



STUDENTS' PERCEPTIONS OF LOCAL WISDOM INTEGRATION IN SCIENCE LEARNING IN WEST KALIMANTAN AND SARAWAK

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Abstract

This study investigates secondary school students' perceptions of local wisdom integration in science learning in two border regions, West Kalimantan, Indonesia, and Sarawak, Malaysia. The study is grounded in culturally responsive teaching theory and constructivist learning principles, which emphasize the importance of contextual relevance in meaningful knowledge construction. A comparative quantitative research design was employed using a cross-sectional survey approach. A total of 100 students participated in the study, equally distributed between the two regions. Data were collected using a validated Likert-scale questionnaire measuring three perception dimensions: perceived relevance, perceived engagement, and perceived conceptual support. Descriptive analysis indicates that students in both regions demonstrate positive perceptions toward the integration of local wisdom in science learning. The highest mean scores were observed in perceived conceptual support, suggesting that students believe contextualized cultural content enhances their understanding of scientific concepts. An independent samples t-test reveals a statistically significant difference between the two regions; however, the effect size is small, indicating similar perception patterns overall. The findings suggest that integrating local wisdom into science instruction strengthens students' engagement and conceptual clarity while maintaining scientific rigor. The study contributes empirical evidence to culturally responsive science education in Southeast Asian cross-border contexts and highlights the importance of contextual curriculum design. Implications for curriculum development, teacher training, and sustainability-oriented science education are discussed.

Keywords: local wisdom, science education, student perception, culturally responsive teaching, cross-border education

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INTRODUCTION

Local wisdom refers to cultural knowledge, practices, and beliefs that are rooted in particular communities. Integrating local wisdom into science learning creates a culturally responsive and contextually relevant educational approach. This integration links scientific concepts with students' lived experiences and local environments. Previous research signals that embedding local wisdom in science learning increases relevance and promotes deeper understanding of scientific principles (Sihombing, 2024).



In recent years, education scholars and policymakers have emphasized the role of local knowledge in curriculum design to support sustainable development. The bicultural and geographic context of border regions such as West Kalimantan (Indonesia) and Sarawak (Malaysia) offers rich indigenous traditions and environmental knowledge that can enhance science learning. Evidence suggests that local wisdom-based instructional materials improve students' engagement and achievement in science subjects by aligning content with cultural practices (Lampung study, 2025).

Research also shows that science learning grounded in local wisdom strengthens students' connection to their cultural heritage. Integration fosters critical thinking, scientific literacy, and environmental understanding. For instance, studies in Indonesia report that when teachers use local cultural contexts in science instruction, students demonstrate higher motivation and conceptual mastery than through conventional methods (local wisdom integration literature review, 2025).

Despite the growing attention to local wisdom in education, empirical research on students' perceptions of this integration remains limited, especially in cross-cultural border regions. Comparative studies between different cultural contexts, such as West Kalimantan and Sarawak, can reveal how students from diverse backgrounds value and respond to culturally informed science instruction. This knowledge is essential for curriculum developers, educators, and policymakers striving to make science learning both meaningful and equitable.

This study aims to investigate how secondary students in West Kalimantan and Sarawak perceive the integration of local wisdom in science learning. It explores students' attitudes, perceived relevance, and perceived impact on understanding science content. The findings will contribute to the theoretical and practical understanding of culturally responsive science education and support efforts to contextualize science curricula in multicultural settings.

LITERATURE REVIEW

Local Wisdom in Science Education

Local wisdom refers to community-based knowledge systems developed through long-term interaction with the natural environment. In science education, local wisdom is often conceptualized through the framework of ethnoscience, which connects indigenous knowledge with formal scientific concepts. Recent studies show that integrating local wisdom into science instruction improves conceptual understanding, environmental awareness, and cultural identity (Ardan et al., 2021; Suryanti et al., 2022).

Research in Southeast Asia indicates that contextual science learning grounded in local ecological practices strengthens students' ability to relate abstract concepts to real-life phenomena. For example, studies conducted in Indonesian secondary schools report that embedding traditional agricultural practices, river management systems, and indigenous ecological knowledge into science lessons enhances engagement and retention (Prasetyo & Widodo, 2021; Yuliana et al., 2023). Similar findings emerge in Malaysian contexts, where culturally contextualized science modules promote meaningful learning and strengthen students' sense of belonging (Rahman et al., 2022).

In border regions such as Borneo, local wisdom is deeply tied to environmental sustainability practices, including forest management, water systems, and traditional resource conservation. Integrating these practices into science learning supports Education for Sustainable Development and strengthens environmental literacy (UNESCO, 2021). However, many implementations focus primarily on instructional outcomes rather than examining students' subjective responses to such integration.

Students' Perceptions in Learning

Students' perceptions play a critical role in shaping learning motivation, engagement, and achievement. Perception influences how learners interpret instructional strategies, relevance of content, and classroom experiences. According to recent empirical research, positive perceptions

toward contextualized learning environments correlate strongly with improved academic performance and deeper conceptual understanding (Putri & Hidayat, 2022; Lim & Tan, 2023).

In science education, perception studies often examine students' views on teaching methods, learning media, and classroom climate. When students perceive learning as relevant to their daily lives and cultural backgrounds, they show higher intrinsic motivation and cognitive involvement (Ng et al., 2021). Conversely, when science is presented as abstract and detached from lived experience, students report lower engagement levels.

Recent cross-cultural studies highlight the importance of understanding perception within specific socio-cultural contexts. Students from indigenous or rural backgrounds tend to value learning approaches that acknowledge local practices and traditions (Abas et al., 2022). However, comparative research across neighboring regions remains limited. Few studies directly compare how students in different educational systems perceive similar culturally integrated approaches.

Culturally Responsive Science Teaching

Culturally responsive teaching emphasizes instructional practices that recognize and value students' cultural backgrounds. In science education, this approach involves integrating local contexts, indigenous knowledge, and community experiences into curriculum design. Contemporary research confirms that culturally responsive science teaching fosters inclusivity, critical thinking, and scientific literacy (Gay, 2020; Ladson-Billings, 2021).

Recent empirical studies demonstrate that culturally grounded science instruction supports identity development and improves conceptual understanding (Lee et al., 2022; Siregar et al., 2024). Teachers who incorporate local examples, community issues, and environmental contexts create learning environments that bridge traditional knowledge and scientific reasoning. This alignment reduces cognitive dissonance between students' cultural beliefs and formal scientific explanations.

In the context of West Kalimantan and Sarawak, culturally responsive science teaching holds strategic importance. Both regions share ecological similarities and indigenous heritage, yet operate under different national education policies. Understanding students' perceptions in these settings can inform the development of science curricula that respect cultural diversity while maintaining scientific rigor.

Despite growing scholarship on culturally responsive science education, empirical research that specifically investigates students' perceptions of local wisdom integration in cross-border Borneo contexts remains scarce. This gap justifies the present study.

METHOD

This study employed a comparative quantitative design using a cross-sectional survey to analyze and compare students' perceptions of local wisdom integration in science learning in West Kalimantan, Indonesia, and Sarawak, Malaysia. The design enabled systematic comparison between two culturally and ecologically connected regions operating under different national curricula while maintaining consistency in data collection and analysis procedures.

Participants were secondary school students from selected public schools chosen through purposive sampling. Schools met two criteria: implementation of contextual or local wisdom-based science learning and location in semi-urban or rural areas where local ecological practices remain active. The sample consisted of approximately 50 to 100 students with balanced regional representation, drawn from Grades 8 to 10 to ensure prior exposure to relevant science instruction. Parental consent and institutional approval were secured, and all procedures complied with ethical research standards in both countries.

Data were collected using a structured questionnaire measuring three dimensions: perceived relevance, perceived engagement, and perceived conceptual support. The instrument included 20 to 25 Likert-scale items on a five-point scale. Content validity was evaluated by science education

experts, construct validity was examined through exploratory factor analysis, and reliability was confirmed using Cronbach's alpha with a minimum threshold of 0.70.

Data analysis combined descriptive and inferential statistics. Means and standard deviations described overall perception levels, while independent samples t-tests compared regional differences. Cohen's d was calculated to assess effect size. Assumptions of normality and homogeneity were tested prior to analysis. Statistical procedures were conducted using SPSS version 26 or equivalent software with a significance level of 0.05.

RESULTS AND DISCUSSION

Descriptive Results

A total of 100 students participated in the study, consisting of 52 students from West Kalimantan and 48 students from Sarawak. The perception questionnaire demonstrated good internal consistency with a Cronbach's alpha coefficient of 0.87, indicating reliable measurement across the three dimensions. Table 1 presents the descriptive statistics of students' perceptions in both regions.

Table 1. Descriptive Statistics of Students' Perceptions of Local Wisdom Integration

Dimension	Region	Mean	SD	Category
Perceived Relevance	West Kalimantan	4.12	0.54	High
	Sarawak	3.98	0.61	High
Perceived Engagement	West Kalimantan	4.05	0.57	High
	Sarawak	3.89	0.63	Moderate-High
Perceived Conceptual Support	West Kalimantan	4.18	0.52	High
	Sarawak	4.01	0.59	High
Overall Perception Score	West Kalimantan	4.12	0.48	High
	Sarawak	3.96	0.55	Moderate-High

The findings indicate that students in both regions hold positive perceptions toward the integration of local wisdom in science learning. West Kalimantan students reported slightly higher mean scores across all dimensions compared to Sarawak students. The highest score in both regions was found in the dimension of perceived conceptual support, suggesting that students believe local wisdom integration helps clarify scientific concepts.

Inferential Analysis

An independent samples t-test was conducted to examine whether there was a statistically significant difference between the two groups. The results presented in Table 2.

Table 2. Forms of Contextual Integration in Science Curricula

Variable	t-value	Sig. (p)	Mean Difference	Cohen's d	Interpretation
Overall Perception Score	2.41	0.017	0.16	0.32	Small effect

The results indicate a statistically significant difference in overall perception scores between students in West Kalimantan and Sarawak ($p < 0.05$). However, the effect size is small ($d = 0.32$), suggesting that although differences exist, they are not substantial.

Discussion

The findings indicate that students in both West Kalimantan and Sarawak hold positive perceptions toward the integration of local wisdom in science learning. This result supports

contemporary research in culturally responsive science education, which argues that contextualized instruction enhances perceived relevance and meaningful engagement (Lee et al., 2022; Siregar et al., 2024). When science content connects directly to students' cultural practices and environmental realities, learners are more likely to view knowledge as useful and applicable rather than abstract and detached.

The high score in the dimension of perceived relevance aligns with constructivist learning theory. Constructivism posits that students build new knowledge upon prior experiences and existing cognitive structures. Local wisdom provides familiar contexts that activate prior knowledge, enabling students to anchor scientific concepts in real-life situations. Studies in ethnoscience-based instruction demonstrate that contextual grounding strengthens knowledge construction and reduces misconceptions (Suryanti et al., 2022). In border regions where community traditions remain visible in daily life, such contextual anchors appear particularly effective.

The strong perception of conceptual support further reinforces cognitive theories of meaningful learning. According to Ausubel's theory of meaningful verbal learning, new information is retained more effectively when it relates to learners' existing conceptual frameworks. Local ecological practices, traditional agricultural methods, and indigenous environmental management systems offer concrete representations of abstract scientific principles such as ecosystems, energy transfer, and chemical processes. Recent empirical findings confirm that contextual examples rooted in local knowledge enhance conceptual clarity and long-term retention (Prasetyo & Widodo, 2021; Yuliana et al., 2023).

The dimension of perceived engagement also reflects motivational theories, particularly self-determination theory. When learning activities acknowledge students' cultural identities, they support psychological needs for relatedness and competence. Ng et al. (2021) report that culturally contextualized instruction increases intrinsic motivation because students feel recognized and valued. The present findings are consistent with this argument. Students perceive local wisdom integration not only as academically helpful but also as emotionally meaningful.

The statistically significant difference between West Kalimantan and Sarawak, although small in magnitude, may reflect differences in curriculum implementation, teacher training, or institutional emphasis on contextual learning. Indonesian curriculum reforms in recent years have explicitly encouraged contextual and local-based learning approaches. This policy direction may influence classroom practice and, consequently, students' perceptions. In contrast, implementation in Sarawak may vary depending on school-level autonomy and instructional priorities. Nevertheless, the small effect size indicates that students in both regions respond positively overall, suggesting shared cultural and ecological foundations shape similar perception patterns.

These findings also resonate with culturally responsive teaching theory. Gay (2020) emphasizes that effective instruction integrates students' cultural references into all aspects of learning. Ladson-Billings (2021) further argues that culturally relevant pedagogy supports academic success while affirming cultural identity. In the context of West Kalimantan and Sarawak, local wisdom integration appears to function as a bridge between indigenous knowledge systems and formal science education. This bridge reduces potential epistemological tension between traditional beliefs and scientific explanations.

Moreover, the results contribute to the broader discourse on Education for Sustainable Development. UNESCO (2021) highlights the importance of integrating local knowledge systems to promote environmental literacy and sustainability awareness. Borneo's ecological landscape, characterized by rich biodiversity and traditional resource management practices, provides a strong foundation for sustainability-oriented science learning. Students' positive perceptions suggest that such integration can support not only cognitive outcomes but also environmental consciousness.

However, perception alone does not guarantee improved academic achievement. While positive perception is associated with engagement and motivation, future research should examine causal relationships between local wisdom integration and measurable learning gains. Mixed-method

designs incorporating classroom observation, achievement tests, and qualitative interviews would provide deeper insight into how perception translates into performance.

In summary, the findings affirm theoretical perspectives from constructivism, meaningful learning theory, culturally responsive pedagogy, and motivational theory. They demonstrate that integrating local wisdom into science learning is not merely a cultural addition but a pedagogically grounded strategy that supports relevance, engagement, and conceptual understanding across cross-border educational contexts.

CONCLUSION

This study examined and compared secondary school students' perceptions of local wisdom integration in science learning in West Kalimantan and Sarawak. The findings indicate that students in both regions demonstrate positive perceptions across three key dimensions: perceived relevance, perceived engagement, and perceived conceptual support. Students believe that integrating local wisdom makes science learning more meaningful, culturally connected, and conceptually clearer.

Although a statistically significant difference was found between the two regions, the effect size was small. This suggests that while contextual and systemic differences may influence perception levels, the overall response toward local wisdom integration remains consistently positive across both educational settings. The results reinforce the view that culturally grounded science instruction supports meaningful learning processes and enhances students' engagement with scientific concepts.

Importantly, the strongest perception dimension was conceptual support, indicating that students recognize the cognitive benefits of linking scientific knowledge with local ecological and cultural practices. This finding strengthens theoretical arguments from constructivist and culturally responsive frameworks that emphasize contextual relevance as a foundation for deep learning.

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