

# Local Wisdom in Chemistry Learning: A literature Review on The Ethnoscience Approach

Vika Puji Cahyani <sup>1\*</sup>, Dewiyanti Fadly <sup>2</sup>

<sup>1,2</sup> Universitas Negeri Makassar, Indonesia

\* [vika.puji.cahyani@unm.ac.id](mailto:vika.puji.cahyani@unm.ac.id)

## Abstract

The main issues in this research are how to integrate local wisdom into chemistry learning, its impact on students' understanding and skills, the challenges faced in its implementation, and the potential of local wisdom as a resource to improve the quality of chemistry education. The purpose of this study is to analyse the implementation of ethnoscience in chemistry learning at school. This research method uses a qualitative descriptive method with a literature review approach to examine local wisdom in learning chemistry through an ethnoscience approach. The steps taken in this research are determining the topic and problem formulation, data collection, literature analysis, synthesis of findings and preparation of conclusions. The results showed that the integration of local wisdom into chemistry learning has shown a positive impact on students' skills and understanding. Several studies have highlighted the importance of incorporating local wisdom as it has the potential to increase students' interest and motivation in learning chemistry. Students become more engaged and active in the learning process when they see the relevance of chemistry materials to their daily lives. The implementation of ethnoscience in chemistry learning in schools has many potential benefits, but still faces various challenges. Teachers face various challenges in implementing ethnoscience, including lack of resources and supportive teaching materials, lack of training and support from the school, as well as difficulties in adapting the existing curriculum to the ethnoscience approach.

**Keywords:** *Local Wisdom; Chemistry Learning; Literature Review; Ethnoscience Approach*

## Introduction

Chemistry learning plays a role in developing various essential skills for students. Through experiments and laboratory activities, students not only learn about chemical theory, but also develop practical skills such as observation, data analysis, and problem solving. Chemistry learning involving citizen science-based projects can improve students' independent work, argumentation, and communication skills, all of which are very important in 21st century education (Munandar et al., 2024). Chemistry education also contributes to the development of students' character and social awareness. Through learning based on character values, students are taught to be responsible for the environment and society. This is in line with research showing that character education in chemistry learning can foster positive behavior and good ethics among students (Adesoji et al., 2019).

Incorporating local wisdom into chemistry learning, particularly through an ethnoscience approach, offers significant opportunities for enriching students' educational experiences. Ethnoscience refers to the study of local knowledge systems, traditions, and practices that communities have developed over time, which are often rooted in their environmental

interactions (Sari et al., 2023). Integrating local wisdom enables students to connect theoretical knowledge with real-world applications that are familiar and meaningful to them (Dewi et al., 2019).

Students not only gain insights into traditional methods and materials used in chemistry-related activities but also understand the cultural relevance and sustainability of these practices, for example local communities often have knowledge of natural resources, such as plant-based substances or traditional techniques for purifying water, that can be explored in chemistry lessons. These practices are based on empirical observations passed down through generations, which can provide valuable hands-on learning experiences for students (Siahaan et al., 2023). Through this, chemistry becomes not just a theoretical subject but a bridge connecting science with cultural heritage, fostering a deeper sense of respect for both the environment and local communities (Rahmawan et al., 2023).

The ethnoscience approach promotes the development of critical thinking and problem-solving skills as students explore how local communities have addressed challenges using chemistry in their daily lives (Ariani et al., 2024). Students might investigate how certain natural materials are used in local medicine or food preservation, discussing the chemical processes involved and how they contribute to sustainability. This practical knowledge not only makes learning more engaging but also emphasizes the importance of applying scientific knowledge to solve real-world problems (Lestari et al., 2024).

Integrating local wisdom into chemistry education helps foster social awareness and responsibility. Students learn to appreciate the value of traditional knowledge while recognizing its potential for addressing contemporary environmental and societal issues, such as sustainability and climate change (Zidny et al., 2022). Chemistry with local cultural practices, students develop a sense of responsibility toward preserving both the environment and their cultural heritage, in line with character education. This approach not only improves academic skills but also nurtures social values, empathy, and a sense of global citizenship (Wahyudiati et al., 2023). The integration of local wisdom through an ethnoscience approach in chemistry education enhances students' learning by making it more relevant, practical, and connected to real-world issues (Murwitaningsih et al., 2023). This method supports the development of critical academic and life skills, while also promoting ethical values and social responsibility—key elements for preparing students for the challenges of the 21st century.

Ethnoscience, is an approach that integrates local culture with science (Pratama et al., 2023). Ethnoscience allows students to engage with their local culture, thus enriching their learning experience. Ethnoscience-based chemistry learning is based on the recognition of local culture as a fundamental part of education, enabling the expression and communication of ideas and the development of science (Widiyawati et al., 2023). Although the ethnoscience approach is recognised to make the learning atmosphere more, there are still obstacles in its application. Some teachers still experience difficulties in linking science materials with local wisdom around them. Therefore, efforts are needed to improve teachers' understanding of ethnoscience so that they are able to integrate cultural knowledge with science in learning (Aulia et al., 2023). Identifying and bridging this research gap is very important to optimise the application of the ethnoscience approach in chemistry learning.

Relevant research has been conducted who state that the use of the ethnoscience approach in chemistry learning can also improve students' science literacy, particularly in the aspects of content, context, and science process (Christiana et al., 2024). This approach not only connects chemical theory with everyday practices that are more relevant to students but

also provides students with the opportunity to understand the relationship between science and their cultural life. In this regard, local wisdom-based learning also helps students understand the values and norms inherent in their local culture, thereby strengthening their identity and pride in their culture (Hasibuan et al., 2023).

The ethnoscience approach in the development of learning materials can be utilized by studying traditional ingredients or local traditional clothing that the community possesses (Fahrudin et al., 2023). Using traditional medicinal plants in chemistry lessons can broaden students' perspectives on natural methods that have been applied by local communities for health and healing. Through exploring the chemical processes in these natural materials, students can learn about chemical reactions, the properties of substances, and the relationship between chemistry and local cultural practices. This can help teachers design chemistry lessons that are more engaging, contextual, and relevant to students' everyday lives (Wirama et al., 2023). Furthermore, the development of digital books based on local wisdom is an effort to utilize regional potential in enhancing students' competencies. These digital books not only present chemistry content that aligns with the curriculum but also include elements of local wisdom that can enrich students' understanding of chemistry within their cultural context. In this way, students can learn chemistry through a more holistic approach, linking scientific theory with relevant and in-depth local practices (Januarti et al., 2024).

Students not only gain scientific knowledge but also strengthen their connection with their culture and environment, creating more meaningful and sustainable learning experiences by integrating local wisdom into teaching materials. Based on the above problems, the purpose of this study is to analyse the implementation of ethnoscience in chemistry learning in schools. This is expected to make a significant contribution to improving the quality of chemistry education that is more contextual and relevant to students. Thus, the ethnoscience approach in chemistry learning makes a valuable contribution in enriching students' learning experiences, improving science literacy, and strengthening local cultural identity in the context of education.

## Method

This research method uses a descriptive qualitative approach with a literature review to examine the application of local wisdom in chemistry learning through the ethnoscience approach. This approach was chosen because it allows the researcher to collect, analyze, and organize information from various relevant sources, providing a deeper understanding of how local wisdom can be integrated into chemistry education, as well as the benefits and challenges faced in its implementation (Kasi et al., 2021). This literature review aims to identify the main concepts in the use of ethnoscience in chemistry education, uncover various local wisdom practices related to chemistry topics, and explore how this approach can enhance students' understanding of chemical concepts.

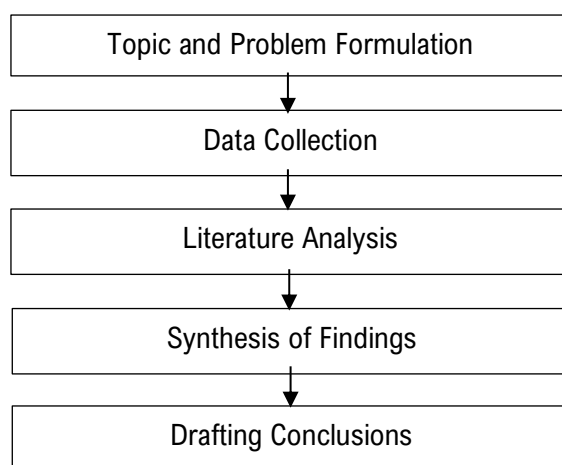
The first step in this research is the determination of the topic and formulation of the problem. The main focus of this research is to study the application of local wisdom in chemistry education through the ethnoscience approach. The problem formulation discussed includes questions such as how to integrate local wisdom into chemistry learning and what impact it has on students' understanding of scientific concepts. This research also explains how local wisdom can be used as a relevant learning resource and how the relationship between local culture and chemistry can provide a deeper meaning in learning.

The researcher conducts a literature search through various sources in the data collection phase such as academic journals, books, articles, and research reports that discuss ethnoscience, chemistry education, and the application of local wisdom in education. The collected literature includes previous studies examining the application of ethnoscience in chemistry learning across different cultural contexts, as well as research discussing the challenges and successes of integrating local wisdom with chemistry education. The researcher can obtain various perspectives and information needed to explore the topic in depth by collecting these references.

The researcher analyzes the literature by classifying various findings related to the application of ethnoscience in chemistry education. This analysis includes identifying the teaching methods used, the chemistry topics taught, and how elements of local wisdom are integrated into the learning process. Additionally, the researcher also evaluates the challenges faced in applying the ethnoscience approach, such as the lack of understanding about the importance of local wisdom, limited resources, and difficulties in linking scientific concepts with local traditions.

The researcher combines the results of the analysis in the synthesis of findings stage from various literatures to identify common patterns and gaps in the application of the ethnoscience approach. This synthesis aims to provide a more comprehensive overview of the potential and challenges associated with integrating local wisdom in chemistry education. The researcher can develop insights into the effectiveness from the synthesis of the ethnoscience approach in enhancing students' understanding of chemistry, as well as the social and cultural benefits gained from local wisdom-based teaching.

The researcher prepares conclusions based on the findings from the literature analysis and synthesis in the conclusion stage. The conclusions provide recommendations for local wisdom-based chemistry teaching practices and their implications for the curriculum and teaching methods that are more relevant to the local cultural context. The researcher also offers suggestions for further development in the use of ethnoscience as an approach in chemistry education, with the hope of enriching students' learning experiences and increasing their awareness of the importance of preserving and maintaining local wisdom as part of their cultural identity. The research steps taken can be seen in Figure 1.



**Figure 1.** Research Stages

## Results and Discussion

The implementation of ethnoscience in chemistry learning at school aims to integrate local cultural knowledge with chemistry concepts. This is expected to make learning more contextual, relevant and interesting for students. This approach also aims to preserve and appreciate local wisdom in the context of science education.

### *Application of Local Wisdom in Chemistry Learning*

Some teachers have begun to integrate local wisdom in chemistry materials, such as the use of natural materials from the surrounding environment as examples in chemistry experiments. Most people, including students, do not know the uniqueness of local wisdom in their area. People think that science learning at school or on campus is not related to local culture in the community (Khusniati et al., 2023). Local wisdom is often closed, shrouded by the frame of mythology and mystical fog, so that the supporting community is less aware of its scientific arguments. The introduction and inheritance of local wisdom knowledge and values can be done by integrating it into the formal education curriculum (Yuliana et al., 2023). The application of local wisdom in chemistry learning can increase the relevance and effectiveness of chemistry learning by integrating local culture and wisdom into the chemistry curriculum. Here are some examples of the application of local wisdom in chemistry learning:

**Table 1.** Results of literature analysis on the application of local wisdom in chemistry learning

No	Author	Article Title	Ethnoscience Integration	The Meaning of Integration
1.	Mashami et al. (2023)	Chemistry Learning Based on Local Wisdom in Betawi Culture	Integrating Jakarta's local wisdom, such as bir pletok, asinan betawi, and gabus pucung, into chemistry learning.	This local wisdom is used to explain chemical concepts such as benzene, acid-base, and electrochemical reactions.
2.	Cahyani et al. (2023)	Innovation of Natural Materials Chemistry Practicum by Utilizing the Local Wisdom of the Sasambo Tribe	Practical Chemistry of Natural Materials (KBA) by utilising the local wisdom of the SASAMBO tribe in the form of various types of medicinal plants.	The isolation methods used consist of extraction, fractionation and purification. The isolation procedures emphasise laboratory-scale practicum and are suitable for KBA lectures.
3.	Damanik et al. (2023)	Development of Digital Chemistry Enrichment Book Based on Local Wisdom of Indramayu Regency	This research developed a digital chemistry enrichment book. Examples of local wisdom used are regional potential, norms, customs, and others.	Utilising regional advantages in terms of economy, cultural arts, human resources, language, information and communication technology, ecology, etc.
4.	Yuendita et al. (2024)	Development of Chemical Teaching Aids Based on Local Wisdom	Developed local wisdom-based chemistry teaching aids for grade XI high school. This teaching aid is equipped with a manual for making and using chemical teaching aids.	Examples of teaching aids developed are a mock-up of limestone burning, natural pH paper, hard water softening device, and electrocoagulation device.

5.	Wahyudiati et al. (2023)	Ethnochemistry: Exploring the Potential of Sasak Local Wisdom as a Chemistry Learning Resource	The relevance of Sasak local wisdom to chemistry materials can be reviewed based on the perspective or approach of analogy, representation, apperception, visualisation and interpretation and the potential of local wisdom as a learning resource in Basic Chemistry courses.	Learning resources in Basic Chemistry courses, namely on 5 subjects including matter and its changes, separation and mixture making, atomic structure of the periodic system of elements, and chemical bonding integrated Sasak local wisdom.
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The integration of local wisdom into chemistry learning has shown a positive impact on students' skills and understanding. Several studies have highlighted the importance of incorporating local wisdom, such as Sasak tribal traditions, Cirebon batik process, and Papuan local wisdom, into science education to improve creative thinking, critical thinking, and overall learning outcomes (Mashami et al., 2023). The students can more easily understand the material being taught by utilising local contexts in chemistry learning, thus improving understanding of science concepts and processes. This approach not only helps preserve local knowledge, but also strengthens students' connection to their cultural heritage while improving their academic performance and skills in chemistry.

There are various studies that highlight the importance of integrating local wisdom in the learning process. The research who showed that the implementation of local wisdom-based science learning model can improve students' creativity and learning outcomes (Rahmawan et al., 2023). This is in line with the view that local wisdom is a good foundation for developing students' personalities and increasing the effectiveness of learning outcomes (Fahrudin et al., 2023). The integration of local wisdom in chemistry learning can also be done through the development of local wisdom-based science learning modules for high grades in elementary schools (Munandar et al., 2024). This research emphasises that local wisdom is the identity of a region and can be a valuable learning resource. The application of local wisdom in chemistry learning can also be done through the development of physics textbooks based on local wisdom in high school (Sari et al., 2023). This shows that local wisdom can be integrated into subject matter to improve student understanding. In addition, the development of STEM-based chemistry e-modules with an ethnosience approach can also be an effective method in improving students' science literacy (Yuliana et al., 2023). Through this approach, students can be involved in the learning process that integrates local wisdom with chemistry concepts.

Thus, the application of ethnosience local wisdom in chemistry learning can make a positive contribution in increasing student creativity, strengthening character, and improving student understanding of science concepts, improving learning quality, increasing student awareness of the importance of local culture, and increasing the relevance of chemistry learning to everyday life and enriching student learning experiences through relevant local contexts.

### ***Impact on Students***

The ethnosience approach has the potential to increase students' interest and motivation in learning chemistry. Students become more engaged and active in the learning process when they see the relevance of chemistry material to their daily lives. This approach can also help students in developing their critical and analytical thinking skills. Although many studies discuss the concept and potential of ethnosience in chemistry learning, there are still limited

empirical studies that systematically evaluate the effectiveness of this approach on student learning outcomes in various cultural contexts (Khusniati et al., 2023).

The application of local wisdom in education, such as through Project-Based Learning (PjBL) and e-modules based on local content, has shown a significant positive impact on students. PjBL based on local wisdom enables cultural preservation, enhances creativity, and develops students' soft skills such as problem solving and teamwork (Cahyani et al., 2023). Similarly, the development of e-modules based on local wisdom has been shown to increase students' cultural awareness and motivation in Reading and Writing subjects (Yuendita et al., 2024). Integrating local wisdom in literary literacy activities has had a positive impact on students' awareness of local culture, although challenges such as low interest in reading still exist (Damanik et al., 2023). Moreover, utilising local wisdom in mathematics education has resulted in ethnomathematics guidelines, which contribute to the preservation of local culture and enhance the mathematics learning experience for students (Dewi et al., 2019). The preventive education model based on multiculturalism and local wisdom has been effective in addressing drug-related issues among students, emphasising spiritual collaboration and vocational skills development (Lestari et al., 2024). Ethnoscience-based local wisdom learning has several positive impacts on students including the following:

**Table 2.** Results of literature analysis positive impact on students

No	Author	Article Title	Impact Type	Impact Description	Indicator
1.	Asiyah et al. (2023)	Needs Analysis of Ethnoscience-Based Learning Model Development to Improve the Quality of Science Learning and Embed the Value of Local Wisdom of Elementary School Students	Improving the Quality of Learning	Ethnoscience-based science learning can improve the quality of learning by integrating local culture and wisdom, making students more active, creative, and motivated in learning.	This can be seen from the behaviour of students who are more active and creative in thinking critically and solving problems.
2.	Hikmawati et al. (2021)	Effectiveness of Ethnoscience-Based Science Module on Improving Students' Critical Thinking Skills	Developing Critical Thinking Skills	Ethnoscience-based science learning can develop students' critical thinking skills to	interpret, analyse, evaluate, draw conclusions, and explain by using the science-ethnoscience module.
3.	Wirama et al. (2023)	The Effect of Ethnoscience Integration in Science Learning on Learning Outcomes: A Meta-Analysis	Raising Students' Awareness	Long-term integration of ethnoscience in science learning can influence students' awareness in utilizing science and technology to contribute to society.	Students become more aware of the importance of science in everyday life
4.	Sari et al. (2023)	Analysis of Ethnoscience in Science Learning in Elementary Schools in Padang and Bukittinggi City	Developing Student Competence	Ethnoscience-based learning can develop students' competence in applying traditional knowledge (ethnoscience) by using student-centered learning methods, such as observation, demonstration, discussion, projects,	It can support students to develop critical thinking and problem-solving skills

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				experiments, and field trip	
5.	Rusmansyah et al. (2023)	The Effectiveness of Ethnoscience-Based PBL Model on Learning Outcomes	Improving Learning Quality with Regular Evaluation	Routine evaluations conducted once a month can improve the quality of learning by providing a forum for teachers to express complaints, shortcomings, needs, and appeals that can improve the quality of learning in schools.	increased understanding or cognitive ability of students

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Table 2 shows that ethnoscience-based local wisdom learning can have significant positive impacts on students, including improving learning quality, developing critical thinking skills, increasing student awareness, developing student competencies, and improving learning quality with the influence of background and regular evaluation.

The implementation of local wisdom in education has shown a positive impact on students, both in terms of environmental sustainability, improved science learning outcomes, resilient character building and the development of a strong character, resilient character building, science process skills and concept mastery, cognitive learning outcomes, writing literacy skills, problem solving skills and student character, social attitudes and critical thinking skills in mathematics and student cognitive learning outcomes (Fahrudin et al., 2023).

The application of local wisdom can also be done through various methods, such as the development of local wisdom-based textbooks, thematic teaching materials, problem-based learning models, thematic science modules, Quick on The Draw learning models, interactive learning videos, and interactive multimedia (Sari et al., 2023). The local wisdom can also be integrated into practicum, e-modules, student textbooks, physics comics, and other learning media (Kasi et al., 2021).

***Challenges in Implementation***

This Teachers face various challenges in implementing ethnoscience, including a lack of resources and supportive teaching materials, as well as a lack of training and support from the school. In addition, there are also difficulties in adapting the existing curriculum to the ethnoscience approach. Chemistry teachers often do not receive adequate training to integrate local wisdom and ethnoscience in their learning. This results in a lack of readiness and confidence in implementing this approach (Siahaan et al., 2023). Challenges in implementing ethnoscience in chemistry learning include the lack of teaching materials that integrate local wisdom, the limited problem-solving ability of students, and the need for more in-depth discussion of the material presented. Several studies emphasise the urgency to develop contextual teaching materials that integrate local wisdom such as Sasak and Javanese traditions, guided inquiry modules to improve problem solving skills, and salt ethnoscience-based multimedia learning tools to improve student understanding and engagement. Development of Ethnoscience-Oriented. The development of ethnoscience-based teaching materials aims to address the difficulties students face in understanding chemistry concepts, highlighting the importance of creating valid and practical resources for effective chemistry education (Zidny et al., 2022). These findings underscore the importance of addressing these challenges to improve the quality and relevance of chemistry education through ethnoscience integration.



The challenges in implementing the application of ethnoscience local wisdom in chemistry learning involve several aspects that need to be considered. The important aspect is student creativity, which can be enhanced through local wisdom-based science learning models with a focus on fluency, flexibility, and originality. Society's adjustment to technology adoption is a global challenge in preserving local wisdom, which shows the need for integration between local wisdom and technological developments in the context of learning. The study of the potential of Sasak local wisdom as a source of chemistry learning highlights the relevance of local wisdom to chemistry materials as well as the potential of local wisdom as a valuable learning resource in basic chemistry learning (Januarti et al., 2024). The implementation of ethnoscience-based science learning in elementary schools shows that teachers face difficulties in applying this approach, although it can help in exploring students' initial conceptions through contextual learning (Hikmawati et al., 2021). The implementation of awik-awik local wisdom in ecotourism management in Gili Trawangan also shows a positive impact on environmental sustainability and the welfare of local communities (Pratama et al., 2023).

The ethnoscience approach in chemistry learning needs to be strengthened to improve students' chemical literacy through the development of contextual learning models that integrate chemical concepts with community knowledge. Understanding and strengthening the character of students can also be improved through local wisdom-based learning models. The local wisdom can be integrated appropriately and effectively to improve students' science literacy. Ethnoscience-based learning can also make the learning atmosphere more interesting and help improve students' understanding of science concepts.

Thus, through the integration of ethnoscience local wisdom in chemistry learning, an increase in student creativity, strong character building, deep understanding of science concepts, and awareness of environmental sustainability and local wisdom can be achieved. The implementation of ethnoscience in chemistry learning can face several challenges, among others:

**Table 3.** Results of literature analysis challenges in implementation

No	Author	Article Title	Type of Obstacle	Obstacle Description	Solution
1.	Wahyudiati et al. (2023)	Ethnoscience approach in chemistry lessons for student character building: responses of Chemistry Teachers in NTB	Curriculum Limitations	A curriculum that does not pay attention to local culture can be an obstacle in the implementation of ethnoscience. Teachers must be able to develop learning models that are in accordance with the existing curriculum, but also pay attention to local culture.	Develop learning modules that incorporate cultural elements and are in accordance with the 2013 curriculum
2.	Nurhasnah et al. (2022)	Effectiveness of Ethnoscience-Based Chemistry Learning on Science Process Skills of Tugumulyo State Vocational School Students	Limitations of Teacher Ability	Chemistry teachers who have not developed the ability to integrate local culture into chemistry learning can face difficulties in developing effective learning models.	Teachers must have the ability to combine chemical knowledge with local culture, as well as use methods, and learning media that can be used as a means of transferring

				knowledge in everyday life, and instilling culture at the same time.
3.	Amini et al. (2021)	Ethnoscience-Based Chemistry Learning Model to Improve Students' Critical Thinking Skills	Limitations of Technology Use	Ineffective use of technology can be an obstacle in the implementation of ethnoscience. Teachers must be able to develop strategies for using technology in accordance with learning objectives and pay attention to student achievement in critical thinking and problem solving.
4.	Hanum et al. (2023)	Ethnoscience-Based Chemistry Learning Model to Improve Students' Critical Thinking Skills	Limitations of Student Awareness	Students who do not have awareness about the importance of local culture in everyday life can face difficulties in understanding chemistry concepts that are integrated with local culture. Teachers should be able to raise students' awareness of the importance of local culture in everyday life and pay attention to students' achievement in critical thinking and problem solving.

Thus, the implementation of ethnoscience in chemistry learning requires good teacher skills, sufficient resources, a curriculum that takes into account local culture, effective measurement of results, high student awareness, and effective use of technology.

## Conclusion

The conclusion, implementation of ethnoscience in school chemistry learning has many potential benefits, but still faces various challenges. Greater efforts are needed to provide the necessary resources. Teachers need to be trained to apply these methods and develop contextualised teaching materials that are relevant to local cultures. Collaboration with local communities can help enrich student learning. The integration of local wisdom in the chemistry curriculum through the ethnoscience approach is also important. Thus, the ethnoscience approach can be implemented more effectively and make positive contributions to science education in Indonesia such as improving understanding of chemical concepts through linkages to everyday life, strengthening students' cultural identity, and supporting local sustainability practices through the application of science in a broader cultural context.

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