

Development Of Guided Inquiry-Based Ethnoscience Textbook To Improve Critical Thinking Skills Of Junior High School Students

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Abstract

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Critical thinking is a vital skill in science education; however, it remains a significant challenge for junior high school students, particularly in learning about elements, compounds, and mixtures. This research aims to design and evaluate a guided inquiry-based ethnoscience textbook intended to enhance students' critical thinking abilities. The textbook incorporates elements of local culture by connecting traditional food from Jember, suwar suwir, with contemporary scientific concepts. The study utilizes a Research and Development (R&D) approach following the ADDIE model, which includes the phases of analysis, design, development, implementation, and evaluation. Data collection involved expert validation sheets, classroom observation during implementation, pre-tests and post-tests, as well as student response questionnaires. The findings reveal that the textbook reached a validity score of 95% (categorized as very valid), a practicality score of 91.71% (very practical), and an effectiveness level demonstrated by an average N-gain of 0.70 (high category). Additionally, student responses scored 93.61%, indicating very positive feedback. Therefore, the guided inquiry-based ethnoscience textbook is considered valid, practical, and effective, and it is suitable for use in science education to support the development of critical thinking skills among junior high school students.

Keywords: *Textbook, Ethnoscience, guided inquiry, critical thinking, Research and Development (R&D)*

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INTRODUCTION

Education in Indonesia continues to evolve in order to improve the quality of human resources that are excellent and competitive in the global era. One of the essential skills that needs to be developed in students is critical thinking ability (Darmawan *et al.*, 2023). However, various studies indicate that Indonesian students' critical thinking skills remain relatively low. According to the Trends in International Mathematics and Science Study (TIMSS) 2019 report, Indonesian students ranked among the lowest in the aspect of reasoning, which refers to the ability to think and analyze information logically (IEA, 2019). This condition reflects that most students are still operating at lower-order thinking skills and are not yet accustomed to developing higher-order thinking skills such as analyzing, evaluating, and drawing conclusions (Sa'adah *et al.*, 2020).

Science (Ilmu Pengetahuan Alam or IPA), as one of the core subjects in junior high school, emphasizes the understanding of concepts through observing natural phenomena and applying concepts in daily life (Lubis *et al.*, 2023).

Therefore, science learning should not only focus on cognitive aspects but also aim to foster students' critical thinking skills. However, in practice, many students still struggle to apply scientific concepts in real-life contexts. This is due to the lack of instructional approaches that emphasize scientific reasoning and higher-order thinking processes (Susilawati et al., 2020).

One instructional model considered effective in fostering critical thinking skills is the guided inquiry-based learning model. This model provides opportunities for students to actively engage in the learning process through structured investigation while still receiving guidance from the teacher (Minner et al., 2019). Guided inquiry learning has been proven to enhance conceptual understanding, science process skills, and students' critical thinking abilities. However, the implementation of this model in schools is still limited due to teachers' lack of understanding regarding its application strategies (Nugroho et al., 2021).

In addition to instructional models, the quality of teaching materials also plays a crucial role in supporting successful learning. Textbooks are one of the main learning resources that can facilitate the achievement of students' basic competencies (Malahayati & Zunaidah, 2021). Unfortunately, many textbooks used in schools are not yet relevant to students' local contexts, making the material less meaningful and difficult to understand. To overcome this, the ethnoscience approach becomes a relevant alternative. Ethnoscience integrates local knowledge with modern scientific concepts, making learning more contextual and meaningful (Faudi et al., 2020). This approach is believed to increase students' learning interest and critical thinking skills because it relates to their daily lives and local culture (Satria & Egok, 2020).

Interviews conducted by the researcher with junior high school science teachers revealed that the learning process still heavily relies on standardized textbooks provided by schools, without innovation in teaching material development. As a result, learning tends to be cognitively oriented and lacks development in students' skills and affective domains. Teachers' limited understanding of how to relate science to local culture also poses a challenge in applying contextual approaches. In fact, the integration of traditional and scientific knowledge can enhance the relevance of the material and improve students' critical thinking abilities (Mahardika et al., 2022).

Based on these issues, the researcher sees the need to develop an ethnoscience-based textbook integrated with the guided inquiry learning model. This textbook is expected to serve as a relevant, contextual, and effective learning tool to foster students' critical thinking skills. Therefore, this study focuses on the development of an Ethnoscience-Based Guided Inquiry Textbook to Improve Critical Thinking Skills of Junior High School Students.

RESEARCH METHOD

This study employed the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation), chosen for its systematic and flexible nature, making it suitable for the development and evaluation of teaching materials. ADDIE allows for structured stages of educational product development, starting from needs analysis to final product evaluation. The research used a development research design based on the ADDIE model. The population in this study included all 8th-grade students in public junior high schools (SMP) in Jember, with the

sample being class VIII J, consisting of 34 students selected using simple random sampling.

The instruments used in this study included expert validation sheets to assess the feasibility of the content, language, presentation, and graphics of the textbook; observation sheets to determine the practicality of using the textbook during learning; pretest and posttest questions to measure the effectiveness of the textbook in improving students' critical thinking skills; and a student response questionnaire to assess students' interest, content understanding, and language clarity. The selection of these instruments was based on the objectives of the research, namely to assess the validity, practicality, effectiveness, and students' responses to the developed product.

Data collection was carried out through several stages according to the ADDIE model. In the analysis stage, interviews with science teachers and classroom observations were conducted to understand students' conditions, the teaching materials used, and problems encountered during the learning process. In the design stage, an initial draft of the ethnoscience-based textbook was developed along with supporting tools such as validation sheets, pretest-posttest questions, and student response questionnaires. The development stage involved material and media experts to validate the content and design of the textbook. In the implementation stage, the textbook was tried out in class VIII J to assess its practicality and effectiveness in real learning situations. Finally, in the evaluation stage, revisions were made to the textbook based on input from validators, implementation observations, student feedback, and pretest-posttest results. These stages were designed to produce a textbook that is valid, practical, and effective in enhancing students' critical thinking skills.

RESEARCH RESULTS AND DISCUSSION

This research produced a product in the form of a Guided Inquiry-Based Ethnoscience Textbook aimed at enhancing critical thinking skills of junior high school students. It was implemented in Grade VIII science learning on the topic of elements, compounds, and mixtures. The textbook development followed the ADDIE model, which includes five stages: Analyze, Design, Develop, Implement, and Evaluate, as described below.

Analyze Stage

At this stage, the researcher conducted observations to identify problems in science learning in Grade VIII at SMP Negeri 7 Jember. The analysis covered the curriculum used, learning constraints, teaching materials, as well as facilities and infrastructure. Based on interviews with the science teacher, it was found that students had diverse characteristics, with some showing low participation, especially during class discussions and Q&A sessions. The school implemented the *Merdeka Curriculum* for Grades VII and VIII, and the 2013 Curriculum for Grade IX. Science learning relied heavily on printed teaching materials from the Ministry of Education, such as textbooks and worksheets, which often made students feel bored and struggle to understand the content.

There had never been any ethnoscience-based guided inquiry textbooks implemented in the school. Therefore, this development aims to enhance learning motivation and critical thinking skills through a contextual approach that incorporates local characteristics, such as Jember's traditional foods (*suwar-suwir* and *prol tape*), into the topic of elements, compounds, and mixtures.

Design Stage

In this stage, the researcher designed the Guided Inquiry-Based Ethnoscience Textbook using the Canva application. The textbook was prepared in PDF format and later printed for use in class. The content focused on the topic of elements, compounds, and mixtures, presented in a structured manner from basic to complex concepts. The textbook included illustrations, images, and contextual examples based on local wisdom, particularly local foods from Jember.

It was also equipped with guided inquiry activities and practice questions to foster students' critical thinking skills. The design fulfilled criteria for effective teaching materials—visually appealing, easy to understand, appropriate for students' cognitive development, and aligned with their needs.



Figure 4.1 shows the textbook cover.

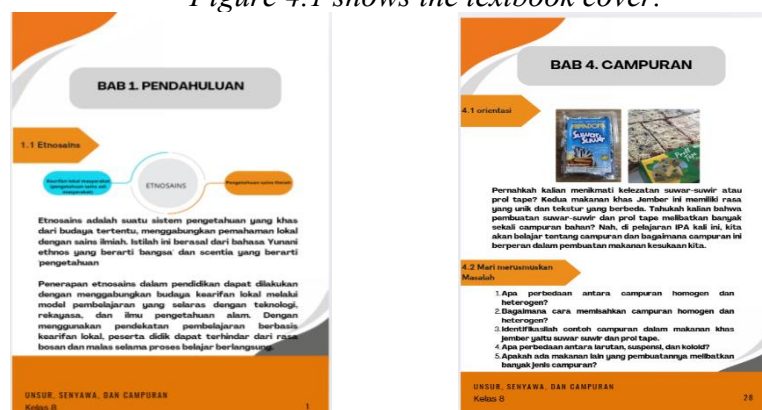


Figure 4.2 shows an example of the introduction and main content.

Development Stage

The developed textbook was validated by three experts, consisting of one lecturer and two junior high school science teachers. The validation assessed several aspects: approach, format, language, content, and practicality.

Table 1. Validation Results of the Guided Inquiry-Based Ethnoscience Textbook

Aspect	Percentage Scores from Each Validator (%)			Persentase	Kategori
	V1	V2	V3		
Approach	94,64	94,64	95,62	91,42	Very valid
Format	95	100	90,62	98,33	Very valid
Language	95	95	93,75	95,00	Very valid

Content	94	89	87,5	93,52	Very valid
Practicality	95	95	93,67	96,67	Very valid
Rata-rata skor (%)	95,09	94,63	95,74	95,06	Very valid

The textbook obtained an average score of 95.06%, classified as **very valid**. Revisions were made based on expert suggestions regarding content and design to improve quality. Validation of the module structure is shown in Table 2:

Table 2. Module Structure Validation

Aspect	Validator (%)			vg (%)	Category
	V1 (%)	V2 (%)	V3 (%)		
General Information	94	100	100	98	Very valid
Competency Targets	75	75	75	75	Very valid
Pancasila Profile	100	75	100	91.66	Very valid
Facilities and Infrastructure	100	75	100	91.66	Very valid
Learning Objectives	100	75	100	92	Very valid
Learning Activities	88	88	100	92	Very valid
Assessment	88	100	100	96	Very valid
Average	94	83	93	90.1	Very valid

To measure effectiveness, pretest and posttest questions were developed based on critical thinking indicators. The validation results are shown below:

Table 3. Pretest-Posttest Validation Results

Aspect	Percentage Scores from Each Validator (%)			Persentase (%)	Kriteria
	V1	V2	V3		
content	87,50	75,0	79,17	80,56	Very valid
Longuage and Clarity	91,67	75,0	79,17	81,94	Very valid
Rata-rata skor (%)	89,58	75,0	79,17	81,25	Very valid

Implementation Stage

The trial implementation of the textbook was conducted in Grade VIII J of SMP Negeri 7 Jember, involving 34 students. The purpose of this stage was to assess the practicality of the textbook in real classroom conditions. Observations were carried out by three observers across six meetings.

In the first meeting, the percentage scores from Observer 1 (O1), Observer 2 (O2), and Observer 3 (O3) were 90.65%, 93.75%, and 90.62%, respectively, with

an average score of 91.67%, categorized as very practical. In the second meeting, the observers recorded scores of 100%, 90.62%, and 90.62%, resulting in an average of 93.74%, also falling in the very practical category. The third meeting obtained scores of 93.75%, 87.50%, and 93.75%, with an average of 91.66%. The fourth meeting had slightly lower scores—87.15%, 90.62%, and 87.50%—with an average of 88.54%, but still considered very practical. In the fifth meeting, the scores were 90.62%, 87.50%, and 93.75%, averaging 90.62%. Finally, in the sixth meeting, the observers recorded 93.75%, 90.62%, and 97.50%, with an average of 94.04%. Overall, the average practicality score across all meetings was 91.71%, placing the textbook in the “very practical” category.

Evaluation Stage

The evaluation stage was conducted to determine the effectiveness of the textbook through a pretest–posttest analysis and student response questionnaires. In terms of learning outcomes, students showed a significant improvement from the pretest to the posttest. The pretest scores had a maximum of 77, a minimum of 33, and an average of 51.9. After the implementation, the posttest scores increased to a maximum of 96, a minimum of 77, and an average of 86.5. The N-gain score was calculated to be 0.72, which falls into the high effectiveness category.

Critical thinking skills were assessed based on six indicators. The *Interpretation* indicator improved from 9.9 to 15, yielding an N-gain of 0.72 (high). The *Analysis* indicator rose from 11 to 15.05, with an N-gain of 0.67 (moderate). The *Evaluation* indicator increased from 10.3 to 13.94, with an N-gain of 0.54 (moderate). The *Inference* indicator improved from 6.67 to 13.5, scoring an N-gain of 0.66 (high). The *Explanation* indicator showed the highest gain, rising from 5.79 to 15.3 with an N-gain of 0.85 (high). Lastly, the *Self-regulation* indicator increased from 5.76 to 14.14, with an N-gain of 0.74 (high). On average, the overall N-gain for critical thinking was 0.70, categorized as high.

Student responses to the textbook were also highly positive. Based on the questionnaire results, the *Engagement* aspect scored 93.18%, the *Content* aspect scored 94.09%, and the *Language* aspect scored 93.56%. The overall average response was 93.61%, which falls under the “very good” category. These results indicate that the textbook was well-received by students and effectively supported the development of their critical thinking skills.

Discussion

The results indicate that the development of a Guided Inquiry-Based Ethnoscience Textbook on the topic of elements, compounds, and mixtures is valid, practical, and effective in enhancing junior high school students’ critical thinking skills. Validation by three experts yielded an average score of 95.6%, categorized as very valid. The ethnoscience and inquiry-based approaches aligned with learning objectives and effectively supported the development of critical thinking. This supports previous findings that instructional materials with a validity score above 70% are considered appropriate for use (Wahyuni et al., 2022).

In terms of practicality, the average implementation rate was 91.71%, indicating that the textbook can be flexibly used in individual, small group, or whole-class settings. Novanda et al. (2024) stated that practical teaching materials are those that are easy to use by both teachers and students and support optimal learning implementation. This practicality was also evident through the successful implementation of guided inquiry stages in the classroom.

Effectiveness testing showed a significant increase in critical thinking, with an N-gain score of 0.72 (high category). According to Hake (1998), an N-gain above 0.70 indicates a high level of learning improvement. The highest gains were in explanation and self-regulation, while evaluation had the lowest, although it still improved. This suggests that the textbook effectively enhances students' critical thinking skills, though evaluative skills may need further reinforcement.

Student responses were also very positive, with an average score of 93.61% (very good), reflecting their interest in the material, visuals, and language. Wahyuni et al. (2022) stated that a positive response toward learning materials indicates student interest and motivation. The ethnoscience approach successfully connected subject matter with local culture, making learning more contextual and meaningful.

However, challenges were encountered during implementation, especially due to limited laboratory tools. These can be addressed by strategies such as small group divisions, using alternative tools, and teacher guidance prior to practical sessions. Overall, the findings suggest that the ethnoscience-based guided inquiry textbook is a feasible alternative teaching material to improve students' critical thinking on the topic of elements, compounds, and mixtures.

CONCLUSION

The ethnoscience-based guided inquiry textbook is deemed suitable for use in science learning at the junior high school level, particularly for the topic of elements, compounds, and mixtures. Validation results by three expert validators indicated an average percentage of 95%, which falls into the very valid category. In terms of practicality, the textbook achieved an implementation percentage of 91.71%, categorized as very practical. Meanwhile, the effectiveness of the textbook is demonstrated by the improvement in students' critical thinking skills, with an average N-Gain score of 0.70, which is classified as "high." Therefore, the textbook is valid, practical, and effective for enhancing junior high school students' critical thinking skills in science learning.

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