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The Effect of Ethnoscience-Integrated Science Teaching Materials on Junior High School Students' Scientific Literacy

Rizka Isnaeni[1], Mahrus[1], Alauddin Shahih[2], Zaena Sultona Osi[3], Fana Tri Prihatini[4]

[1]Master of Science Education Program, University of Mataram, Mataram, Indonesia;
[2]Business Management Program, Melbourne Polytechnic, Melbourne, Australia;
[3]Master of Science Education Program, University of Mataram, Mataram, Indonesia;
[4]Chemistry Education Program, University of Sunan Kalijaga, Yogyakarta, Indonesia.

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***Corresponding Author**
Rizka Isnaeni,
University of Mataram, Indonesia;
E-mail: rizkaisnaeni5@gmail.com

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Abstract

Scientific literacy is an essential competency in twenty-first-century science education, yet Indonesian students' achievement in this area remains relatively low. One possible contributing factor is the limited availability of contextual teaching materials that connect formal science concepts with students' sociocultural environment. This study aimed to analyze the effect of ethnoscience-integrated science teaching materials on eighth-grade students' scientific literacy at MTs. Birrul Walidaini NW Bertong. The study employed a quantitative pre-experimental method with a one-group pretest-posttest design involving 20 students selected through saturated sampling. Data were collected using a scientific literacy test and analyzed descriptively and inferentially through normalized gain (N-gain), the Shapiro-Wilk normality test, and a paired-sample t-test. The results showed a statistically significant increase in students' scientific literacy ($p < 0.05$), with the mean score rising from 54.95 on the pretest to 78.60 on the posttest, and an average N-gain of 0.575, placing it in the medium category. These findings suggest that ethnoscience-integrated teaching materials are highly effective in improving scientific literacy, particularly when implemented through guided inquiry with adequate teacher scaffolding, by bridging abstract scientific concepts with students' everyday cultural realities. The study provides empirical support for culturally responsive, context-based science learning and offers practical implications for the development of science teaching materials in madrasah settings.

Keywords: contextual learning; ethnoscience; guided inquiry; scientific literacy; teaching materials.

INTRODUCTION

Scientific literacy has become one of the most important goals of contemporary science education because students are expected not only to master scientific concepts but also to interpret evidence, evaluate claims, and make responsible decisions in everyday life (Valladares, 2021; Ke et al., 2021; Almeida et al., 2023; Sjöström, 2025). One promising approach to developing this multidimensional competence is integrating ethnoscience into science teaching materials. Ethnoscience refers to local knowledge, cultural practices, community experiences, and indigenous perspectives that can be reconstructed and connected to formal school science (Andayani, 2021; Alifa & Zainil, 2025). In science education, local and indigenous knowledge are increasingly recognized as valuable resources for making learning more culturally responsive, sustainability-oriented, and epistemically inclusive (Zidny et al., 2020; Zidny et al., 2021; Latip et al., 2024; Rasmawan et al., 2025). This approach is particularly relevant to the MTs (Islamic junior high school) context, where students' learning experiences are intricately shaped by community values, local traditions, and daily sociocultural practices that are intertwined with Islamic values. In madrasah education, science learning is expected not only to transmit concepts but also to remain connected to students' lived realities. Therefore, ethnoscience-integrated science teaching materials are urgently needed to function as a bridge between formal scientific concepts and the local world already familiar to students.

The urgent need for this contextual approach is evidenced by the persistently low levels of scientific literacy among Indonesian students. According to the OECD, Indonesia's performance in science on PISA 2022 remained far below the OECD average, indicating that many students still have difficulty applying scientific knowledge in authentic contexts (OECD, 2023). A direct contributing factor to these low scores is that science

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instruction often remains decontextualized, relies heavily on abstract formulas, and is insufficiently connected to students' local sociocultural realities. When science is taught mainly as abstract concepts, students may perceive it as distant from their own lives rather than as a relevant tool for understanding the world. Recent literature emphasizes that context-based science education makes learning more inclusive and meaningful for diverse learners (Hüfner et al., 2025; Pinneo & Benton, 2024). In this sense, context is not merely an example added to a lesson, but a pedagogical entry point. Research has shown that integrating ethnoscience into science learning can effectively address this gap by supporting scientific and environmental literacy and students' perception of science's relevance in daily life (Dewi et al., 2019; Dewi et al., 2021; Hikmah et al., 2025).

Despite its proven advantages, significant problems remain in its practical application and in the existing literature. Practically, as observed at MTs. Birrul Walidaini NW Bertong, the science learning process is not optimal due to teachers' limited mastery in developing innovative, culture-based teaching materials. This condition is further evidenced by students' daily science scores, which often fall below the minimum passing threshold, leading to a heavy reliance on conventional printed textbooks that lack integration of local wisdom. Furthermore, a review of the literature reveals a clear research gap. Although ethnoscience has been widely discussed, the available evidence remains fragmented. Several studies have highlighted the value of local knowledge, but many have focused on broad curriculum innovation, cultural literacy, critical thinking, or sustainability-related outcomes without explicitly targeting the junior high school (SMP/MTs) level with a primary focus on scientific literacy (Latip et al., 2024; Atmojo et al., 2025; Rasmawan et al., 2025). A recent systematic review also indicates that while ethnoscience shows promise, its implementation varies substantially across educational levels, instructional models, and targeted learning outcomes (Hikmah et al., 2025). Consequently, more specific empirical evidence is still needed regarding whether ethnoscience-integrated teaching materials can directly overcome these practical and theoretical problems in the madrasah context.

Therefore, the novelty of this study lies in positioning ethnoscience-based teaching materials not merely as supplementary media, but as the main instructional intervention, particularly when delivered through guided inquiry, which serves as a highly effective implementation strategy for junior high school students to directly strengthen scientific literacy. This distinguishes the present study from previous research which largely focused on elementary school levels (Suryanti et al., 2020), targeted other competencies like critical thinking (Atmojo et al., 2025), emphasized STEM-PBL integration without a primary scientific literacy focus (Utami et al., 2025), highlighted general module feasibility (Setiawan et al., 2017), or yielded low-to-moderate improvements without explicit evidence for MTs contexts (Saefullah et al., 2017; Zulirfan et al., 2023). Accordingly, this study aims to analyze the effect of ethnoscience-integrated science teaching materials on students' scientific literacy through a quantitative pre-experimental approach with a one-group pretest-posttest design. The findings are expected to contribute theoretically to the growing literature on culturally responsive science learning and practically provide a concrete reference for developing ethnoscience-based science modules or teaching materials for other public and private madrasahs in Indonesia (Yacoubian, 2018; Pinneo & Benton, 2024; Sjöström, 2025).

MATERIALS AND METHODS

Time and Place

This research was conducted from June to July 2024 at MTs. Birrul Walidaini NW Bertong. The intervention was implemented in two instructional meetings, each lasting 2 x 40 minutes (two class hours). The school was selected because it represents a learning context in which students are closely connected to local cultural practices, while ethnoscience-based science teaching materials had not yet been systematically implemented. The participants were eighth-grade students with relatively similar school backgrounds and limited prior exposure to ethnoscience-based contextual science teaching materials.

Research Design

This study employed a quantitative pre-experimental method using a one-group pretest-posttest design. This design is expressed in the notation O1 - X - O2, where O1 refers to the pretest administered before the intervention to measure students' initial scientific literacy, X refers to the treatment in the form of learning using ethnoscience-integrated science teaching materials, and O2 refers to the posttest administered after the intervention to measure students' final scientific literacy. Thus, the difference between O1 and O2 was used to identify changes in students' scientific literacy after the treatment. This design is useful for examining changes within the same group before and after an intervention, although its findings should be interpreted with caution because the absence of a control group limits the ability to draw strong causal inferences (Knapp, 2016).

Population and Sample

The population in this study consisted of all 20 eighth-grade students of MTs. Birrul Walidaini NW Bertong in the 2023/2024 academic year. Because the population size was relatively small, saturated sampling was used, meaning that all members of the population were included as research participants (Sugiyono, 2019). This technique allowed the data to represent the condition of the entire target population in the class. The independent variable in this study was the use of ethnoscience-integrated science teaching materials, while the dependent variable was students' scientific literacy. In this study, scientific literacy was operationally defined as students' ability to explain scientific phenomena, interpret data and evidence scientifically, and apply scientific concepts in relevant everyday contexts (Ke et al., 2021; Almeida et al., 2023; Sjöström, 2025).

Research Prosedure

The research procedure consisted of four stages: subject determination, preparation, implementation, and analysis. In the first stage, all eighth-grade students were designated as the research sample. In the second stage, the researcher prepared and validated the ethnoscience-integrated science teaching materials, prepared the scientific literacy test instrument, and developed the lesson plans for the topic of Force and Newton's Laws. In the third stage, students first completed a pretest to measure their initial scientific literacy. The intervention was then carried out in two meetings utilizing a guided inquiry approach, as providing adequate teacher scaffolding is highly effective for junior high school students. In the first meeting, students were introduced to contextual phenomena drawn from local cultural practices and guided to identify scientific concepts related to force and motion. In the second meeting, students analyzed these phenomena using ethnoscience-integrated science teaching materials, discussed the relationship between local practices and formal scientific concepts, and completed follow-up tasks to strengthen scientific reasoning. After the intervention, students completed a posttest to assess their final level of scientific literacy. The learning process was facilitated by the same teacher, and prior to implementation, the teacher received a short briefing regarding the use of the teaching materials. In the fourth stage, pretest and posttest data were analyzed to determine the level and significance of improvement in students' scientific literacy.

Data Analysis Techniques

The primary research data were collected using a scientific literacy test administered before (pretest) and after (posttest) the intervention. The data were analyzed descriptively and inferentially. Descriptive analysis was used to characterize the data using the mean, minimum score, maximum score, and standard deviation. To determine the magnitude of improvement, the normalized gain (N-gain) was calculated and categorized as low, medium, or high. In the context of this study, a medium N-gain was interpreted as a meaningful improvement because the intervention was conducted within a limited duration of two meetings. Furthermore, to test the significance of the difference between pretest and posttest scores, a paired-samples t-test was conducted at the 0.05 significance level. Before performing the t-test, the normality of the score differences was examined using the Shapiro-Wilk test (Afifah et al., 2022). If the data had not met the assumption of normality, the planned alternative non-parametric analysis was the Wilcoxon signed-rank test (Okoye, K., & Hosseini, S., 2024). The scientific literacy instrument was validated through expert judgment.

RESULTS AND DISCUSSION

Result

Results of Students' Science Literacy Pretest and Post-test

Students' scientific literacy scores were converted into a 0–100 scale for analysis. The instrument consisted of essay and HOTS-based items designed to assess students' ability to explain scientific phenomena, interpret evidence, and apply scientific concepts in contextual situations. Based on the pretest and posttest data from 20 students, an increase in scientific literacy scores was observed after students learned using ethnoscience-integrated science teaching materials. Descriptively, a comparison of test scores is presented in Table 1.

Table 1. Descriptive statistics of pretest and posttest scores

Data	n	Minimum	Maximum	Mean
Pretest	20	35	88	54,95
Posttest	20	48	96	78,60

Table 1 shows that the mean pretest score of 54.95 increased to 78.60 in the posttest, representing an average increase of 23.65 points. In addition, the minimum score increased from 35 to 48, and the maximum score increased from 88 to 96. These findings indicate that the improvement occurred not only at the class-average level but also across students' individual performance.

Test Result Improvement Based on N-Gain

To determine the magnitude of improvement, the pretest and posttest scores were analyzed using normalized gain (N-gain). The calculation results are presented in Tables 2 and 3.

Table 2. Results of N-gain Analysis

Indicator	Value
Pretest Mean	54,95
Posttest Mean	78,60
N-gain Mean	0,575

Table 3. Distribution of N-gain Categories

N-gain Category	n	Percentage (%)
Low	3	15
Medium	10	50
High	7	35

As shown in Table 3, the mean N-gain score was 0.575, which falls into the medium category. Meanwhile, Table 4 shows that 10 students (50%) were in the medium N-gain category, 7 (35%) in the high category, and 3 (15%) in the low category. These results indicate that, overall, the ethnoscience-integrated science teaching materials were effective in producing meaningful gains in students' scientific literacy within a short intervention period. Although the present analysis focuses on overall scores rather than indicator-level gains, the findings still provide evidence of a positive shift in students' scientific literacy performance. The three students who remained in the low N-gain category may reflect individual differences in readiness, participation, or adaptation to the instructional approach; however, further qualitative investigation would be necessary to explain these differences more accurately.

Results of Normality Test and Hypothesis Test

Before testing the effect of the intervention, the normality of the score differences (posttest minus pretest) was examined using the Shapiro-Wilk test (Table 4).

Table 4. Results of the normality test

Data	W Statistic	Sig.	Description
Pretest posttest difference	0,947	0,321	Normal

The result showed a significance value of 0.321 ($p > 0.05$), indicating that the data were normally distributed. Therefore, a paired-sample t-test was used to test the significance of the difference between pretest and posttest scores (Table 5).

Table 5. Results of the paired sample t-test

Comparison	Mean difference	t	df	Sig. (2-tailed)
Pretest-posttest	23,65	13,760	19	0,000

The t-test result showed a mean difference of 23.65 (t = 13.760, df = 19, p = 0.000), indicating a statistically significant difference between the pretest and posttest scores. Thus, it can be concluded that the use of ethnoscience-integrated science teaching materials had a significant positive effect on students' scientific literacy. Based on the available t-value and sample size, the intervention also showed a very large practical effect (Cohen's dz = 3.08). Although the increase from 54.95 to 78.60 reflects substantial classroom-level progress, the result should not be interpreted as directly equivalent to national or international PISA benchmarks, as this study used an internal instructional assessment rather than the standardized PISA instrument (OECD, 2023).

Discussion

Effect of Ethnoscience-Integrated Teaching Materials on Students' Scientific Literacy

The findings of this study indicate that ethnoscience-integrated science teaching materials contributed positively to students' scientific literacy. This conclusion is supported by three main results: the increase in the mean score from 54.95 in the pretest to 78.60 in the posttest, the average N-gain score of 0.575 in the medium category, and the statistically significant paired-sample t-test result. Taken together, these results suggest that the intervention was associated with meaningful improvement in students' scientific literacy within the same class, even though the study did not include a control group. This finding is important because scientific literacy is now widely understood not merely as the recall of scientific facts, but as a multidimensional competence involving the ability to explain phenomena, interpret evidence, and use scientific knowledge in meaningful social and personal contexts (Valladares, 2021; Ke et al., 2021; Almeida et al., 2023; Sjöström, 2025). In other words, improvement in scientific literacy suggests that students are becoming better able to engage with science as a way of thinking about everyday life rather than as a body of isolated concepts.

The Reason Ethnoscience-Integrated Materials May Improve Scientific Literacy

One likely explanation for the improvement is that ethnoscience-integrated teaching materials made science learning more contextual. Recent research on context-based science education shows that context does not merely function as an example added to a lesson; it can also serve as a pedagogical bridge that increases relevance, accessibility, and inclusion in science learning (Hüfner et al., 2025). In the present study, the teaching materials successfully played this bridging role by connecting the topic of Force and Newton's Laws to concrete local cultural experiences. For instance, rather than illustrating mechanical force with abstract blocks on frictionless planes, the materials prompted students to analyze the forces and physical principles in the traditional Peresean (Lombok stick-fighting) art. By examining the action-reaction forces (Newton's Third Law) when a rattan stick strikes a shield, or analyzing the acceleration and mass involved in a fighter's swing (Newton's Second Law), students were able to contextualize abstract physics within a familiar, culturally significant practice. This interpretation aligns with discussions emphasizing that local knowledge enriches science learning best when explicitly connected to scientific reasoning (Zidny et al., 2020; Latip et al., 2024; Rasmawan et al., 2025).

The Role of Cultural Relevance in Supporting Student Meaning-Making

A second explanation concerns cultural relevance. Research suggests that students learn science more meaningfully when their cultural backgrounds and community knowledge are treated as legitimate resources for learning, thereby promoting academic meaning-making and equitable participation (Pinneo & Benton, 2024). When students encounter scientific concepts through situations or practices that are already part of their cultural environment, they begin from familiarity rather than abstraction. To ensure this shift from concrete, culturally meaningful experiences to formal scientific explanation is achieved systematically, the implementation of guided inquiry is crucial. For junior high school students, guided inquiry is the most effective instructional model, as it provides the necessary teacher scaffolding to anchor real-world observations to formal science concepts (Moemeke et al., 2025). Therefore, the likely contribution of the teaching materials in this study lies in supporting students' structured meaning-making process through guided inquiry, rather than merely simplifying the material.

The Reason N-Gain Was Moderate Rather Than High

Although the findings were positive and statistically significant, the average N-gain remained in the medium category. Scientific literacy is a complex competence that develops through repeated opportunities to reason with evidence across diverse contexts, rather than through one-time exposure alone (Ke et al., 2021; Almeida et al., 2023; Sjöström, 2025). Given that the intervention was conducted in only two meetings, a medium improvement is an educationally meaningful result, particularly in indicators such as explaining phenomena, which benefited most directly from the localized context. The result demonstrates the potential of the teaching materials and suggests that deeper literacy development, such as advanced data interpretation, requires a longer, more sustained intervention. The presence of three students in the low N-gain category also indicates that individual differences in readiness or participation may have influenced the results, highlighting the need for further qualitative investigation to explain these differences accurately.

Comparison with Previous Studies

The findings of this study are broadly consistent with previous ethnoscience research showing that culturally grounded learning can improve scientific literacy. Earlier studies have reported that local wisdom-based modules and ethnoscience-oriented materials strengthen students' literacy when concepts are explicitly linked to their sociocultural environment (Dewi et al., 2021; Setiawan et al., 2017; Suryanti et al., 2020; Utami et al., 2025). The present study supports this pattern and extends it specifically to the MTs context. However, the present findings should also be interpreted alongside studies reporting more limited outcomes. A comparison of these contextual studies is summarized in Table 6.

Table 6. Comparison of the present findings with relevant previous studies

Author(s) & Year	Research Focus / Intervention	Key Findings & Limitations
Setiawan et al. (2017); Dewi et al. (2021); Suryanti et al. (2020); Utami et al. (2025).	Ethnoscience modules, collaborative learning, and PBL across various educational levels.	Consistently improved scientific literacy; however, these generalized approaches often lacked a specific emphasis on guided inquiry scaffolding tailored for the MTs context.
Saefullah et al. (2017).	Guided inquiry learning based on Baduy's local wisdom.	The learning was effective, but the improvement in scientific literacy remained relatively low.
Zulirfan et al. (2023).	Ethnoscientific literacy using the Pacu Jalur tradition.	Students' emotional closeness to local culture did not automatically translate into strong ethnoscientific literacy.
The Present Study	Ethnoscience-integrated materials delivered via guided inquiry at an MTs.	Significant improvement in the medium category, proving that cultural elements must be accompanied by explicit teacher scaffolding to build scientific reasoning

These comparative findings indicate that the success of ethnoscience-based learning is not determined solely by the presence of cultural content, but by how effectively cultural elements are transformed into structured activities that explicitly guide students to reason scientifically (Michie et al., 2023).

Practical Implications for Science Teaching in Madrasah Contexts

The findings have practical implications for science teachers, especially in madrasah settings. Ethnoscience-based materials should be designed so that local phenomena serve as conceptual entry points rather than decorative illustrations. This aligns with culturally responsive science education, which emphasizes that relevance emerges when students connect scientific ideas to their own world (Hüfner et al., 2025; Pinneo & Benton, 2024). To operationalize this for Classroom practice, teachers can utilize a structured template for ethnoscience teaching materials, which includes: (1) presentation of a local cultural phenomenon, (2) observation prompts, (3) guiding questions with teacher scaffolding, (4) formal science explanations, (5) evidence-based student tasks, and (6) reflective questions aligned with PISA scientific literacy indicators. This measurable structure helps teachers utilize ethnoscience as a clear pedagogical pathway.

Limitations and Directions for Future Research

This study has several limitations. First, the one-group pretest-posttest design lacked a control class, limiting comparisons against other instructional conditions. Second, the two-meeting intervention limited observation of deeper development in scientific literacy. Third, the study reports overall literacy gains rather than detailed indicator-level changes. Future studies should consider longer interventions, quasi-experimental designs, and granular analyses of scientific literacy indicators. Combining test data with classroom observations or interviews would further elucidate how ethnoscience-based instruction functions in practice, as sustained pedagogical development is necessary to strengthen literacy in a durable way (Bossér, 2024).

CONCLUSION

Based on the findings, it can be concluded that the use of ethnoscience-integrated science teaching materials significantly improved the scientific literacy of eighth-grade MTs students, yielding a medium level of effectiveness. By utilizing local cultural contexts, such as the Perseian tradition, to explain abstract concepts like Newton's Laws, these materials functioned as an effective pedagogical bridge. The study reinforces the view that integrating local wisdom into science learning is not only valuable for cultural preservation but is also pedagogically essential for making structured scientific knowledge more accessible, contextual, and meaningful for junior high school students.

However, this study has several limitations, including the use of a one-group pretest-posttest design without a control group, a small sample size, and a brief two-meeting intervention period that constrained deeper indicator-level analysis. To address these limitations with measurable solutions, future studies are recommended to employ quasi-experimental designs with comparison groups and to extend the instructional duration to 4–6 sessions, ideally. This extended duration, combined with explicit teacher scaffolding during discussions, would provide sufficient time to specifically target and improve complex scientific literacy indicators, such as data interpretation and evidence evaluation.

For educational practice, particularly in madrasah settings, teachers and curriculum developers are encouraged to systematically design ethnoscience-based materials. To ensure the implementation is practical and operational, teachers are recommended to use a structured teaching material template aligned with PISA benchmarks. This practical template should include: (1) presentation of a local cultural phenomenon, (2) observation prompts, (3) guiding questions with teacher scaffolding, (4) formal science explanations, (5) evidence-based student tasks, and (6) reflective evaluation questions. By applying this operational framework through a guided inquiry approach, context-based science learning will more effectively support the development of robust scientific literacy alongside cultural relevance.

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AUTHOR'S CONTRIBUTION

The first author contributed to the conceptualization of the study, literature review, methodology development, instrument development, data collection, data analysis, interpretation of the results, writing the initial draft of the manuscript, reviewing, editing the manuscript, validating the substance of the article, and supervision. The second, third, and fourth authors contributed to the review, edited the manuscript, validated the article's substance, supervised the overall research process, and refined the final manuscript. All authors have read, reviewed, and approved the final version of the manuscript for publication.

Table of Author Contributions

Contribution Indicator	Author				
	1	2	3	4	5
Conceptualization	✓	✓		✓	
Literature Review	✓		✓	✓	✓
Research Design / Methodology	✓	✓			
Instrument Development	✓	✓			
Data Collection	✓				
Data Curation	✓	✓			
Formal Analysis	✓	✓	✓	✓	✓
Data Interpretation	✓				
Writing – Original Draft	✓				
Writing – Review & Editing	✓	✓	✓	✓	✓
Visualization / Tables	✓		✓	✓	✓
Supervision	✓	✓	✓	✓	✓

REFERENCES

Afifah, S., Mudzakir, A., & Nandiyanto, A. B. D. (2022). How to calculate paired sample t-test using SPSS software: From step-by-step processing for users to the practical examples in the analysis of the effect of application anti-fire bamboo teaching materials on student learning outcomes. *Indonesian Journal of Teaching in Science*, *2*(1), 81-92. DOI: https://doi.org/10.17509/ijotis.v2i1.45895

Alifa, F. N., & Zainil, M. (2025). Etnosains Dalam Pendidikan: Memperkuat Identitas Dan Pengetahuan Sains. *Sindoro: Cendikia Pendidikan*, *15*(3), 1-10. DOI: https://doi.org/10.99534/ezeebg15

Almeida, B., Santos, M., & Justi, R. (2023). Aspects and abilities of science literacy in the context of nature of science teaching. *Science & Education*, *32*(3), 567-587. https://doi.org/10.1007/s11191-022-00324-4

Andayani, Y., Purwoko, A. A., Jamaluddin, J., Makhrus, M., & Harjono, A. (2020). Identifikasi pemahaman guru tentang pengembangan perangkat pembelajaran IPA SMP dengan pendekatan etnosain. *Jurnal Pepadu*, *1*(2), 229-234. https://elibrary.ru/item.asp?id=78749421

Astiti, K. A., & Yusuf, Y. H. M. (2018). Pengaruh penggunaan bahan ajar berbasis kontekstual terhadap peningkatan pemahaman konsep fisika siswa materi suhu dan kalor. *Jurnal Fisika: Fisika Sains Dan Aplikasinya*, *3*(2), 185-192. DOI: https://doi.org/10.35508/fisa.v3i2.625

Atmojo, S. E., Anggriani, M. D., Rahmawati, R. D., Skotnicka, M., Wardana, A. K. & Anindya, A. P. (2025). Bridging STEM and Culture: The Role of Ethnoscience in Developing Critical Thinking and Cultural Literacy. *Jurnal Pendidikan IPA Indonesia*, *14*(2). DOI: 10.15294/jpii.v14i2.23505.

Bossér, U. (2024). Transformation of school science practices to promote functional scientific literacy. *Research in science education*, *54*(2), 265-281. DOI: https://doi.org/10.1007/s11165-023-10138-1

Dewi, C. A., Erna, M., Martini, Haris, I. & Kundera, I. N. (2021). The Effect of Contextual Collaborative Learning Based Ethnoscience to Increase Students' Scientific Literacy Ability. *Journal of Turkish Science Education*, *18*(3): 525–541. DOI: 10.36681/tused.2021.88.

Dewi, C. A., Khery, Y. & Erna, M. (2019). An Ethnoscience Study in Chemistry Learning to Develop Scientific Literacy. *Jurnal Pendidikan IPA Indonesia*, *8*(2): 279–287. DOI: 10.15294/jpii.v8i2.19261.

Dwianto, A., Wilujeng, I., Prasetyo, Z. K. & Suryadarma, I. G. P. (2017). The Development of Science Domain Based Learning Tool Which Is Integrated with Local Wisdom to Improve Science Process Skill and Scientific Attitude. *Jurnal Pendidikan IPA Indonesia*, *6*(1): 23–31. DOI: 10.15294/jpii.v6i1.7205.

Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). Analisis faktor penyebab rendahnya kemampuan literasi sains peserta didik. *Jurnal Ilmiah Profesi Pendidikan*, *5*(2), 108-116. https://scholar.archive.org/work/kiap54erzvgbbmbjak3gezr24q/access/wayback/http://www.jipp.unram.ac.id/index.php/jipp/article/download/122/110

Haryadi, R., & Nurmala, R. (2021). Pengembangan bahan ajar fisika kontekstual dalam meningkatkan motivasi belajar siswa. *SPEKTRA: Jurnal Kajian Pendidikan Sains*, *7*(1), 32-39.

Hikmah, N., Yohandri, Arsih, F., Azhar, M. & Razak, A. (2025). Uncovering the Potential of Ethnoscience in Science Learning to Improve Students' Literacy: A Systematic-Literature Review (2014–2024). *Jurnal Pendidikan IPA Indonesia*, *14*(3).

Hüfner, S., Weirauch, K., List, F., Menthe, J., & Abels, S. (2025). Context-based science education to promote diversity-equity-inclusion–a systematic literature review on the understanding of context in science education. *Studies in Science Education*, 1-41. DOI: https://doi.org/10.1080/03057267.2025.2563946

Ke, L., Sadler, T. D., Zangori, L. & Friedrichsen, P. J. (2021). Developing and Using Multiple Models to Promote Scientific Literacy in the Context of Socio-Scientific Issues. *Science & Education*, *30*(3): 589–607. DOI: 10.1007/s11191-021-00206-1.

Knapp, T. R. (2016). Why is the one-group pretest–posttest design still used?. *Clinical nursing research*, *25*(5), 467-472. DOI: https://doi.org/10.1177/1054773816666280

Latip, A., Hernani & Kadarohman, A. (2024). Local and Indigenous Knowledge (LIK) in Science Learning: A Systematic Literature Review. *Journal of Turkish Science Education*, *21*(4): 651–667. DOI: 10.36681/tused.2024.035.

Mashami, R. A., Ahmadi, A. & Pahriah, P. (2025). Green Chemistry and Cultural Wisdom: A Pathway to Improving Scientific Literacy among High School Students. *Social Sciences & Humanities Open*, 11: 101653. DOI: 10.1016/j.ssaho.2025.101653.

Michie, M., Hogue, M., & Rioux, J. (2023). Two-Ways thinking and Two-Eyed Seeing as ways of implementing Indigenous perspectives in the science education curriculum. *Disciplinary and Interdisciplinary Science Education Research*, *5*(1), 23. DOI: https://doi.org/10.1186/s43031-023-00084-3

Moemeke, C. D., Chukwunenye, J. N., & Malik, N. A. (2025). Understanding the Theoretical Foundations of Inquiry-Based Learning: Pivot For Productive Science Eduation in Africa. *Educational Considerations*, *50*(3), 4. https://newprairiepress.org/edconsiderations/vol50/iss3/4/

OECD. (2023). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education*. Paris: OECD Publishing. DOI: 10.1787/53f23881-en.

Pinneo, L. & Benton, A. L. (2024). Culturally Responsive Elementary Science Teaching: A Meta-Analysis of Current Science Teaching Studies and Implications. *Cultural Studies of Science Education*, *19*(4): 553–572. DOI: 10.1007/s11422-024-10222-6.

Purnawati, A., & Yakin, N. (2025). Implementasi Kemampuan Literasi Sains dalam Pembelajaran IPA Terintegrasi di Sekolah Dasar. *Action Research Journal*, *2*(2), 107-120. DOI: https://doi.org/10.63987/arj.v2i2.204

Ramdani, A., & Artayasa, I. P. (2023). Pelatihan Pengembangan Bahan Ajar IPA Berbasis Inkuiri Terintegrasi Kearifan Lokal Sebagai Sumber Belajar Guru Madrasah Tsanawiyah Qamarul Huda Bagu. *Jurnal Pengabdian Magister Pendidikan IPA*, *6*(4), 631-635. DOI: 10.29303/jpmpi.v6i4.6610.

Rasmawan, R., Haryani, S., Susilaningsih, E. & Handayani, L. (2025). Integrating Indigenous Knowledge in Science Education: A Systematic Review of Strategies, Models, and Impacts. *Journal of Teaching and Learning*, *19*(5): 206–225. DOI: 10.22329/jtl.v19i5.9444.

Saefullah, A., Samanhudi, U., Nulhakim, L., Berlian, L., Rakhmawan, A., Rohimah, B. & El Islami, R. A. Z. (2017). Efforts to Improve Scientific Literacy of Students through Guided Inquiry Learning Based on Local Wisdom of Baduy's Society. *Jurnal Penelitian dan Pembelajaran IPA*, *3*(2): 84–91. DOI: 10.30870/jppi.v3i2.2482.

Setiawan, B., Innatesari, D. K., Sabtiawan, W. B. & Sudarmin. (2017). The Development of Local Wisdom-Based Natural Science Module to Improve Science Literation of Students. *Jurnal Pendidikan IPA Indonesia*, *6*(1): 49–54. DOI: 10.15294/jpii.v6i1.9595.

Sjöström, J. (2025). Vision III of scientific literacy and science education: an alternative vision for science education emphasising the ethico-socio-political and relational-existential. *Studies in Science Education*, *61*(2), 239-274. DOI: https://doi.org/10.1080/03057267.2024.2405229

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta. ISBN: 978-602-289-533-6.

Suryanti, S., Mariana, N., Yermiandhoko, Y. & Widodo, W. (2020). Local Wisdom-Based Teaching Material for Enhancing Primary Students' Scientific Literacy Skill. *Jurnal Prima Edukasia*, *8*(1): 96–105. DOI: 10.21831/jpe.v8i1.32898.

Utami, A. F., Prasetya, A. T. & Sumarni, W. (2025). Development of Problem-Based Learning (PBL) Ethnoscience Based Teaching Materials Food and Beverage Additives Material to Improve Students' Science Literacy. *Unnes Science Education Journal*, *14*(3): 553–561. DOI: 10.15294/usej.v14i3.37400.

Valladares, L. (2021). Scientific Literacy and Social Transformation: Critical Perspectives About Science Participation and Emancipation. *Science & Education*, *30*(3): 557–587. DOI: 10.1007/s11191-021-00205-2.

Yacoubian, H. A. (2018). Scientific literacy for democratic decision-making. *International Journal of Science Education*, *40*(3), 308-327. DOI: https://doi.org/10.1080/09500693.2017.1420266

Zidny, R., Sjöström, J., & Eilks, I. (2020). A multi-perspective reflection on how indigenous knowledge and related ideas can improve science education for sustainability. *Science & education*, *29*(1), 145-185. DOI: https://doi.org/10.1007/s11191-019-00100-x

Zidny, R., Solfarina, S., Aisyah, R. S. S. & Eilks, I. (2021). Exploring Indigenous Science to Identify Contents and Contexts for Science Learning in Order to Promote Education for Sustainable Development. *Education Sciences*, *11*(3): 114. DOI: 10.3390/educsci11030114.

Zulirfan, Yennita, Maaruf, Z. & Sahal, M. (2023). Ethnoscientific Literacy in Pacu Jalur Tradition: Can Students Connect Science with Their Local Culture? *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(1): em2210.10.29333/ejmste/12773.