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## IMPLEMENTATION OF ETHNOSCIENCE APPROACH IN CHEMISTRY LEARNING TO IMPROVE STUDENTS' CREATIVE THINKING SKILLS: A LITERATURE REVIEW

### Abstract

Creative thinking is a skill that students need to develop in 21 st-century education, particularly in the field of chemistry. This study aims to examine the ethnoscience approach in chemistry education to enhance students' creative thinking abilities. The methodology employed for this research is a Literature Review. The literature review focused on articles relevant to the research goals. Articles were sourced from Google Scholar and selected based on specific criteria from Sinta S1-S5, published between January 2019 and December 2024, including those published nationally. A total of nine articles that satisfied the research criteria were identified and evaluated for quality. The findings suggest that the ethnoscience approach can enhance students' creative thinking skills in chemistry across various dimensions such as fluency, flexibility, elaboration, and originality. Subjects that can be taught to students through the ethnoscience approach encompass salt hydrolysis, redox reactions, green chemistry, and colloids. The ethnoscience approach can be integrated into several educational models, including PBL (Problem-Based Learning), PjBL (Project-Based Learning), STEM (Science, Technology, Engineering, and Mathematics), and Culturally Responsive Transformative Teaching (CRTT).

**Keywords:** Ethnoscience, Creative Thinking Skills, Chemistry Learning

### INTRODUCTION

The Partnership for 21st Century Skills highlights the importance of teaching four key competencies in 21st-century learning: communication, collaboration, critical thinking, and creativity. A method in science education that can enhance the effectiveness of 21st-century learning is the use of ethnoscience, which incorporates cultural elements into the learning process (Nurrubi et al., 2022). Learning through an ethnoscience approach involves integrating educational materials with the local culture and environment. This integration aims to help students recognize that their learning activities are closely connected to their surroundings. This connection is expected to create a sense of relevance in the learning process. In ethnoscience-focused learning activities, we particularly hope for students to engage in observations, discussions, presentations, and participate in internships. The involvement of students in these learning activities employs their procedural skills. Therefore, implementing ethnoscience-based education requires a transition from a teacher-centered learning model to a student-centered one, as well as a move from individual learning methods to collaborative approaches and scientific learning (Fahrozy et al., 2022).

Chemistry is a branch of science that has a strong connection to daily life. Its significance is profound and can be examined through the lens of local knowledge. The study of chemistry can be integrated with ethnoscience as it incorporates practical experiences from daily life and local knowledge into educational materials and societal phenomena (Dewi et al., 2019). Chemistry encompasses numerous abstract concepts, making it essential to have effective visual representations to enhance understanding of these concepts, encouraging students to observe and analyze chemical phenomena. By engaging in observation, students develop the ability to approach problems from various viewpoints (Allo et al., 2024).

Creative thinking skills involve the capacity to evaluate situations using existing data while also generating innovative concepts that are significantly improved. This process includes

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exploring various alternatives and ideas that can be utilized to address challenges. In the realm of creative thinking, individuals engage in synthesizing ideas, as well as developing new concepts that enhance the effectiveness of their plans. Ultimately, these ideas are put into action to create something original and more refined (Siregar et al., 2020). Numerous studies demonstrate that ethnoscience-based chemistry education effectively enhances students' creative thinking abilities. One study reveals that students' creative thinking skills improve with the ethnoscience approach in chemistry lessons, with the experimental group's creativity rising progressively at each session, reporting averages of 53.64% (considered quite good), 64.20% (classified as good), and 72.02% (also in the good category). In contrast, the control group shows an average increase at each meeting of 46.82% (quite good), 58.75% (also quite good), and 63.86% (categorized as good) (Syafitri et al., 2022). Other research indicates that the effectiveness of Etno-Stem-based learning tools in enhancing students' creative thinking skills has an n-gain value percentage reflecting a medium category with an increase in average creative thinking skills at  $0.3 < g < 0.7$ . Additionally, the average response rate from students collected through questionnaires showed an 85% average value for a limited trial, while the average for a broader trial rose to 89% (Karim et al., 2022). This indicates that the ethnoscience method can enhance the creative thinking abilities of students.

Certain researchers have worked on enhancing students' creative thinking abilities using an ethnoscience methodology. These initiatives are examined through Literature Review research. In particular, this study aims to showcase national articles concerning the application of the ethnoscience approach in chemistry education to boost students' creative thinking skills.

**METHODS**

This Literature Review study was performed utilizing a straightforward technique, in which data analysis involved merging the identified articles and streamlining the findings from each research. The author initially creates sub-chapters and then gathers relevant articles that align with the established sub-chapters. The selection of articles is still grounded in the primary keywords (Sukasih et al., 2022). The researchers looked for an article by utilizing the keywords ethnoscience, creative thinking skills, and chemistry education. They acquired articles via Google Scholar and chose them according to the criteria from Sinta S1-S5, published between January 2019 and December 2024, and including those published nationally.

**RESULTS AND DISCUSSION**

According to the Literature Review, nine articles were identified from the 30 analyzed based on the keywords. A summary of these articles can be found in Table 1.

Table 1. Results of Article Review

Peneliti	Judul	Metode	Hasil Penelitian	Indeks
(Syafitri et al., 2022)	The Effect of Ethnoscience-Based PBL Model on Students' Creative Thinking Ability on Salt Hydrolysis Material	Quasi Experiment with Non-Equivalent Control Group Design	The influence of employing an ethnoscience approach in teaching chemistry on salt hydrolysis topics enhances students' creative thinking skills, with the observed percentages for various aspects being fluency at 67.42%, flexibility at 67.05%, originality at 61.49%, and elaboration at 60.61%, all falling within the categories of adequate and good.	Sinta 4
(Karim et al., 2022)	Effectiveness of Ethno-Stem Based Learning Tools to Improve Creative Thinking Skills of Learners	Quasi Experiment	The impact of Ethno-STEM-based learning tools on enhancing students' creative thinking abilities shows an N-gain value indicating a medium increase in average creative thinking skills, ranging from 0.3 to less than 0.7. Feedback from students through surveys revealed an average score of	Sinta 4

			85% during a limited trial, while the average score for a broader trial rose to 89%.	
(Sumarni & Kadarwati, 2020)	Ethno-STEM Project-Based Learning: Its Effect on Critical and Creative Thinking Skills	Quantitative using a descriptive statistical approach	The findings of this research suggest that teaching colloidal chemistry using the Ethno-STEM approach along with the Problem-Based Learning (PBL) model can enhance the average creative thinking skills of students, as evidenced by pretest scores reflecting improvements in fluency (33.7%), flexibility (30.3%), elaboration (29.8%), and originality (19.4%) across high, medium, and low criteria.	Sinta 1
(Ariyatun, 2021)	Analysis of Ethno-STEM Integrated Project-Based Learning on Critical and Creative Thinking Skills of Students	One-Shot Case Study	According to the findings from the data analysis, it is evident that students' creative thinking abilities are rated positively, with the highest performance observed in the flexibility dimension, which involves offering diverse interpretations of an image, narrative, or challenge. Consequently, the ethno-STEM integrated Project-Based Learning (PBL) model has the potential to enhance students' critical and creative thinking abilities.	Sinta 3
(Wanggi et al., 2023)	The Effect of Ethnoscience-Integrated Project-Based Learning Model on Students' Creative Thinking Ability in Science Class VII at SMPN 2 Pujut	Quasi Experiment dengan Non Equivalenta Control Group Design	The results showed that the ethnoscience-integrated PBL (Project Based Learning) learning model had a positive effect on creative thinking skills. This is evidenced by the results of the T-test significance value of $0.006 < 0.05$ and the average value of the student's creative thinking ability test in the experimental class of 76.68 which is classified as creative while in the control class of 69.00 which is classified as quite creative. Based on the results of the N-Gain test, the results of increasing student knowledge after being treated with an ethnoscience-integrated PBL (Project Learning) learning model in the criteria for moderate improvement with an N-Gain value score of $0.4 (0.3 < g \leq 0.7)$ .	Sinta 4
(Ramandanti & Supardi, 2020)	The Effect of Problem-Based Learning Model Integrated Ethnoscience on	Posttest Only Experiment	The results showed that there was an effect of PBL (Problem-Based Learning) learning integrated with ethnoscience on the understanding of concepts in redox material of class X MA Negeri Blora students and the magnitude of the influence of PBL	Sinta 5

	Understanding the Concept of Redox Material		(Problem-Based Learning) integrated with ethnoscience on the understanding of chemical concepts of class X MA Negeri Blora students by 0.81% with an average posttest of experimental class 1 greater than experimental class 2 which is 51.52% and 49.73%.	
(Asna et al., 2024)	Ethnochemical Module Integrated with Islamic Values in Project-Based Learning to Train Creativity	Research and Development (R and D)	The results of the research on the ethnochemical module of green chemistry material integrated with Islamic values in project-based learning to train creativity obtained indicators of flexibility of thinking (flexibility) obtained 70.83% very creative, indicators of originality of thinking (originality) obtained 75% very creative, and indicators of elaboration of thinking (elaboration) obtained 58.33% very creative.	Sinta 3
(Adawiyah et al., 2022)	Development of Ethnoscience Chemistry Module Integrated with Culturally Responsive Transformative Teaching (CRTT) Model	Research and Development (R and D)	The results of students' responses show that the chemistry module on thermochemical material can attract the interest of students to learn it. The response from students resulted in a score of 3.46 which shows that the development of ethnoscience chemistry modules integrated with the Culturally Responsive Transformative Teaching (CRTT) model is quite excellent in the aspects of appearance (3.49), material (3.46), motivation (3.50), and language (3.46).	Sinta 4
(Triana, 2020)	The Effectiveness of Ethnoscience-Based Chemistry Learning on Science Process Skills of Students of SMK Negeri Tugumulyo	Quasi Experiment dengan Non Equivalent Control Group Design	The study indicates that the development of science process skills through ethnoscience models surpasses that of traditional models. Chemistry education utilizing an ethnoscience approach is more efficient than conventional methods regarding science process skills and enhancing students' understanding of chemical concepts.	Sinta 5

Based on the analysis of 30 articles, nine articles listed in Table 1 indicate that utilizing the ethnoscience approach can enhance students' creative thinking abilities, particularly in the context of chemistry education. Learning that incorporates the ethnoscience approach involves merging educational content with local culture and the environment. This integration aims to help students perceive the learning activities as connected to their immediate surroundings. Consequently, it is anticipated that this will lead to a significant learning experience (Fahrozy et al., 2022).

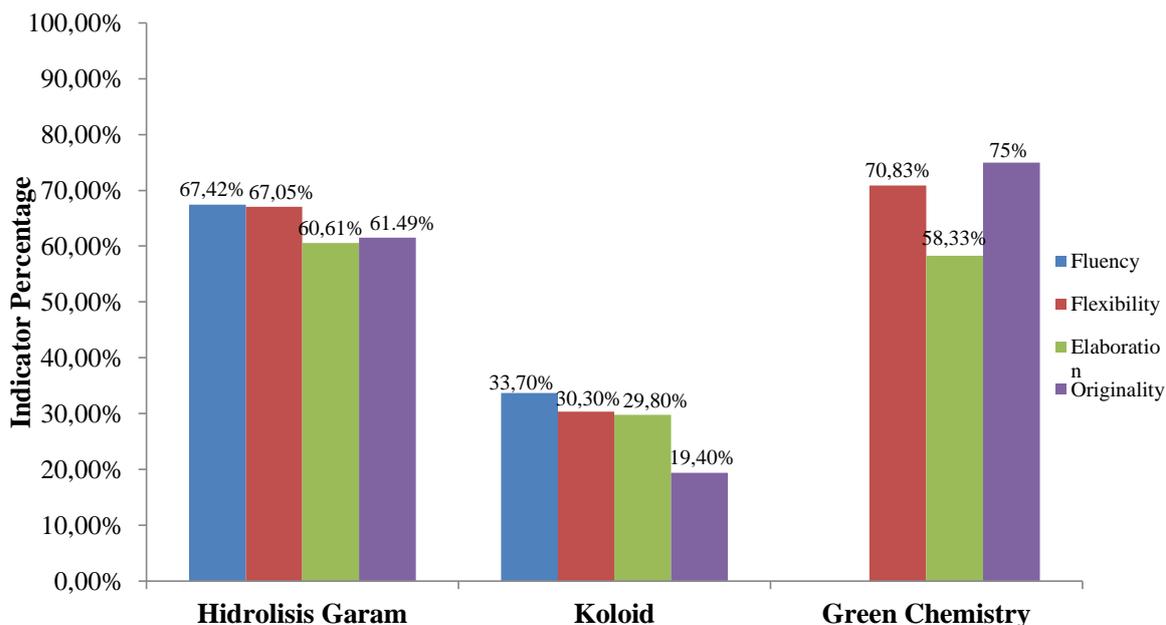


Figure 1. Percentage Chart of Indicators in Chemistry Learning Materials

The data presented in Figure 1 indicates that employing the ethnoscience approach in certain chemistry lessons enhances students' creative thinking abilities, particularly with salt hydrolysis topics, as demonstrated through the PBL (Problem-Based Learning) model. It shows that students' creative thinking has improved progressively at each session, falling within the categories of adequate and good (Syafitri et al., 2022). Research in colloidal materials indicates that the Ethno-STEM method, employing the PBL (Problem-Based Learning) model, enhances the average critical and creative thinking abilities of students across all indicators in multiple categories: high, medium, and low (Sumarni & Kadarwati, 2020), in the field of green chemistry, developing ethnochemical modules that incorporate Islamic values within project-based learning, categorized as both creative and highly creative (Asna et al., 2024), and in redox, the material showed an increase in student understanding using the PBL (Problem-Based Learning) model integrated with ethnoscience by 0.81% (Ramandanti & Supardi, 2020).

In chemistry education that incorporates ethnoscience, resources like modules can enhance the creative thinking abilities of students, as shown by research conducted by (Adawiyah et al., 2022) developing ethnoscience chemistry modules integrated with the Culturally Responsive Transformative Teaching (CRTT) model resulted in a score of 3.46 indicating that it is quite very good, in the sense that the use of language is appropriate for the age level of students. Research conducted (Karim et al., 2022) shows that the effectiveness of Ethno-STEM-based learning devices to improve students' creative thinking skills has an average N-gain value percentage at  $0.3 < g < 0.7$  with a moderate category.

The ethnoscience-based approach can improve students' creative thinking skills as evidenced by several studies, such as those conducted by (Ariyatun, 2021) demonstrating that students' creative thinking abilities are part of the desirable criteria, particularly excelling in the flexibility aspect, which involves offering multiple interpretations of an image, narrative, or issue, as indicated in research carried out by (Wanggi et al., 2023) The findings indicate that the PjBL (Project Based Learning) model, which incorporates ethnoscience, significantly improves creative thinking skills with a score of 76.68, categorized as creative. In comparison, the control group achieved a score of 69.00, which is considered to be quite creative.

Ethnoscience-based education seeks to familiarize students with facts that have emerged within a society, which are then connected to scientific materials and knowledge. These scientific materials can be obtained through the use of science process skills in the ethnoscience model. According to (Trianah, 2020) The development of science process skills through ethnoscience models surpasses that of conventional models. The use of ethnoscience models in chemistry education proves to be more efficient than traditional methods regarding science process skills and enhancing students' understanding of chemical concepts.

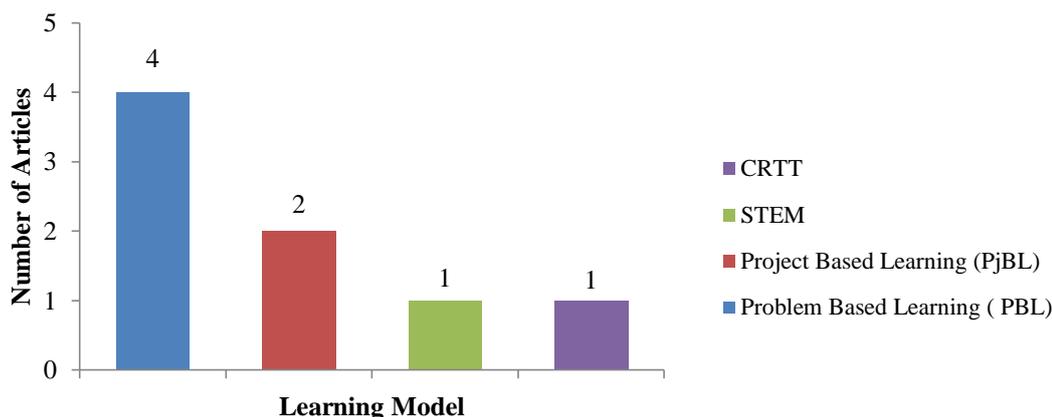


Figure 2: Graph of the number of articles using the learning model

In Figure 2, it can be seen that out of the nine articles analyzed, four utilize the PBL (Problem Based Learning) model, two employ the PjBL (Project Based Learning) model, one article adopts the STEM model, and one integrates the CRTT (Culturally Responsive Transformative Teaching) model. The application of these models has shown to positively enhance students' creative thinking abilities. In contrast, the other two articles solely adopted the ethnoscience approach for their instructional methods.

## CONCLUSIONS

Overall, these studies indicate that incorporating ethnoscience into chemistry education can enhance students' creative thinking abilities. This method not only makes learning more pertinent and meaningful for learners but also deepens their understanding and fosters the acquisition of 21st-century skills. The ethnoscience approach, which merges scientific concepts with local knowledge, leads to learning that is contextual and relevant to students' everyday experiences. Consequently, ethnoscience-based chemistry education represents a noteworthy and promising innovation for improving educational quality. Ethnoscience has been shown to effectively boost student motivation when engaging with chemistry content. The advancement of ethnoscience education can be achieved through the use of various instructional models and educational tools.

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