

ETHNOSCIENCE IN EDUCATION: A SYSTEMATIC LITERATURE REVIEW ON THE INTEGRATION OF CULTURE AND SCIENCE IN LEARNING

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Abstract: This systematic literature review analyzes the pattern of local wisdom integration in science education through a review of 28 selected studies identified from Google Scholar (n=163) and Science Direct (n=22) using the PRISMA method. The analysis results showed that Biology (12 studies) was the most dominant field, focusing on traditional events and traditional food/drinks. Furthermore, Physics (8 studies) was generally related to traditional games or musical instruments (e.g., analysis of style and sound). Natural Science (5 studies) with a multidisciplinary approach, combining biology, physics, and chemistry in the context of traditional food and traditional events. In contrast, for chemistry study in culture-based science learning, no suitable related research was found. This shows that over the past five years, the ethnoscience approach has been applied more widely in the field of Biology and Physics. This finding reveals the potential of ethnoscience in creating contextual science learning while preserving local wisdom, although research gaps still exist in several cultural aspects.

Keywords: Ethnoscience, local wisdom, science education, cultural integration, SLR.

1. Introduction

Ethnoscience, as an approach that integrates local and cultural knowledge with modern science, has great potential in building a more culturally relevant education system. This approach provides an opportunity to bridge the gap between formal science and local wisdom, thereby increasing the relevance of learning and enriching students' learning experiences. In the context of globalization, ethnoscience-based education is becoming increasingly important to maintain cultural identity while supporting scientific innovation. Ethnoscience in biology learning can provide a more contextual and relevant learning experience for students (1–3).

Some research shows that ethnoscience-based learning can improve students' interest, motivation, and learning outcomes (4). For example, studies have found that the use of ethnobotany in biology learning helps students understand the concept of biodiversity in a more meaningful way (5). Another study revealed that ethnoscience approaches in traditional physics (such as a stilt game to understand balance) increase student engagement in rural areas (6,7). However, the implementation of ethnoscience in education still faces various challenges. First, teachers often lack understanding of how to integrate culture into the science curriculum. Second, the limitations of teaching materials that relate the concept of modern science to local knowledge. Third, a lack of adequate policy support to accommodate culture-based learning in the national education system (8).

Over the past five years, research on ethnoscience in education has shown various interesting trends. This includes the application of culture-based teaching methods, the development of a curriculum based on local wisdom, and its impact on student engagement and understanding. However, although the number of these studies continues to grow, there has not been a systematic review that comprehensively analyzes the contributions and key findings of ethnoscience research in education.

This research aims to address this need by conducting a systematic literature review of ethnoscience research in education during the 2019–2024 period. Through this approach, this study seeks to identify the main trends, methods used, and the impact of these studies on the development of culture-based education. The results of this study are expected to serve as a foundation for further development in this field, both in research and educational practice.

2. Literature Review

2.1 The Concept of Ethnoscience in Education

Ethnoscience is a learning approach that integrates traditional or local science knowledge with formal science in the context of education. This concept was first introduced as an effort to bridge the gap between indigenous knowledge owned by community and modern scientific knowledge taught in schools (9). In a broader context, ethnoscience can be defined as a system of knowledge and practices owned by a particular group of people, which is used to understand and explain natural phenomena within their own cultural framework (10)

The ethnoscience approach differs from conventional learning in several key ways. Ethnoscience-based learning is contextual because it is directly related to students' daily lives and real experiences in their local culture (11). In addition, this approach is holistic, because it integrates various aspects of life such as social, cultural, economic, and environmental in one complete learning unit. Another characteristic is its empirical nature, which is based on people's direct observation and experience of natural phenomena. It is also dynamic, because it continues to develop and adapt along with changing times and societal needs (12,13)

2.2 The Importance of Ethnoscience in the Context of Education

The implementation of ethnoscience in education has high significance in several aspects. First, ethnoscience can increase the relevance of science learning to students' lives. When students can see the direct connection between the subject matter and their culture and daily lives, motivation and interest in learning will increase significantly (9). Research conducted by (11) shows that ethnoscience-based learning can increase students' enthusiasm for science subjects by up to 75% compared to conventional learning. Second, the integration of ethnoscience in education plays an important role in building and strengthening students' cultural identity. In an era of globalization that increasingly threatens the preservation of local culture, the ethnoscience approach helps students to understand, appreciate, and preserve local wisdom and their cultural identity (14). This is align with the national education goals, which focus not only on cognitive aspects, but also on the development of national character and identity. Third, ethnoscience has proven effective in developing students' science literacy. Research showed that ethnoscience-based learning can increase students' science literacy skills by 68% compared to the control group. This increase occurs because students not only memorize science concepts, but also understand the application and relevance of science in real life through the local cultural contexts (12). Fourth, the ethnoscience approach can overcome the cultural gap between the home culture and the school environment. This gap is often an obstacle in the learning process, especially for students who come from cultural backgrounds that are different from the dominant culture in school (15). By integrating local culture elements in learning, ethnosciences help create bridges that connect the two cultures. Fifth, ethnoscience-based learning can develop students' critical thinking skills. Through the process of comparison and analysis between traditional knowledge and modern scientific knowledge, students are trained to evaluate information from various perspectives, identify the strengths and weaknesses of each approach, and draw objective and rational conclusions (16)

2.3 Implementation of Ethnoscience in Learning

The implementation of ethnoscience in learning requires the right strategies and approaches. One of the strategies that can be applied is problem-based learning that uses contextual problems in local communities as a starting point for learning. This approach allows students to explore traditional knowledge while learning relevant formal science concepts (16). Another strategy is inquiry learning that encourages students to investigate and compare traditional knowledge with scientific knowledge. Through this inquiry process, students can develop scientific thinking skills while still respecting local wisdom in their communities. Collaborative learning can also be applied by involving local communities as resource persons and partners in the learning process, so that synergy is created between schools and communities.

The development of ethnoscience-based media and learning resources is also an important aspect in the implementation of this approach. Learning media that integrate elements of local culture, such as learning modules based on local wisdom, documentary videos of traditional practices, teaching aids from local materials, and field study activities to places that have historical value or traditional practices, can increase the effectiveness of learning (9).

3. Method

This study uses a systematic literature review (SLR) with a qualitative approach to analyze the integration of ethnoscience in education during the 2019–2024 period. The SLR was chosen because it can provide a comprehensive synthesis and critical evaluation of previous research findings (17). The research procedure follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure transparency and accountability in the literature selection (18). The research stage begins with searching for articles on indexed databases as Google Scholar and Science Direct using keywords "ethnoscience AND education", "local wisdom AND science learning", and "kearifan lokal AND pembelajaran sains" for Indonesian language sources. Inclusion criteria include publications in the form of research journals, published between 2019–2024, and a focus on cultural integration with science education, while articles without full text or off-topic are excluded.

The selection process is carried out in stages, including identification, screening, eligibility, and inclusion (18). The collected data is then analyzed thematically to identify research trend patterns, ethnoscience integration models, and the challenges and benefits of its implementation in education. The analysis was carried out with the help of Excel to categorize the findings based on key themes.

Table 1. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Year Range	2019-2024	Publications before 2019
Publication Type	Academic journal articles, conference proceedings, and research journals	Books, Thesis, service journals
Theme Relevance	Studies that discuss the integration of culture and science in education (screening abstract)	Studies that focus only on culture without considering the scientific aspect in education
Research Methods	- Literature review with a systematic approach - Research with a clear methodology	- Non-systematic studies, essays, or opinion articles - Unclear research methodology
Language	Indonesian and English	Publication in other languages without translation

Accessibility	Articles with open access or available through institutions	Articles are closed or only available through paid sources that are not accessible
Population or Context	Studies of ethnoscience-based education at different levels of education	Studies that only discuss pure science without cultural context

Screening and Eligibility Criteria

Based on the presented PRISMA diagram, the study identification process began with a search through two main databases: Google Scholar (n = 163) and Science Direct (n = 22). A total of 2 duplicate records were removed, so a total of 183 records were filtered based on abstracts. Of these, 47 records did not meet the eligibility criteria, and another 89 records were also removed for irrelevant. In addition, 19 recordings are inaccessible in full text. After going through the screening process, 75 reports were successfully obtained for in-depth assessment, and finally 28 studies met the inclusion criteria for review.

After going through the full screening stage, articles that still meet the criteria will be evaluated in the eligibility assessment stage. In this stage, each article is reviewed based on the research methodology, clarity of the data, and significance of contribution to the topic of ethnoscience in education. This evaluation was carried out using the PRISMA checklist to ensure that only high-quality studies were included in further analysis (Figure 1). Articles that show significant bias or have unclear methodologies will be removed from the list of studies used. Finally, in the final selection and analysis stage, articles that have passed the final selection are included in the research reference list. Data from these articles is analyzed to identify patterns and trends related to the integration of culture and science in Education.

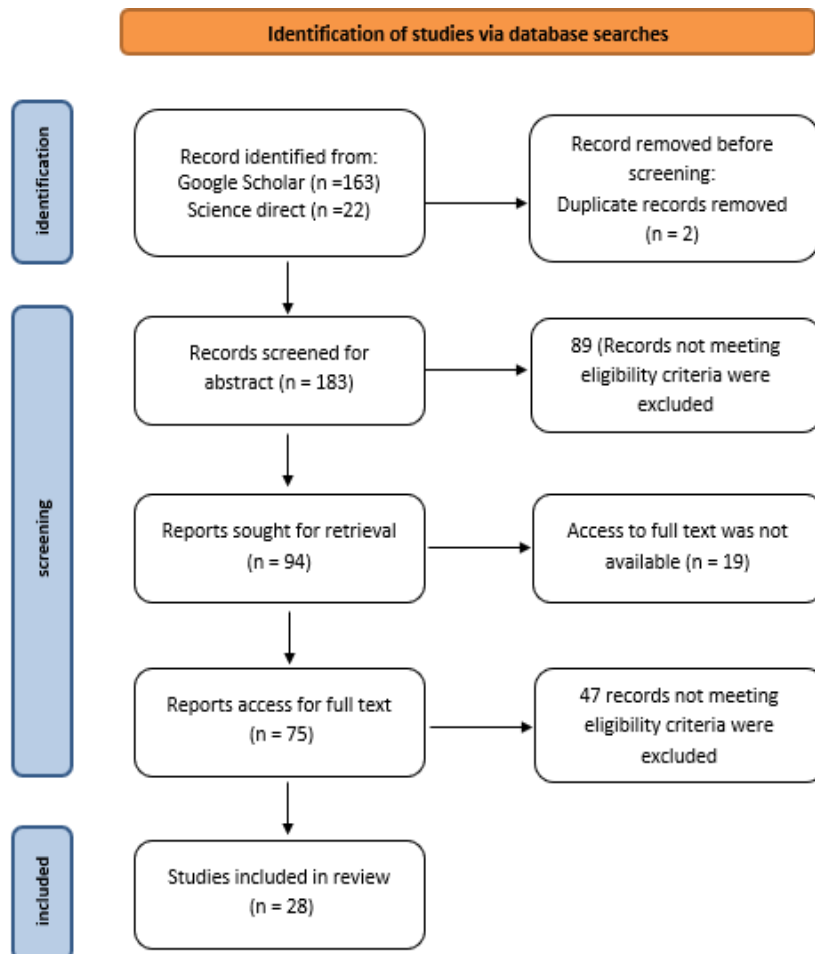


Figure 1. PRISMA flowchart illustrating the systematic review process

4. Finding and Discussion

Based on the results of the analysis that has been carried out, the following data is obtained:

Table 2. Included Data

Resear cher	Subject				Local Wisdom						
	Biol ogy	Phy sic	Chemi stry	Scie nce	Traditi onal food	Ende mic plant	Traditi onal game	Traditi onal dance	Traditi onal events	Handic rafts	Traditi onal Music
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Based on the data in the table above, information related to study distribution data based on the field of science and the type of local wisdom integrated in science education is obtained. The field of study Biology (12 studies), is the most dominant, with a focus on traditional events and traditional food/drinks. Furthermore, Physics (8 studies) is generally related to traditional games or musical instruments (e.g., analysis of style, sound). As well as Science (Natural Sciences) (5 studies) with a multidisciplinary approach, combining biology, physics, and chemistry in the context of traditional food and traditional events. For the field of chemistry study in culture-based science learning, no suitable related research was found, as of 2019-2024. This shows that over the past 5 years, the ethnoscience approach has been applied more widely in the field of Biology and Physics.

Based on the analysis of 28 articles published between 2019 and 2024, the types of local wisdom integrated into science learning are identified as follows:

Table 3. Distribution of Local Wisdom

Types of Local Wisdom	Frequency	Example Topics
Traditional Food/Beverage	7 Studies	Fermentation, nutrient content, heat and energy
Endemic Plants	2 Studies	Medicinal plants, conservation.
Traditional Dance	2 Studies	Motion analysis (physics), cultural symbolism.
Traditional Events	12 studies	Ecological value, science-based rituals (e.g., traditional agriculture).
Traditional Games	3 Studies	Concepts of physics (force, energy), and mathematics
Handicrafts	1 study	Material technology, art based on natural resources.
Traditional Musical Instruments	2 Studies	sound and vibration.

Based on the table, it was found that traditional events and traditional food/beverages are the most commonly used local wisdom as science learning media. Traditional games, traditional dances, and endemic plants are also integrated, albeit with lower frequencies. Also, some studies explore traditional handicrafts and musical instruments, although they are limited in number. This shows an attempt to connect science with more dynamic cultural practices.

5. Conclusion and Recommendation

Based on the data analysis, it can be concluded that the application of the ethnoscience approach in science learning over the last five years (2019–2024) reveals several key trends. Biology and Physics have been the most dominant fields in implementing this approach, with a primary focus on traditional events and traditional food and beverages as the most commonly utilized forms of local wisdom. Conversely, Chemistry remains largely unexplored within the context of culture-based learning. Furthermore, there are discernible efforts to integrate science with more dynamic cultural practices, such as traditional games, dances, and handicrafts, albeit with significantly lower frequency. Overall, these findings underscore the considerable potential for further exploration, particularly within the field of Chemistry and across a wider variety of local wisdom types.

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