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Ethnoscience Analysis in Science Learning at Elementary Madrasahs in Pal Merah District, Kota Baru District, and Telanai Pura District, Jambi City

Maysarah[1*], Nazurty[1], Eddy Haryanto[1]

[1] Master of Elementary Education Study Program, Faculty of Teacher Training and Education, University of Jambi, Indonesia.

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Corresponding Author:
Maysarah
maysarah2580@gmail.com

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Abstract: This study analyzes the effect of CTL learning model based on ethnoscience on critical thinking skills and science learning outcomes of elementary school students. Initial observations indicate that students' critical thinking skills still need to be improved, especially in articulating their ideas and understanding. With a quantitative approach, data were collected through standardized research instruments and analyzed statistically. The results of the analysis showed a significant difference between the experimental group taught by CTL model based on ethnoscience and the control group. The F count was 83.267 ($p < 0.05$) for simultaneity between the two, 20.075 ($p < 0.05$) for critical thinking, and 168.644 ($p < 0.05$) for learning outcomes. Ethnoscience that connects traditional knowledge with modern science has been proven to play a strategic role in transforming learning. This approach allows students to construct knowledge by connecting academic concepts and cultural experiences, changing the learning model from conventional to constructivist that develops declarative and procedural knowledge. Learning experiences that are linked to cultural contexts create meaningful learning that enhances students' cognitive and metacognitive capacities. Ethnoscience not only bridges local wisdom and scientific knowledge, but also becomes a catalyst for the development of high-level thinking skills.

Keywords: Critical thinking skills; CTL; Ethnoscience; Science learning outcomes

Introduction

The process of improving students' abilities, skills, and attitudes requires a systematic series in Education facilitated through learning activities in Educational Institutions. Learning is an interactive system that encourages constructive dynamics between students and their environment, which significantly influences behavioral changes and cognitive development. The concept of integrated learning emphasizes an active exploration approach and conceptual discovery by students, which allows them to construct knowledge through direct involvement and meaningful experiences. An effective teaching process requires strategic organization of the learning environment, creating interactive spaces that support individual growth and encourage active student participation in knowledge construction (Pawe et al., 2024). From the above perspective, it can be concluded that education is a systematic process used by educational institutions to improve students' understanding and literacy in an academic environment (Dhoka et al., 2024).

Research in Indonesia reveals significant challenges related to students' problem-solving skills. The Programme for International Students Assessment (PISA) results consistently show that Indonesian students' performance is still below the international average, prompting the need for innovative teaching methods (Bate et al., 2024). So Ethnoscience, defined as the integration of local customs and knowledge, emerges as a potential strategy to improve problem-solving skills. Science education has goals that include

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increasing conceptual awareness, developing curiosity, active participation, inquiry skills, and self-awareness and the environment. Through an integrative and contextual approach (Sadiah et al., 2024).

This supports students in science education by seeking knowledge about the world, learning how to solve problems related to everyday life and the surrounding environment, and developing their ability to think critically and objectively (Sadiah et al., 2024). Especially in Madrasah Ibtidaiyah Mahabbatullah, learning resources available in the environment include plants, flower gardens, school yards, Batanghari River, and gardens that can be used for scientific and technological observations, as well as science and natural sciences materials (Alviya et al., 2023).This integration forms an enriching learning opportunity for students, as well as to enhance their understanding of natural sciences, culture and the environment (Pawe et al., 2024).

Several previous studies have shown the effectiveness of cultural integration in elementary school learning. Hidayanti et al. (2023) found that ethnoscience-based learning significantly improves students' scientific literacy, with students gaining hands-on experience and taking an active role in learning using ethnoscience-based problem-based learning models. This research is in line with the findings Sudarmin et al. (2018) which identified an average increase in critical thinking skills of 78% in the experimental group that applied the ethnoscience approach (Nathaniel, 2024). Western and African epistemology of science by documenting that science/chemistry educators have many resources that they can use to make chemistry teaching and learning more meaningful. At the same time, chemistry teaching will accommodate their concrete experiences and everyday experiences. The transformation of traditional knowledge into meaningful science learning concepts with increased student engagement makes chemistry teaching and learning meaningful. Unlike the aforementioned studies that focus more on cognitive aspects, this study not only explores how ethnoscience improves students' conceptual understanding, but also analyzes how the process of integrating scientific knowledge with local wisdom can shape students' cultural identity and environmental awareness. In addition, this study specifically develops a learning model that combines the ethnoscience approach with the newly implemented independent curriculum in Indonesia, filling the gap in the literature on the implementation of ethnoscience in the national curriculum that is undergoing transformation.

Ethnoscience consists of the words ethnos and scientia which means nation and knowledge. Ethnoscience itself also has the meaning of understanding a science from a society that comes from the beliefs it has (Wahyuningsih et al., 2024). In the independent curriculum learning that has been included in the ethnoscience study, students are encouraged to have high-level conceptual knowledge about their social and natural world. Learning in Indonesia, based on the independent curriculum, has directed teachers in socio-economic and socio-cultural integration (Rofisian et al., 2024).

Thus, there will be meaningfulness that occurs during the learning process (Fahrozy et al., 2022). It can be concluded that ethnoscience is a learning approach that uses local knowledge as a source/object of learning which can be integrated into learning that is presented contextually.

There are several important things found from this study, such as: (1) culture, education, cognition, and learning as collaborative learning methods that improve student learning outcomes; (2) theory, goals, and ethnoscience as educational strategies that focus on observation, meta-analysis of problem solving, and discovery of new things from students; (3) ethnoscience can be integrated into elementary school science, ecology, marine fisheries, and educational science, in general; (4) useful for teachers because they can discuss various beliefs or cultures of students; (5) Students can work on projects in groups in the learning process Based on the findings of the study, it is very important to integrate ethnoscience into the curriculum in Elementary Schools.

Ethnoscience in the Independent Curriculum

Independent Curriculum is an educational approach that gives schools the freedom to develop a curriculum according to students' local needs and context (Pratiwi et al., 2023). One important aspect of the Independent Curriculum is the integration of ethnoscience, which connects scientific knowledge with local wisdom, so that it is more relevant to students' daily lives (Gumilar, 2023). In the context of ethnoscience, the Independent Curriculum allows for the development of education that values cultural diversity and local wisdom, in accordance with the potential of the region and local community (Lestari et al., 2024).

According to Muyassaroh et al. (2024) the structure of the Independent Curriculum in elementary schools is regulated in the Decree of the Minister of Education, Culture, Research and Technology of the Republic of Indonesia Number 56/M/2022 concerning Guidelines for the Implementation of the Curriculum in the Framework of Learning Recovery, Development & Learning, which is divided into 3 phases, namely: a)

Phase A for students in grades 1 and 2; b) Phase B for students in grades 3 and 4; c) Phase C for students in grades 5 and 6 Phase A is the phase of developing and strengthening students' basic literacy and numeracy skills. In this phase, Natural and Social Sciences (IPAS) are not yet compulsory subjects. Phase B begins to teach IPAS which aims to build basic skills. To study IPAS. Schools can present learning for each subject or continue thematically that refers to the formation of the Pancasila profile character. Based on the explanation above, it can be concluded that there are three phases in the independent curriculum, namely phase A (grades 1 and 2), phase B (grades 3 and 4) and phase C (grades 5 and 6) and IPAS subjects begin to be taught in phase B, namely grade 3.

Independent Curriculum Structure for Ethnoscience in Elementary Education

In the Independent Curriculum, ethnoscience can be included in the curriculum structure through several subjects and approaches, which are arranged in the following main components:

Curriculum Components

a) Local Content (Learning Content)

Ethnoscience as part of local content allows cultural knowledge and practices as well as local wisdom to be part of learning. This provides space for students to understand scientific knowledge that is rooted in the experiences and cultural traditions of local communities (Setyowati et al., 2023). Examples: Learning about traditional technology, nature management methods, organic farming, and traditional herbal remedies.

b) Thematic Subjects

Ethnoscience can be included in thematic learning that connects several disciplines. For example, in the theme of nature and the environment, students can learn science through local cultural experiences such as how indigenous peoples utilize natural resources sustainably.

Integration of ethnoscience in science, mathematics, social, and art, with a contextual approach based on local wisdom.

c) Learning Project

In the Independent Curriculum, project-based learning is highly emphasized. Ethnoscience can be used to encourage students to study and solve problems related to their culture and environment, such as designing a tradition-based irrigation system or utilizing medicinal plants (Kamila et al., 2024).

So it can be concluded that the Merdeka Curriculum Structure based on ethnoscience in elementary education represents an innovative approach in integrating local knowledge with modern scientific constructs. Through problem-based methodology, projects, and contextual thematic approaches, this curriculum comprehensively connects students' empirical experiences with contemporary scientific frameworks. Based on the legal basis and theoretical studies of experts, the implementation of this curriculum is not only aimed at developing scientific literacy, but also transforming students' perspectives through strengthening characters that respect local wisdom, encouraging critical thinking skills, and developing creativity in responding to the dynamics of global change.

Method

This study uses a quantitative descriptive research design. This study aims to analyze students' initial knowledge of teaching materials.. In quantitative research, the researcher is present directly in the field with the aim of analyzing the data obtained can be trusted or accurate data. The subjects in this study were three Madrasah Ibtidaiyah located in three sub-districts in Jambi City. The three sub-districts are Telanai Pura, Kota Baru, and Pal Merah. The sample of this study was the fourth grade teachers in three Madrasah Ibtidaiyah located in Jambi totaling 20 people. The sample selection was carried out on the grounds that the teachers based on the data were teachers who taught the subject of Science. Furthermore, samples were also used from fourth grade students in three Madrasah Ibtidaiyah with a total of 140 samples from 6 classes with samples used 27 children for the experiment and 27 children for the control. This study took part of the population members to participate as samples and objects. The classes used as samples in this study were classes IV C and IV F, for data collection through learning outcome tests in the form of 20 multiple-choice questions, namely in the experimental class and the control class. Then, the data collection for the critical thinking ability test in the form of 5 essay questions was carried out using a critical thinking ability sheet.

Result and Discussion

Results the research is presented in the form of tables and descriptive. Table 1 explains the use of ethnoscience in learning. This study explains the application of ethnoscience in learning reviewed from 3 aspects, namely the Teaching Module, Teaching Materials used and Exam Questions given to students. The 3 aspects are examined whether they have

elements of ethnoscience in their implementation. Table 1. Achievement of Ethnoscience in 3 aspects of learning The Use of Ethnoscience in Elementary Madrasah (MI) Teaching Modules containing Ethnoscience Teaching Materials containing Ethnoscience Exam Questions containing Ethnoscience MI Mahabbatullah Pal Merah None, MI Mahabbatullah Kota Baru None, and MI Mahabbatullah Telanai Pura None Based on Table 1, it can be concluded that the Teaching Module does not contain ethnoscience in it, while the teaching materials and student exam questions are already based on ethnoscience. Elementary school learning that is suitable for the application of ethnoscience is the themes of science learning and mathematics learning in high grades. This is supported by the characteristics of ethnoscience according to Snively and Corsigli (2001:12), ethnoscience exists in various traditional community lives such as ecology, botany, horticulture, mathematics, and so on. For example, in ethnoscience it is developed into ethnomathematics, by studying certain customs in a region related to mathematics. The stages of implementation of ethnoscience-based learning development are presented in the following chart (Asrizal et al., 2017).

Table 1. Interview, Achievement of Ethnoscience in 3 Aspects of Learning

The Use of Ethnoscience in Elementary Madrasahs (MI)	Teaching Modules Containing Ethnoscience	Teaching Materials Containing Ethnoscience	Exam Questions Containing Ethnoscience
MI Mahabbatullah District. Red Pal	There isn't any	There is	There isn't any
MI Mahabbatullah, Kota Baru District	There isn't any	There is	There is
MI Mahabbatullah District. Telanai Temple	There isn't any	There is	There is

From the chart above, ethnoscience learning is integrated into declarative and procedural materials. The implementation of learning by applying a scientific learning approach (scientific approach) through discovery, inquiry, PBL, PjBL, CTL and KPS (process skills) learning models. Therefore, this explains that the integration of ethnoscience into the national education system shows a pattern of implementation that is not uniform in various learning elements. Analysis of the differentiation of ethnoscience application indicates that the elaboration of ethnoscience in teaching modules is still limited even though it shows significant developments in teaching materials. With structural complexity in the development of teaching modules being a determinant factor, considering that the integration of traditional knowledge with contemporary scientific concepts requires a comprehensive and validated methodological approach. However, the limited capacity and competence of educators in exploring, interpreting and integrating ethnoscience into a systematic learning module structure is another determining factor.

Meanwhile, Dinurrohmah et al. (2023) teaching materials show higher flexibility for modification and contextualization of ethnoscience. The transformation of the national education paradigm that emphasizes the contextual relevance of learning and assessment to the sociocultural realities of students has encouraged the acceleration of the application of ethnoscience in teaching materials and exam questions. The implication is that a comprehensive approach is needed to increase institutional and professional capacity in developing ethnoscience-based teaching modules as an effort to strengthen cultural identity in the national education system.

Another thing that can also be seen from the results of the tests that have been carried out, the results obtained are presented in the following table 2.

Table 2. Percentage of Categories of Pre-Test and Post-Test Results of Students' Critical Thinking Skills in the Control Class

	Pre-test control class		Post-test Control Class	
	Amount	Presentation (%)	Amount	Percentage (%)
Very critical	0	0	6	22.22
Critical	4	14.81	7	25.92
Quite Critical	3	11.11	6	22.22
Less critical	3	11.11	7	25.92
Not critical	17	62.96	1	3.70

In the control class, students' critical thinking skills experienced significant changes. In the pretest, the average score was 33.74 with a non-critical category, with details of 4 critical students, 3 fairly critical students, 3 less critical students, and 17 non-critical students. After the posttest, the average score increased to 64.70 with a fairly critical category, with a distribution of 10 very critical students, 4 critical students, 3 fairly critical students, 6 critical students, and 4 students in other categories.

Table 3. Percentage of Categories of Pre-Test and Post-Test Results of Students' Critical Thinking Skills in the Experimental Class

Category	Experimental Class Pre-test		Post-test Experimental Class	
	Amount	Percentage (%)	Amount	Percentage (%)
Very Critical	0	0	15	57.69
Critical	8	29.62	12	42.30
Quite Critical	3	11.11	0	0
Less Critical	8	29.62	0	0
Not Critical	8	29.62	0	0

In the experimental class, students' critical thinking skills increased significantly after implementing the Contextual Teaching and Learning (CTL) model based on ethnoscience. In the pretest, the average score was 50.26 in the less critical category, with a distribution of 8 critical students, 3 fairly critical students, 8 less critical students, and 8 non-critical students. After the posttest, there was a very good increase with an average score of 81.25 which was in the very critical category. The results showed 15 students in the very critical category and 12 students in the critical category, with a score range between 67 and 100.

Table 4. Description of Science Learning Outcome Completion in Control Class

Category	Score	Frequency	Percentage (%)
$0 \leq X < 72$	Not finished	18	66.66
$72 \leq X \leq 100$	Completed	9	33.33
Amount		27	100

In the control class, student learning outcomes showed that the minimum completion criteria were 72. From the data analysis, it was found that: 18 students (66.66%) had not met the minimum completion criteria and 9 students (33.33%) had met the minimum completion criteria. Based on these data, it can be concluded that the science learning outcomes at the Mahabbatullah Elementary Madrasah in Jambi City in the control class did not meet the classical learning outcome completion criteria.

Table 5. Description of Science Learning Outcome Completion in Experimental Class

Category	Score	Frequency	Percentage (%)
$0 \leq X < 72$	Not finished	0	0
$72 \leq X \leq 100$	Completed	27	100
Amount		27	100

In the experimental class, student learning outcomes showed complete success: The minimum completion criteria were 72, 0 students (0%) had not met the minimum completion criteria, and finally 27 students (100%) had met the minimum completion criteria.

Thus, it can be concluded that the results of learning science at the Mahabbatullah Elementary Madrasah, Jambi City in the experimental class perfectly meet the criteria for completing learning outcomes in a classical manner.

Table 6. Descriptive Statistics of Critical Thinking Skills and Science Learning Outcomes

	Learning model	Mean	Std. Deviation	N
Learning outcomes	Experimental Class	90.1481	4.72883	27
	Control Class	70.4444	6.30832	27
	Total	80.2963	11.37463	54
Critical thinking skills	Experimental Class	79.9630	12.02715	27
	Control class	63.4444	14.91085	27
	Total	71.7037	15.79662	52

Based on table 6, it is known that the descriptive statistics presented are in the form of a comparison of the average (mean) posttest of critical thinking skills and the average (mean) posttest of learning outcomes using the Contextual Teaching and Learning (CTL) model based on ethnoscience and those using the conventional learning model.

Sampling was carried out using purposive sampling technique, which is a technique for taking data sources with certain considerations (Sugiyono, 2018). The methods used by researchers are observation, documentation, and interviews.

This study uses a data collection method used in this study is a test method. The test of students' critical thinking skills is in the form of an essay, while the test of students' science learning outcomes is in the form of a multiple-choice test. After all the data in this study was collected, an analysis was carried out using SPSS-assisted Manova analysis. The research was conducted at the Mahabbatullah Elementary Madrasahs, Telanai Pura District, Mahabbatullah Elementary Madrasahs, Kota Baru District, and Mahabbatullah Elementary Madrasahs, Pal Merah City of Jambi. The research was conducted on September 16, 23 and 25, 2024. The target/subject of this quantitative research was students at the Mahabbatullah Elementary Madrasahs, Telanai Pura District, Mahabbatullah Elementary Madrasahs, Kota Baru District, and Mahabbatullah Elementary Madrasahs, Pal Merah City of Jambi. In this case, students were interviewed by several people to

ask what their opinions were regarding the application of ethnoscience in learning provided by the teacher.

Based on the previous description, it also appears that the application of the Contextual Teaching and Learning (CTL) learning model based on ethnoscience has an effect on improving students' critical thinking skills and science learning outcomes. Students who follow the Contextual Teaching and Learning (CTL) learning model based on ethnoscience have higher critical thinking skills, so that these students can produce better science learning outcomes. The findings in this study are in line with research conducted by Ariani et al. (2022), Amin (2018), and Devi et al. (2020) that the Contextual Teaching and Learning (CTL) learning model based on ethnoscience is one of the learning methods that has been proven successful in improving students' critical thinking skills and science learning outcomes. In addition, it can also increase the activities of students and teachers during learning.

The objectives of implementing ethnoscience in learning are: (1) To know and become more familiar with the natural, social, and cultural environment. (2) To provide provisions for abilities, skills and knowledge about their area that are useful for themselves and the community in general. (3) To provide attitudes and behaviors that are in line with the values of the rules that apply in their area and to preserve by developing the noble values of local culture. 4) To play a role in forming the character of the nation and forming the character of the students themselves. 5) To preserve the nation's culture.

Conclusion

Based on the data analysis conducted, the critical thinking skills of students in the control class increased from an average pretest score of 33.74 (non-critical category) to 64.70 on the average posttest score (quite critical category), with the distribution of students still dominated by the less critical and non-critical categories. Meanwhile, the experimental class that implemented the Contextual Teaching and Learning (CTL) model based on ethnoscience showed a significant increase, from an average pretest score of 50.26 (less critical category) to 81.25 on the average posttest score (very critical category), with the majority of students in the very critical and critical categories. In addition, the results of science learning in the control class showed that 66.66% of students had not achieved minimum completeness, so they did not meet classical completeness. In contrast, the experimental class achieved 100% completeness with all students getting scores above 72. Thus, the application of the CTL model based on ethnoscience has proven to be more effective in improving critical thinking skills and student learning outcomes compared to the method used in the control class. Practical implications of this research include reorienting the role of teachers from knowledge transferors to facilitators who connect academic contexts with socio-cultural realities. The learning model developed allows educators to design learning experiences that develop local wisdom values, environmental empathy, and character through empirical experiences. This approach also provides a framework for developing curricula that are responsive to local social and cultural systems, thereby strengthening the relevance of education to students' daily lives. Further research can be directed at developing specific learning tools that integrate ethnoscience in various subjects in Elementary Madrasahs. It is recommended to conduct research and development (R&D) that produces ethnoscience-based learning modules that have been tested for their effectiveness, dissertations with implementation guidelines for teachers and authentic assessment systems. Collaboration between education researchers, practitioners and community leaders is also needed to identify and document local cultural elements that can be meaningfully integrated into the curriculum so as to enrich the treasury of ethnoscience-based learning resources in Elementary Madrasahs.

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Authors' contributions include: Maysarah in data collection, data analysis, writing the original draft, conceptualizing the research, focusing on methodology, reviewing the paper and so on.

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The author declares no conflict of interest.

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