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Cultural Integration in Science Education: Teachers' Perceptions of The Sumbawa Oil (*Melala)* as Local Wisdom in Chemistry Learning

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Abstract

Integrating local wisdom into chemistry education is crucial for creating a contextual and meaningful learning experience. This study analyses teachers' perceptions of incorporating Sumbawa Oil (Melala) local wisdom into chemistry lessons in Sumbawa and West Sumbawa Regencies. Using a quantitative descriptive method, a Likert scale questionnaire was distributed via Google Forms. Results show that teachers' perceptions generally fall within the good-to-excellent range, with the highest scores (90.2%) on relevance to curriculum and chemistry content. The significance test (Sig. 2-tailed) reveals no significant differences in perceptions across indicators or among teachers with different teaching experiences, indicating a consistently positive outlook on teaching with Melala local wisdom. The study emphasizes the importance of developing culture-based teaching tools and training. It encourages collaboration among schools, universities, and local governments to ensure the effective and sustainable integration of local wisdom.

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Keywords: Learning innovation, Cultural integration in chemistry learning, Local wisdom-based learning, Ethnoscience.

INTRODUCTION

Education plays a strategic role in national development, not only as a means of transferring knowledge but also of shaping character and fostering national identity (Hakim & Darojat, 2023; Sudargini & Purwanto, 2020; Yolandha & Anggareni Dewi, n.d.). The swift flow of information and external culture also impacts shifts in national values, morals, and character. Education needs to be both reactive and proactive in preserving identity and cultural relevance (Tambunan et al., 2022). Integrating local wisdom into education is an important means of preserving national identity (Wafiqni & Nurani, 2018). Integration of local wisdom helps foster identity, character, and a sense of pride in regional culture (Hatima et al., 2025).

Integrating local wisdom into chemistry education is a strategic approach to make learning more relevant to students' daily lives (Asrin et al., 2022). For instance, the process of producing Sumbawa Oil (Melala) involves chemical reactions where coconut milk and spices undergo breakdown, resulting in the separation of oil into different phases and the formation of an emulsion colloid. Additionally, it involves studying the chemical structures of bioactive compounds, such as terpenoids, alkaloids, and phenolics (Agustina, 2016). That is why the local wisdom promotes social harmony and environmental sustainability, while also enabling students to understand scientific concepts through authentic and meaningful experiences (Anggraisa et al., n.d.; Syarif et al., 2024). Incorporating these values into chemistry teaching is essential to make science more contextual, relevant, and connected to students' culture, environment, and daily routines (Tabun, 2024).

Teachers, as key figures in implementing learning, play a vital role in integrating local wisdom into teaching materials, methods, and classroom activities. Their perceptions, experiences, and attitudes greatly influence the success of incorporating local wisdom-based Chemistry education (Atrup et al., 2022). Believing that local wisdom can enhance Chemistry content is a crucial step toward increasing student motivation and improving conceptual understanding (Ramlah & Julyyanti, 2025). Previous studies suggest that ethnoscience applications, such as the barodak tradition, help students understand concepts more easily and foster cultural values in schools (Atmojo & Wafa, 2022; Fahrudin et al., n.d.; Laksmana et al., 2023; Mukti et al., 2022; Ningsih et al., 2022). Culture-based learning has also shown promise in strengthening the link between science and local wisdom practices (Liswijaya et al., 2025). However, most research focuses on practical implementation without thoroughly connecting local wisdom to core chemical concepts, such as reactions, colloidal systems, and chemical structures, areas that are inherently related to these cultural practices. This creates a challenge: the limited development of a model for integrating contextual local wisdom. Thus, local wisdom

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should be used not only as a teaching tool but also as a conceptual resource to deepen students' understanding of chemistry.

Based on this description, integrating local wisdom into chemistry education has great potential to promote a more contextual, meaningful, and culturally rooted learning experience. This study aims to explore chemistry teachers' perceptions of integrating Melala local wisdom into chemistry lessons. Their opinions, perceptions, and the challenges they encounter are essential in the process of integrating learning. This research is expected to make a scientific contribution by providing a comprehensive overview of teacher perceptions and serving as a foundation for developing chemistry learning strategies that are relevant, sustainable, and aligned with the local cultural context.

MATERIALS AND METHODS

Time and Place

This research was conducted from September 16 to September 29, 2025, in Sumbawa Regency, West Nusa Tenggara Province, Indonesia.

Research Design

This study employs a quantitative research method with a descriptive survey approach, aiming to obtain an objective, empirical picture of teachers' perceptions of integrating Sumbawa oil (Melala) local wisdom into Chemistry learning. This approach was selected because it enables systematic collection and analysis of numerical data, allowing the results to be generalised to a broader population (Lapang, 2006). The descriptive method is used to illustrate general tendencies and perceptions held by teachers without manipulating the variables studied.

Population and Sample

The population in this study consisted of chemistry teachers from 24 public high schools in Sumbawa and West Sumbawa Regencies. The sample obtained from the calculation results of Yamane's (1967) method was 22 chemistry teacher schools (Oakland, 1953).

Research Instrument

The instrument used in this study was a closed questionnaire (closed-ended question). The questionnaire is in the form of a Likert scale with four options (Strongly Agree, Agree, Disagree, Strongly Disagree). The questionnaire consists of 22 questions that measure five indicators of Teacher Perceptions of the Integration of Sumbawa Oil Local Wisdom *(Melala)* in the Chemistry Learning Process, namely: 1) Relevance to Chemistry Curriculum & Material; 2) Benefits for Students; 3) Preservation of culture and environment; 4) Teacher Readiness; and 5) School and community support. With 22 items spread across the five indicators, this instrument is expected to comprehensively describe teachers' perceptions of the integration of Sumbawa Oil local wisdom in chemistry learning.

Research Procedure

Data collection was conducted online via an electronic questionnaire (Google Form) distributed to chemistry teachers in the Sumbawa and West Sumbawa Regencies. Prior to completion, respondents were provided with a brief explanation of the research objectives and assured of the confidentiality of the data collected. Teachers who agreed to participate were asked to carefully read the instructions and provide answers based on their own perceptions. The questionnaire data were automatically recorded in a Google Spreadsheet.

Data Analysis Techniques

The data were analysed quantitatively by calculating the percentage of respondents' responses in each answer category for each indicator. This analysis aimed to comprehensively describe teachers' perceptions of integrating Sumbawa Oil (Melala) local wisdom into chemistry instruction. The percentage of each answer category was calculated using the following formula:

$$P = \frac{f}{N} x\ 100\%$$

Description
P : Percentage
F : Frequency of respondents' answers in a particular category
N : Total number of respondents

The percentage calculation results are then analysed using the following interpretive criteria guidelines (commonly employed in educational research):

Table 1. Criteria Guidelines

Percentage Range (%)	Criteria
81–100	Excellent
61–80	Good
41–60	Enough
21–40	Not enough
0–20	Very less

RESULTS AND DISCUSSION

Result

A study was conducted to explore chemistry teachers' perceptions of the *Melala* local wisdom-based learning in two regions: Sumbawa Regency and West Sumbawa Regency. The sample consisted of 22 chemistry teachers from 22 schools across both areas. The analysis employed a descriptive quantitative approach, calculating the frequency and percentage of respondents in each answer category for each indicator. Data collected via Google Forms were analysed descriptively for each predetermined indicator. The analysis involved calculating the percentage of respondents in each assessment category to determine the achievement criteria for each indicator. This method aims to provide a comprehensive description of teachers' perceptions regarding the implementation of chemistry learning that integrates local wisdom values. The following are the results of the data analysis on teachers' perceptions of chemistry learning integrated with local wisdom in the teaching process, as reflected in the teachers' perception scores.

Teachers' Perceptions of Culturally Integrated Learning

The results of the calculations from questionnaires completed by Chemistry Teachers in two districts, Sumbawa and West Sumbawa, after analysis showed the percentage for each indicator that measures

teachers' perceptions of culture-based learning related to chemistry lessons.

Table 2. Results of Analysis of Teachers' Perceptions of Integrated Learning of the *Melala* Culture

No	Indicator	Percentage (%)	Criteria
1	Relevance to Chemistry Curriculum and Material	90.2	Excellent
2	Benefits for Students	69.8	Good
3	Preservation of culture and environment	67.9	Good
4	Teacher Readiness	65.9	Good
5	School and community support.	67.3	Good

The results showed that the correlation between the curriculum and chemistry materials achieved the highest percentage at 90.2%, categorized as very good. This confirms that the developed learning content is highly aligned with the characteristics of the Independent Curriculum, which emphasizes contextual, project-based learning, and supports the strengthening of the Pancasila Student Profile. The benefit indicator for students reached 69.8%, categorized as good, indicating that teachers see tangible benefits from applying local wisdom in chemistry learning. The indicator for cultural and environmental preservation obtained a score of 67.9%, also categorized as good. Teachers assessed that the integration of the *Melala* culture serves as a means of preserving local culture as well as a medium for environmental education.

The teacher readiness indicator reached 65.9% (good category), indicating that most teachers already understand the importance of local wisdom-based learning, although they still face obstacles in the pedagogical aspect and the availability of learning resources. The final indicator, namely support from schools and communities, obtained a score of 67.3% (good category). Schools and communities are considered to have provided sufficient support, especially in the provision of materials, practice locations, and collaboration with indigenous communities. Overall, these five indicators show a positive trend towards the implementation of local wisdom-based chemistry learning in the *Melala*. The following graphic visualization shows a comparison of the level of achievement of each indicator.

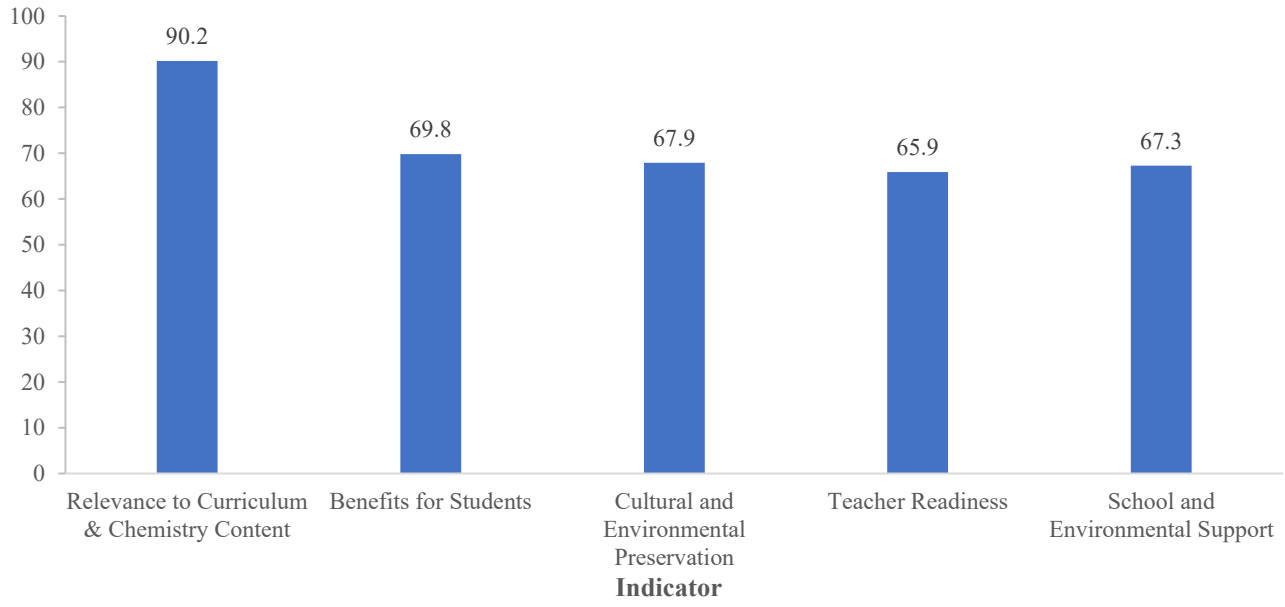

Figure 1. Level of Achievement of Each Indicator.

Significance Test

Another analysis conducted was a significance test (Sig. 2-tailed) to determine whether there were differences in teachers' perceptions of the five indicators of chemistry learning integrated with local wisdom. This test was conducted to evaluate the consistency of respondents' responses and to determine if each indicator was perceived differently by teachers. In other words, this analysis was used to evaluate whether teachers' assessments of important aspects in the implementation of local wisdom-based learning were uniform or varied. The following table shows the significance test (Sig. 2-tailed):

Table 3. Significance Test Table (Sig. 2-tailed)

No	Indicator	Sig. (2-Tailed)	Criteria
1	Relevance to Chemistry Curriculum and Material	0.419	No Different
2	Benefits for Students	0.627	No Different
3	Cultural and Environmental Preservation	0.407	No Different
4	Teacher Readiness	0.172	No Different
5	School and Environmental Support	0.592	No Different

Based on the results of the significance test (Sig. 2-tailed), all indicators have a significance value greater than 0.05. Thus, there is no significant difference between

teachers' perceptions of each indicator of chemistry learning integrated with local wisdom. These results indicate that teachers' perceptions of each aspect of learning are relatively consistent and homogeneous across relevance, benefits, cultural values, readiness, and institutional support.

Comparison of Teachers' Perceptions Based on Length of Teaching Experience

The final analysis conducted in this study compared teacher perceptions by teaching experience, specifically between teachers with more than 5 years of experience (>5 years) and those with less than 5 years of experience (<5 years). This analysis aimed to determine whether there were differences in perception tendencies between senior teachers and relatively new teachers in their assessment of the implementation of local wisdom-integrated chemistry learning.

Graph 2 shows a comparison of perceptions between teachers with more than five years (>5 years) and less than five years (<5 years) of teaching experience regarding five indicators of chemistry learning integrated with local wisdom. Melala.

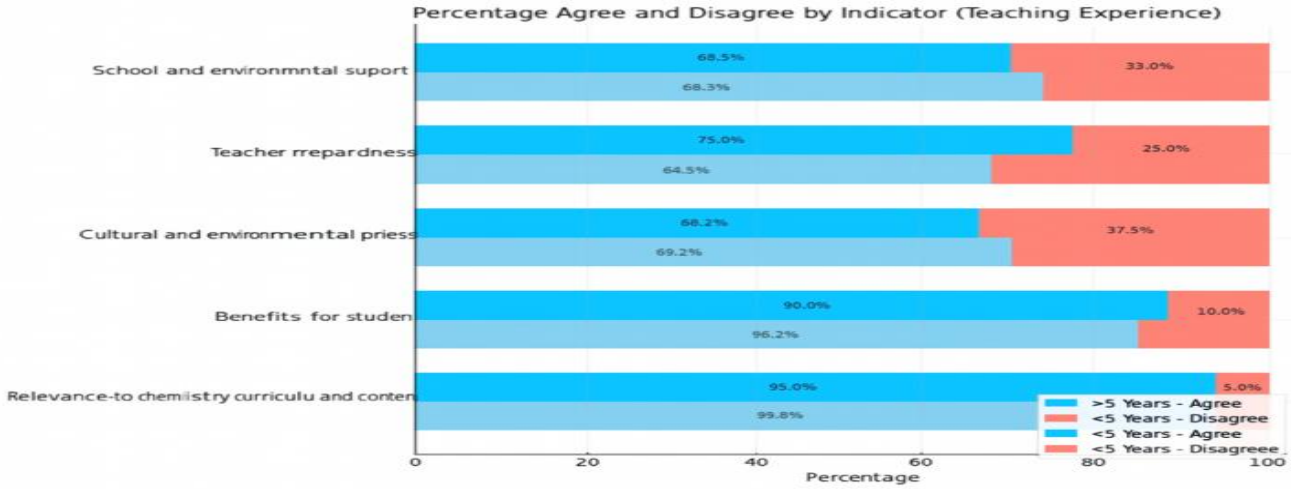

Figure 2. Comparison of Teachers' Perceptions Based on Length of Teaching Experience

Discussion

Teachers' Perceptions of Culturally Integrated Learning

The highest percentage of relevance-to-curriculum indicators indicates that Melala-based learning aligns with the principles of the Independent Curriculum, which emphasises contextual, collaborative learning, and is oriented toward the values of the Pancasila Student Profile (Hanifah et al., 2025). Teachers believe that the Melala tradition can be a concrete context for explaining chemistry concepts such as decomposition reactions, dissolution, and physicochemical changes. This finding aligns with the study by Doloksaribu et al. (2020), which states that integrating local culture into science learning can significantly enhance the relevance and understanding of concepts.

Indicators of benefits for students suggest that applying local cultural contexts can enhance students' interest in learning, intrinsic motivation, and critical thinking skills (Munawwarah & Alqadri, 2025). This is also supported by Septina et al.'s (2025) research, which demonstrates that an ethnoscience approach can enhance scientific literacy through learning experiences relevant to students' lives. However, some teachers consider these benefits suboptimal due to limited media, learning resources, and technical training (Sihombing et al., 2023). Therefore, the development of more systematic teaching tools is urgently needed to ensure that learning benefits are felt more comprehensively (Rahman, 2018).

Cultural and environmental preservation indicators suggest that the Melala tradition promotes increased ecological awareness and the value of cooperation. In the Melala oil-making activity, students learn about thermal reactions and the dissolution of non-polar compounds, and gain an understanding of sustainability and conservation (Doloksaribu et al., 2020; Munawwarah & Alqadri, 2025). Regarding teacher readiness indicators, 65.9% of teachers indicated that they are aware of the importance of ethnoscience, although they still need to improve their pedagogical skills and develop learning resources. Some teachers are not yet accustomed to designing ethnoscience-based modules or worksheets, so ongoing training and mentoring are important strategies (Sumartini et al., 2025; Halimah et al., 2025).

Meanwhile, indicators of support from schools and communities indicate good initial collaboration, such as the provision of materials and practice locations by indigenous communities. However, for sustainability, strengthening school policies, funding for cultural research, and cross-sector collaboration are needed (Dasar & Dan, 2025). These findings confirm that the success of local wisdom-based learning depends on synergy between schools, local governments, and cultural communities (Handayani et al., 2024).

Significance Test

The significance test showed no difference in opinion between teachers who had taught for less than five years and those who had taught for more than five years. This finding suggests that teachers share a positive view of the implementation of local wisdom-based learning. (Wilujeng et al., 2019) This uniformity of perception can be interpreted as indicating that teachers have a comprehensive understanding of contextual learning grounded in local culture, as mandated by the Independent Curriculum, which requires learning to be rooted in the social and cultural context of the students (Suastra & Arjana, 2021).

These results align with research suggesting that positive, consistent perceptions among teachers are indicators of the education system's effectiveness in implementing ethnoscience-based learning innovations. (Budiastra et al., 2021). The uniformity of perceptions also reinforces the finding that teachers in the West Nusa Tenggara region have demonstrated openness and readiness to embrace learning approaches that promote local values as a context for science learning. The absence of significant differences between indicators also suggests that the five learning aspects—relevance, benefits, cultural preservation, teacher readiness, and school support — are closely interrelated and form a unified learning ecosystem that supports the strengthening of scientific literacy and student character. (Saribas, 2015). Local culture-based learning can serve as a cultural bridge, connecting scientific knowledge and traditional wisdom, thereby enhancing students' understanding to make it more contextual and meaningful (Ilhami et al., 2019).

Comparison of Teachers' Perceptions Based on Length of Teaching Experience

Comparison of teacher perceptions based on length of teaching experience, namely between teachers with more than five years of experience (>5 years) and teachers with less than five years of experience (<5 years). In general, the analysis results indicate that both groups of teachers hold positive, relatively consistent perceptions, with a significantly higher percentage of "agree" responses than "disagree" responses across all indicators. The highest level of agreement is found on the indicator relevance to the curriculum and chemistry materials, where 95% of experienced teachers and 89.8% of new teachers agreed that problem-based learning is relevant to the Independent Curriculum, which emphasizes contextual and real-life-based learning. In addition, the indicators' benefits for students also showed a positive response, namely 90% for experienced teachers and 86.2% for new teachers. These two findings suggest that teachers, regardless of their teaching experience, recognise that incorporating local wisdom into chemistry learning can significantly enhance students' interest in learning, motivation, and conceptual understanding. (Marhayani, 2016).

Meanwhile, on the cultural and environmental preservation indicator, the level of agreement among teachers <5 years was 68.2%, and among teachers >5 years was 62.5%, both still in the good category. This indicates that teachers from both groups recognise the significance of context-based learning. Melalain instilling the values of cultural preservation and environmental sustainability (Rukiyati Sugiyo & L. Andriani Purwastuti, 2017). Regarding the indicator of teacher readiness, a slight difference was observed between the two groups: 75% for experienced teachers and 64.5% for new teachers. This difference is reasonable because experienced teachers tend to possess more mature pedagogical skills and a deeper contextual understanding. In contrast, new teachers demonstrate outstanding potential for improvement through training and mentoring. Finally, regarding the indicator of school and community support, 68.5% of teachers <5 years and 65% of teachers >5 years agreed that the school and the surrounding community had supported learning, based on the *Melala*. Although categorized as good, these findings underscore the need for strengthened institutional collaboration and policy support to ensure optimal and sustainable implementation of local wisdom-based chemistry learning.

Based on the analysis and discussion results, several follow-up steps can be taken to strengthen the implementation of local wisdom-based chemistry learning. Melala. The uniformity of teachers' perceptions indicates a strong foundation for developing culture-based contextual learning in a more focused and sustainable manner. Therefore, recommended follow-up actions include developing culture-based teaching tools. Ethnoscience, such as modules, e-LKPD, and digital media, that raise the context in a scientifically interesting way, in accordance with the learning outcomes of the Independent Curriculum (Wilujeng et al., 2024). Furthermore, training and mentoring are needed for teachers to develop curriculum (the ability to design and implement culturally relevant, locally grounded learning creatively). Collaboration among schools, universities, and local governments is also crucial for expanding the implementation of learning models (e.g., *Melala*) across various educational units (Halimah et al., 2025). Further research is recommended to assess the impact of implementing this learning on students' learning outcomes, science process skills, and cultural literacy using an experimental or quasi-experimental design.

While this study presents a positive picture of teachers' perceptions, several limitations should be considered. The respondents were limited to two districts, Sumbawa and West Sumbawa, so generalizing the results to other regions should be done with caution. Furthermore, the research instrument used was quantitative and descriptive, so it did not delve deeply into the reasons behind teacher perceptions through qualitative approaches such as interviews or classroom observations. Furthermore, the research focus was limited to teacher perceptions without including empirical data on the direct impact on students. Therefore, further research is expected to expand the population, combine quantitative and qualitative approaches, and explore the effectiveness of problem-based learning. Melalain is improving students' scientific literacy, character, and critical thinking skills.

CONCLUSION

The results of this study indicate that teachers hold positive perceptions of chemistry learning integrated with local wisdom, with overall scores falling within the good-to-excellent range. The average percentages for the five leading indicators, curriculum relevance (90.2%), student benefits (69.8%), cultural and environmental preservation (67.9%), teacher readiness (65.9%), and school support (67.3%), support this conclusion. Significance test results also show p-values above 0.05 for all indicators, meaning no significant differences in teachers' perceptions across these aspects. Furthermore, both experienced teachers (more than 5 years) and novice teachers (less than 5 years) share similar views, reinforcing a consistent, uniform perception of local wisdom–based chemistry instruction.

These findings suggest that integrating local wisdom into chemistry learning aligns effectively with the Independent Curriculum, particularly in promoting contextual, culturally relevant, and meaningful learning experiences. This approach has the potential to enhance students' scientific literacy, conceptual understanding, and cultural awareness. For future research, it is recommended

to examine the instructional effectiveness of this approach through experimental or mixed-method designs, analyze its impact on scientific process skills, and evaluate long-term student outcomes. Additionally, further studies should explore teacher professional development models and develop standardized teaching materials to ensure broader and sustainable implementation of local wisdom–based chemistry learning.

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