropriate criteria. Based on the assessment results by the learning expert team, it was concluded that the non-textbook on biodiversity in Sumatra based on SDGs that was developed had met the very appropriate criteria based on the learning aspects on the material content indicator, constructive requirements and didactic requirements.

Furthermore, based on input and notes from the validator team of material experts, learning experts, and design experts, several sections of the SDGs-based non-textbook on biodiversity in Sumatra that were developed needed revision. The revised sections were based on input and notes from the expert validator team. The product can be viewed in the product.

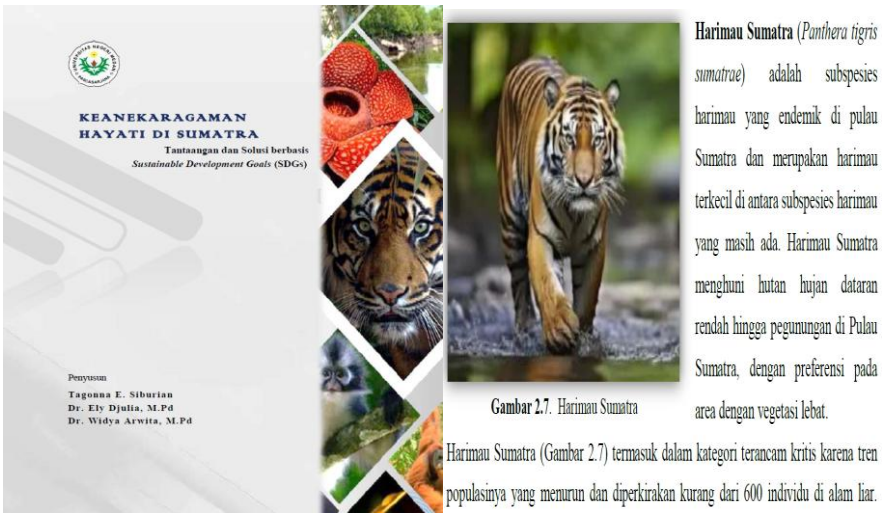

Figure 1. product diversity

The effectiveness aspect is a criterion for the quality of the developed teaching tools or materials, assessed by student appreciation for learning. High student appreciation will increase students' desire to learn, which in turn can improve student achievement. Effective teaching materials are considered effective if they achieve their intended goals. The effectiveness of the developed teaching materials

can be measured based on the achievement of learning objectives and through evaluations or tests given to students after participating in learning activities.
The effectiveness of the SDGs-based non-textbooks in this study was also met quantitatively (values) and qualitatively (categories) based on the consistency of several evaluation and measurement results, including pre- and post-test scores for students' critical thinking and problem-solving abilities, and the calculation of improvements in students' critical thinking and problem-solving abilities (N-gain). The effectiveness of the teaching materials in improving students' critical thinking and problem-solving abilities can also be analyzed using an Independent Sample t-test approach by comparing post-test scores between the experimental class that implemented learning using SDGs-based non-textbooks on biodiversity in Sumatra and the control class that received direct instruction using textbooks (conventional).

The results of the initial evaluation (pretest) of students' critical thinking skills in the experimental class before being given the intervention, obtained an average pretest score of 39.53 ± 6.007. After being given learning with SDGs-based non-textbooks, the results of the final evaluation (posttest) obtained an average posttest score of students' critical thinking skills of 85.31 ± 6.874; or an increase in critical thinking skills with N-gain of 75.7% (effective). Meanwhile, the results of the initial evaluation (pretest) of students' critical thinking skills in the control class before being given the intervention, obtained an average pretest score of 41.11 ± 7.502. After being given direct learning using textbooks/conventional (without SDGs-based non-textbooks), the results of the final evaluation (posttest) obtained an average posttest score of students' critical thinking skills in the control class of 77.89 ± 6.964; and there was an increase in critical thinking skills with N-gain of 62.5% (quite effective). The results of the analysis or hypothesis testing on the post-test data of critical thinking skills between the experimental class and the control class, using the Independent Sample t-test approach, obtained a t-value > t-table, namely 4.548 > 1.665 and a Sig. value of 0.000 < 0.05; so it is concluded that there is a significant difference between the average post-test of critical thinking skills of students in the experimental class and the control class after being given different actions, with a difference in the mean difference (mean difference) of post-test critical thinking skills between students in the experimental class (85.31) and students in the control class (77.89) of 7.42. These results also indicate that the application and use of SDGs-based non-textbooks (experimental class) are more effective in improving students' critical thinking skills than the control class. Thus, it is concluded that SDGs-based non-textbooks on biodiversity in Sumatra are effectively used in the learning process to improve students' critical thinking skills with an N-gain of 75.7% (effective).

4. CONCLUSION

Taking into consideration the findings of the research and the debates that were presented before, the following conclusions were reached: The non-textbook on biodiversity in Sumatra that was built based on the Sustainable Development Goals (SDGs) has been deemed suitable for use, according to evaluations conducted by the validator team consisting of 80 percent of material experts, 89.3 percent of learning experts, and 78.8 percent of media and design experts. With an N-gain of 75.7% (effective) and statistical test findings with a probability value (sig.) of 0.000 < 0.05, the implementation of the Sustainable Development Goals-based non-textbook on biodiversity in Sumatra has been demonstrated to be beneficial and has considerably improved the critical thinking skills of students.

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