Galaxy: Jurnal Pendidikan MIPA dan Teknologi
E-ISSN: 3063-9905 | Vol. 3, No. 1, Juni 2026
https://doi.org/10.59923/galaxy.v3i1.742

The Secrets of Salt from the Earth's Core: Bledug Kuwu as an Inspiration for Science Literacy of Elementary School Students

Catur Prasetiawati[1)*], Marno Nugroho[2)], Galih Cahya Pratama[3)]

[1,2,3)]Universitas Islam Sultan Agung, Jawa Tengah, Indonesia

*Correspondence: galihcp@unissula.ac.id

ABSTRACT

This study aims to analyze the effectiveness of ethnoscience-based Natural Science (IPA) learning by utilizing the Bledug Kuwu phenomenon as a learning resource to enhance elementary school students' scientific literacy. Bledug Kuwu is a unique geological phenomenon characterized by mud eruptions containing salt, which has long been utilized by the local community as a traditional source of salt. This research employed a mixed-method approach that combined qualitative and quantitative methods. Qualitative data were obtained through field observations, interviews with community members, teachers, and students, as well as an analysis of instructional documents. Quantitative data were collected through scientific literacy tests administered as pre-tests and post-tests to an experimental class and a control class, each consisting of 16 students. Quantitative analysis was conducted using paired sample t-tests, independent sample t-tests, and N-Gain analysis. The qualitative findings indicate that ethnoscience-based science learning incorporating the Bledug Kuwu phenomenon enhances students' understanding of scientific concepts, curiosity, scientific attitudes, and awareness of environmental and local cultural values. Students demonstrated an improved ability to connect scientific concepts with real-life phenomena in their surrounding environment. The quantitative results show a significant improvement in scientific literacy in the experimental class compared to the control class, as indicated by higher post-test mean scores and moderate-to-high N-Gain values. These findings suggest that integrating local phenomena as ethnoscience-based learning resources makes science learning more contextual, meaningful, and effective. Therefore, Bledug Kuwu has strong potential as an inspiration for science learning to optimally develop scientific literacy and character among elementary school students.

Keyword: Etnosains, Bledug Kuwu, Science Literacy

INTRODUCTION

Natural phenomena often contain rich local knowledge that holds great potential for use in the learning process. One such interesting natural phenomenon can be found at Bledug Kuwu, a unique geological site located in Grobogan Regency, Central Java. The area is well known for its mud eruptions that contain salt, making Bledug Kuwu one of the rare natural phenomena in Indonesia. In addition to serving as a tourist attraction, Bledug Kuwu also represents the cultural richness of the local community (Chika, 2022). For generations, the community has recognized and utilized the salt produced by these eruptions, incorporating it into daily life and traditional practices. Knowledge about the process through which the salt emerges has been passed down from one generation to the next, forming an essential part of the community's indigenous knowledge (Martasari et al., 2024). The underground geological mechanisms responsible for the formation of salt, including pressure from gas and mineral-rich mud, have not only shaped the physical landscape but have also influenced local traditions, beliefs, and ways of understanding the natural world. By observing and interacting with this phenomenon, students and researchers can gain insights into both natural science concepts and the cultural practices that surround them, making Bledug Kuwu a valuable resource for contextual, place-based learning.

Natural Science (IPA) learning in elementary schools requires an approach that is relevant to students' lives. Students need learning experiences that are closely connected to the realities they encounter in their daily lives. However, science learning in elementary schools has tended to remain theoretical in nature, relying heavily on textbooks and abstract explanations. This condition often makes the subject matter feel disconnected from students' real-life experiences, reducing their engagement and interest in the subject. In fact, the

https://doi.org/10.59923/galaxy.v3i1.742
Vol. 3, No. 1, Juni 2026

surrounding environment contains many natural concepts that can be used as learning resources, ranging from local plants and animals to geological phenomena and weather patterns (Atmojo et al., 2025). These resources are authentic and meaningful for the development of students' understanding, as they provide concrete examples that illustrate abstract scientific principles. Unfortunately, the use of contextual learning media remains limited, and teachers may not always have the knowledge or resources to integrate local phenomena into their lessons effectively (Boz et al., 2025). This limitation affects the learning process, causing students to be less able to relate science concepts to the phenomena they encounter in their daily lives. Consequently, students' scientific understanding does not develop optimally, and opportunities to foster curiosity, problem-solving skills, and critical thinking through real-world experiences are often missed.

Ethnoscience is an approach that connects local wisdom with formal scientific knowledge. This approach views community knowledge as an integral part of science and considers it a valuable source of scientific information. Such knowledge can then be bridged into school-based learning, providing a more contextual and meaningful learning experience. Through ethnoscience, students do not only learn scientific concepts in a theoretical manner, but also become familiar with the culture within their surrounding environment, observing how scientific principles manifest in everyday life (Johnson et al., 2020). In addition, students gain an understanding of local community practices, such as traditional agricultural methods, natural resource management, or local crafts, and recognize indigenous knowledge that has been passed down through generations. This approach supports educational efforts to foster environmental awareness and care, as students learn to see the connections between human activities, natural resources, and ecological balance. Ethnoscience also helps enhance students' appreciation of local culture, encouraging respect for traditional wisdom and strengthening their sense of identity and belonging within their community. By integrating cultural context with scientific learning, ethnoscience creates opportunities for students to develop critical thinking, problem-solving skills, and a deeper awareness of the relevance of science in real-life contexts (Sya'ban et al., 2024).

Bledug Kuwu is an interesting example of an ethnoscience-based object that is highly relevant for study in elementary school science learning. This phenomenon can be used to explain the concept of salt to students and illustrate fundamental ideas about changes in the states of matter. The material properties resulting from the mud eruption process can be directly observed, allowing students to connect abstract scientific concepts to tangible, real-world examples. The geological phenomena occurring at Bledug Kuwu further enrich its scientific aspects, including the interplay of pressure, mineral content, and gas emissions that lead to the eruption of mud and the formation of salt. The process of salt emerging from mud eruptions is visually engaging and has a simple scientific explanation that can be easily understood by elementary school students, making it an ideal resource for hands-on and inquiry-based learning (Latip et al., 2024). In addition, the local community possesses indigenous knowledge regarding the utilization of this salt, from harvesting techniques to traditional uses, which holds important educational value. Introducing this knowledge to younger generations not only strengthens their understanding of science but also fosters an appreciation for local culture, environmental awareness, and the practical application of scientific knowledge in everyday life. By integrating both scientific and cultural perspectives, Bledug Kuwu provides a holistic learning experience that bridges classroom science with students' local context (Nurfaizah et al., 2025).

The implementation of Bledug Kuwu ethnoscience in science learning is expected to enhance students' scientific literacy. Scientific literacy is not limited to understanding scientific concepts alone; it also involves the ability to relate these concepts to everyday life and to apply scientific reasoning in familiar contexts. Learning that utilizes local phenomena can effectively support this process by connecting classroom content to students' immediate environment and lived experiences. Local phenomena provide learning experiences that are closer to students' real-life contexts, making learning more meaningful, engaging, and easier to comprehend (Nurfaizah et al., 2025). As a result, the material becomes more accessible and relevant for elementary school students, enabling them to construct knowledge through direct experiences and to learn from careful observation of real phenomena. In addition, integrating local ethnoscience encourages students to develop critical thinking and problem-solving skills, as they explore the natural causes and effects behind observable events such as the mud eruptions and salt formation at Bledug Kuwu (Muhammad Imron et al., 2025). By engaging students in both scientific inquiry and cultural understanding, this approach not only deepens conceptual comprehension but also fosters curiosity, environmental awareness, and an appreciation for the practical applications of science in everyday life, allowing students' scientific literacy to develop more optimally and holistically.

https://doi.org/10.59923/galaxy.v3i1.742
Vol. 3, No. 1, Juni 2026

In addition to providing a local context, Bledug Kuwu can be utilized as a valuable learning resource for students. The use of this phenomenon helps students understand the relationship between nature and human activities, illustrating how science is connected to daily life (Wahyu Y. et al., 2025). Students can observe how local communities wisely utilize natural phenomena, such as harvesting salt from mud eruptions, demonstrating the practical application of scientific knowledge. This type of understanding aligns with the goals of science education, which aim to develop students' critical thinking, analytical skills, and ability to make informed decisions. Furthermore, students are encouraged to think creatively in solving problems by exploring natural processes and considering ways to use resources responsibly (Sari et al., 2020). This learning approach also fosters students' environmental awareness, instilling a sense of responsibility for protecting and conserving natural resources. In addition, it introduces students to the natural wealth of their own region, helping them recognize the unique environmental and cultural characteristics of their local area. Such natural wealth is part of an important cultural heritage that should be preserved and passed down to future generations, allowing students not only to learn science but also to develop respect for their environment and cultural identity.

The ethnoscience approach to studying Bledug Kuwu opens new opportunities for teachers, allowing them to develop interdisciplinary and holistic learning experiences. It enables the integration of multiple subjects within a single lesson, providing students with a richer understanding of both science and its connections to other fields (Matindike & Ramdhany, 2025). Science learning can be enriched with elements of local history, helping students explore the cultural background of the surrounding community and understand how knowledge about natural phenomena has been passed down through generations. The geography of the area around Bledug Kuwu can also be incorporated into lessons, illustrating how geological formations, land features, and environmental conditions influence the occurrence of natural phenomena. Even the local economy related to salt utilization can be included, demonstrating the practical applications of scientific knowledge in everyday life. By combining these subjects, teachers can create learning experiences that are not only engaging but also meaningful, helping students see the interconnectedness of science, culture, and society (Aprilia et al., 2025). Thus, Bledug Kuwu has value beyond being merely a geological object; it can serve as a comprehensive learning resource that allows students to understand various aspects of scientific knowledge in an integrated and contextual manner while fostering critical thinking, problem-solving, and an appreciation for their local environment and heritage.

The novelty of this study lies in the development of scientific literacy among elementary school students through the integration of local phenomena into learning. The research utilizes the salt phenomenon from the Bledug Kuwu eruptions as an ethnoscience-based learning resource, making the learning approach more contextual, engaging, and meaningful. Unlike previous studies, Bledug Kuwu is not examined solely as a geological object, nor do earlier studies focus exclusively on its cultural aspects. This study presents a new perspective in science education by using local phenomena as a source of inspiration for understanding scientific concepts, thereby bridging formal scientific knowledge with students' everyday experiences (Puspita et al., 2025). By observing and interacting with real phenomena, students can construct knowledge through direct experiences, which enhances comprehension, retention, and the ability to apply science in practical situations. The integration of ethnoscience with local natural phenomena creates a learning model that is not only educational but also culturally relevant, fostering curiosity, environmental awareness, and appreciation for local heritage. Consequently, this model provides a holistic approach to science education, demonstrating that learning can be both academically rigorous and deeply connected to the students' own surroundings, making it highly applicable and effective in elementary school settings (Sudirman et al., 2025).

METHODS

This study employed a mixed-methods approach, combining qualitative and quantitative methods, to obtain a comprehensive understanding of the implementation of the Bledug Kuwu phenomenon as an ethnoscience resource in elementary school science learning. The qualitative approach was used to gain an in-depth understanding of the learning process, including students' experiences, their comprehension of scientific concepts, and teachers' perceptions of integrating ethnoscience into science lessons. Qualitative data were collected through classroom observations, in-depth interviews with teachers and students, and analysis of instructional documents such as lesson plans (RPP) and teaching materials. This approach aimed to capture the meaning and socio-cultural context related to the Bledug Kuwu phenomenon, thereby explaining how local knowledge about salt and mud eruptions is integrated into students' scientific literacy. Observations focused

https://doi.org/10.59923/galaxy.v3i1.742
Vol. 3, No. 1, Juni 2026

on activities such as simple experiments, group discussions, and the use of local media that emphasize the connection between scientific concepts and students' everyday lives (Latip et al., 2024).

Meanwhile, the quantitative method was employed to measure the effectiveness of implementing the ethnoscience approach in enhancing students' scientific literacy. The quantitative instruments consisted of science literacy tests and questionnaires designed to assess students' ability to understand scientific concepts, relate the material to real-world phenomena, and demonstrate critical and creative thinking skills (Fitria et al., 2025). The research sample was selected purposively, comprising several classes in elementary schools located around the cultural and geological area of Bledug Kuwu. Quantitative data analysis was conducted using descriptive statistics to examine the distribution of students' literacy scores, as well as t-tests or ANOVA to compare results before and after the implementation of ethnoscience-based learning. By combining these two approaches, the study not only produced measurable numerical data but also provided an in-depth understanding of the learning process and students' contextual learning experiences.

Furthermore, the integration of the two methods was carried out through data triangulation, which involved combining the results of observations, interviews, document analysis, and quantitative tests to obtain valid and reliable insights. This triangulation allowed the researchers to systematically identify the relationship between students' learning experiences and improvements in their scientific literacy. In addition, the mixed-methods approach enabled the researchers to develop a practical Bledug Kuwu-based ethnoscience learning model for elementary school science education (Roy et al., 2025). The results of the study are expected not only to provide empirical evidence of the effectiveness of this approach but also to offer guidance for teachers in designing contextualized learning that integrates local knowledge, formal science, and students' scientific literacy skills. Thus, this study offers both a scientific and practical contribution to the development of ethnoscience-based science education in elementary schools.

RESULTS AND DISCUSSION

Qualitative Research Results

a. Field Observations at Bledug Kuwu

Direct observations in the Bledug Kuwu area revealed that the mud eruptions containing salt are a highly distinctive and rare natural phenomenon with significant scientific value. The eruptions occur repeatedly, though their intensity varies, and are characterized by soft booming sounds caused by gas pressure from underground layers. The mud that is ejected to the surface carries saline content, which then spreads and settles around the active crater. This event indicates ongoing natural geological processes beneath the earth's surface, making Bledug Kuwu a potential open-air natural laboratory. The phenomenon is not only fascinating for the local community and tourists to observe but also holds great potential as a contextual learning resource, as it allows students and observers to directly understand earth dynamics, gas pressure, and the movement of material from the earth's interior to the surface (Lestari, 2025; Novitasari & Raida, 2025).

Figure 1. Bledug Kuwu

Around the eruption site, salt deposits were clearly visible, formed after the saline water underwent natural evaporation due to exposure to sunlight. These deposits appeared as salt crystals adhering to the ground surface and to simple containers used by the local community. This process illustrates a change in the state of matter from liquid to solid through evaporation and crystallization (Putri et al., 2024). Such observations provide students with concrete examples of physical changes, making abstract scientific concepts more accessible and understandable. This natural phenomenon is highly relevant to elementary school science topics,

https://doi.org/10.59923/galaxy.v3i1.742
Vol. 3, No. 1, Juni 2026

particularly in discussions about the properties of materials, changes in the states of matter, and natural processes occurring in the surrounding environment (Amakraw & Kartika, 2022; Amelia, 2025). Moreover, the process of salt formation at Bledug Kuwu allows students to see the connection between science and daily life, as the harvested salt has practical uses and cultural significance for the local community. By integrating these observations into science learning, students not only gain a clearer understanding of scientific principles but also develop curiosity, critical thinking, and an appreciation for the interaction between natural phenomena and human activity.

Figure 2. Residents' Activities Making Salt in Bledug Kuwu

In addition to the geological aspects, field observations also recorded the activities of the local community around Bledug Kuwu in utilizing the saline water from the mud eruptions as a source of traditional salt. The community collects the saline water using simple tools and then stores it in open containers to dry naturally. The salt processing is carried out without modern technology and depends entirely on natural conditions, particularly sunlight (Nasution et al., 2019; Putranto et al., 2024). This activity reflects the traditional use of natural resources based on local knowledge passed down through generations, even though it has not been fully explained using formal scientific concepts. Observing this process provides students with a concrete example of how humans interact with and adapt to their environment, applying indigenous knowledge to solve practical problems. Integrating such local practices into science learning allows students to connect formal scientific concepts, such as evaporation and crystallization, with real-world cultural practices, making learning more meaningful and contextually relevant. It also highlights the value of ethnoscience, showing that local knowledge can complement formal science education by fostering curiosity, respect for cultural heritage, and an understanding of sustainable use of natural resources.

Figure 3. The Process of Making Bledug Kuwu Salt

The Bledug Kuwu environment also demonstrates a strong connection between natural phenomena and the socio-cultural life of the local community. Bledug Kuwu is not only regarded as a natural tourist attraction but also as an integral part of the cultural identity and history of the Grobogan community. Its existence carries symbolic meaning as well as economic value for the surrounding population. These observational findings indicate that Bledug Kuwu has great potential as an ethnoscience learning resource, as it encompasses scientific concepts, local wisdom, and environmental awareness values that can be contextually integrated into elementary school science education. By incorporating the socio-cultural aspects of Bledug Kuwu into science lessons, students are able to understand the interconnection between natural phenomena and human life, recognizing that scientific knowledge is not isolated but linked to culture, economy, and daily practices. This approach allows students to develop both scientific literacy and cultural appreciation simultaneously, fostering

https://doi.org/10.59923/galaxy.v3i1.742
Vol. 3, No. 1, Juni 2026

environmental responsibility, curiosity, and respect for local traditions while enhancing their ability to relate classroom concepts to real-world contexts.

b. Interview results at Bledug Kuwu and School

Interviews with the local community around Bledug Kuwu revealed that they have long been familiar with the mud eruption phenomenon as a natural source of salt. The community explained that the salt from Bledug Kuwu is believed to originate from the "belly of the earth" and emerges due to gas pressure from underground. Although this explanation is traditional, it indirectly reflects the scientific concepts of pressure and the movement of materials from underground layers. The community also stated that the salt is harvested in a simple and environmentally friendly manner, without damaging the Bledug Kuwu area.

Interviews with elementary school teachers indicated that the Bledug Kuwu phenomenon is highly relevant as a science learning resource. Teachers stated that, until now, science lessons have tended to use examples that are distant from students' daily lives. By incorporating Bledug Kuwu as the learning context, students find it easier to understand scientific concepts because they are directly related to their surrounding environment. Teachers also noted that the ethnoscience approach helps foster students' pride in their local area and increases their motivation to learn.

Meanwhile, interviews with students revealed that they found science lessons more engaging when connected to Bledug Kuwu. Students reported that they could more easily understand topics such as salt, changes in the states of matter, and natural phenomena because they could directly visualize the processes involved. Students also expressed interest in visiting Bledug Kuwu to observe the phenomenon firsthand, indicating an increase in curiosity and the development of a scientific attitude.

c. Results of improving science literacy in elementary School students

The qualitative findings indicate an improvement in students' scientific literacy after participating in Bledug Kuwu-based ethnoscience learning. This improvement is evident in students' ability to explain scientific concepts in their own words, relate science topics to real natural phenomena, and understand the relationship between nature and human activities. Students no longer merely memorize definitions but are able to provide simple explanations of processes, such as the formation of salt from mud eruptions.

Students also demonstrated improved abilities in asking questions and providing simple scientific explanations for observed phenomena. During class discussions, they were able to connect the process of saline water evaporation with the formation of salt crystals and relate it to the community's activities at Bledug Kuwu. This indicates the development of contextual and functional scientific literacy among the students.

In addition to cognitive aspects, improvements in scientific literacy were also evident in students' attitudes and awareness of the environment and local culture. Students demonstrated pride in their region's natural wealth and an understanding of the importance of environmental preservation. Thus, Bledug Kuwu-based ethnoscience learning not only enhances students' understanding of scientific concepts but also fosters a scientific attitude and environmentally responsible character in elementary school students.

Quantitative Research Results

a. Description of Pre-Test and Post-Test Data on Science Literacy

Quantitative data were obtained through science literacy tests administered before (pre-test) and after (post-test) the implementation of Bledug Kuwu-based ethnoscience learning. The study subjects consisted of 32 elementary school students, divided into two groups: an experimental class (n = 16) and a control class (n = 16). The experimental class participated in science learning activities that integrated the Bledug Kuwu phenomenon as an ethnoscience-based resource, allowing students to observe and engage directly with natural processes and related cultural knowledge. Meanwhile, the control class followed conventional science instruction, which relied primarily on textbooks and standard classroom exercises. By comparing pre-test and post-test results between the two groups, the study aimed to evaluate the effectiveness of the ethnoscience approach in improving students' scientific literacy. This research design enabled a controlled assessment of learning outcomes, providing insight into how contextual, locally grounded science learning can influence understanding, application, and appreciation of scientific concepts among elementary school students.

Table 1. Initial Pre-Test and Post-Test Data

https://doi.org/10.59923/galaxy.v3i1.742
Vol. 3, No. 1, Juni 2026

Groups	Test	N	Average	Standard Deviation
Experimental	Pre-Test	16	56,25	6,84
	Post-Test	16	82,13	6,15
Control	Pre-Test	16	55,81	7,02
	Post-Test	16	68,94	6,47

The results of the descriptive analysis indicate that the students' initial scientific literacy skills in both groups were relatively balanced. In the experimental class, the mean pre-test score for scientific literacy was 56.25 with a standard deviation of 6.84, while the control class had a mean pre-test score of 55.81 with a standard deviation of 7.02. These results suggest that the students' initial abilities in both groups were in the moderate category and did not differ significantly. This balance between the groups is important for ensuring the validity of subsequent comparisons, as it indicates that any observed differences in post-test scores are likely due to the learning intervention rather than pre-existing disparities in ability. Furthermore, the moderate initial literacy levels highlight the need for engaging and contextualized learning approaches, such as the Bledug Kuwu-based ethnoscience model, to enhance students' understanding and application of scientific concepts. By establishing a baseline of comparable abilities, the study provides a clear foundation for assessing the effectiveness of ethnoscience-based learning in improving elementary students' scientific literacy (Asriyadin et al., 2025; Nurjumiati et al., 2026).

After the implementation of ethnoscience-based science learning using Bledug Kuwu, there was a significant increase in the post-test scores of the experimental class. The mean post-test score of the experimental class increased to 82.13 with a standard deviation of 6.15, reflecting substantial improvement compared to the pre-test scores. Meanwhile, the control class, which followed conventional science instruction, also showed an improvement, although it was not as substantial as that of the experimental class, with a mean post-test score of 68.94 and a standard deviation of 6.47. These results indicate that while conventional teaching methods can improve students' scientific literacy to some extent, the integration of local phenomena through ethnoscience provides a more effective and engaging learning experience. The significant difference in post-test scores suggests that contextualized learning, which connects scientific concepts to students' real-life environment and cultural knowledge, can enhance comprehension, retention, and application of science content. This finding emphasizes the importance of using place-based and culturally relevant approaches in elementary science education to optimize learning outcomes and foster a deeper understanding of scientific principles.

Descriptively, these data indicate that science learning which utilizes the local phenomenon of Bledug Kuwu has a positive impact on improving students' scientific literacy compared to conventional instruction, as shown in Table 1 presenting the pre-test and post-test scientific literacy scores. The integration of Bledug Kuwu into the learning process allows students to connect scientific concepts with real-life observations, making abstract ideas more concrete and easier to understand. Unlike traditional methods, which often rely on textbooks and rote memorization, ethnoscience-based learning engages students actively through observation, discussion, and hands-on experiences. This contextual approach not only improves comprehension of scientific concepts but also fosters curiosity, critical thinking, and the ability to relate classroom knowledge to the surrounding environment. The descriptive results highlight that students exposed to Bledug Kuwu-based learning not only achieved higher post-test scores but also appeared more engaged and motivated, suggesting that the use of local phenomena as learning resources can enhance both cognitive and affective aspects of science education.

b. Uji Statistik Inferensial

1. Uji Paired Sample T-test

A paired-sample t-test was conducted to examine the differences between pre-test and post-test scores within each group. The results of the paired-sample t-test for the experimental class showed a calculated t-value of 12.87 with a significance level (p) of $0.000 < 0.05$, indicating a significant difference between students' pre-test and post-test scientific literacy scores. This finding suggests that ethnoscience-based science learning using Bledug Kuwu significantly improved students' scientific literacy. The substantial increase in scores demonstrates that contextualized learning, which integrates local phenomena and indigenous knowledge, can effectively enhance students' understanding of scientific concepts. By providing opportunities for hands-on observation and engagement with real-world phenomena, students were able to construct

knowledge actively rather than passively receiving information. This approach not only strengthened their conceptual understanding but also fostered skills such as critical thinking, problem-solving, and the ability to connect science to everyday life, highlighting the practical and educational value of incorporating ethnoscience into elementary school science instruction.

CONCLUSIONS

Based on the research findings, it can be concluded that ethnoscience-based science learning utilizing the Bledug Kuwu phenomenon is effective in improving elementary school students' scientific literacy. The integration of local knowledge related to the process of salt formation from mud eruptions makes learning more contextual, meaningful, and closely connected to students' everyday lives. The qualitative results indicate improvements in students' conceptual understanding, curiosity, and attitudes toward environmental awareness and local culture. Meanwhile, the quantitative results reveal significant differences between the experimental and control classes, as reflected in the increases from pre-test to post-test scores, statistical test results, and N-Gain values. Therefore, Bledug Kuwu as an ethnoscience resource not only contributes to the mastery of scientific concepts but also strengthens contextual scientific literacy and character development among elementary school students.

References

Amakraw, Y., & Kartika, N. (2022). Strategi implementasi praktikum pembelajaran ilmu pengetahuan alam untuk siswa sekolah dasar dan menengah. *SEARCH: Science Education Research Journal*, *1*(1), 34–41.

Amelia, Z. (2025). *PENGEMBANGAN E-MODUL BERBASIS STEM-PJBL UNTUK MEMBANGUN NATURE OF SCIENCE PADA MATERI SIFAT BENDA DAN PERUBAHAN WUJUD BENDA PESERTA DIDIK KELAS IV SEKOLAH DASAR*. UNIVERSITAS LAMPUNG.

Aprilia, V., Sartika, S. B., & Salim, A. (2025). Contextual Teaching and Learning Based on Ethnoscience in Natural and Social Sciences. *Indonesian Journal of Education Methods Development*, *20*(4), 1–12. https://doi.org/10.21070/ijemd.v20i4.901

Asriyadin, A., Fuadi, M., Ibnusaputra, M., & Anwar, K. (2025). Pengaruh Model Inquiry-Based Learning Berbasis Etnosains Rumah Lengge terhadap Kemampuan Berpikir Logis Siswa Sekolah Dasar. *Bima Journal of Elementary Education*, *3*(1), 27–35.

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), 251–266. https://doi.org/10.15294/jpii.v14i2.23505

Boz, T., Smith, N., Hammack, R., Davis, H., & Cornish, J. (2025). Middle School Students' Experiences with Place-Based STEM Outreach. *Research in Science Education*, *55*(6), 1685–1705. https://doi.org/10.1007/s11165-025-10245-1

Chika, S. (2022). Konsepsi Pelaksanaan Konservasi Lumpur Bledug Kuwu dan Potensinya Dalam Pembuatan Natrium Klorida di Kabupaten Grobogan. *Seminar Nasional Pendidikan Biologi Dan Saintek*, *4*(2), 213_217.

Fitria, Y., Fitri, U., Yaswinda, & Oktarina, R. (2025). *Scientific Literacy Achievement of Elementary School Students in STEM Learning Using E-Modules* (Issue Iceste). Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-489-1_67

Johnson, M. D., Sprowles, A. E., Goldenberg, K. R., Margell, S. T., & Castellino, L. (2020). Effect of a Place-Based Learning Community on Belonging, Persistence, and Equity Gaps for First-Year STEM Students. *Innovative Higher Education*, *45*(6), 509–531. https://doi.org/10.1007/s10755-020-09519-5

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. https://doi.org/10.36681/tused.2024.035

Lestari, S. (2025). KONSEP DASAR DAN METODE PENGAJARAN FISIKA, BIOLOGI, KIMIA, ILMU PENGETAHUAN BUMI DAN ANTARIKSA DALAM IPA DI SD/MI. *Research and Development Journal of Education*, *11*(2), 1431–1445.

Martasari, R. D., Pambudi, S., Haty, I. P., Yoni, D. R., Afrilita, Farizzi, M. I. A., Santosa, W. B., Lukita, A. D., & Riyadurrizqy, M. S. (2024). Geotourism in Mount Pandan and Bledug Kuwu Hotspring as a potential resources for community development. *IOP Conference Series: Earth and Environmental Science*, *1339*(1). https://doi.org/10.1088/1755-1315/1339/1/012033

Matindike, F., & Ramdhany, V. (2025). Incorporating indigenous knowledge perspectives in integrated STEM education: a systematic review. *Research in Science and Technological Education*, *43*(3), 1022–1042. https://doi.org/10.1080/02635143.2024.2413675

Muhammad Imron, E., Sarwendah Asri Nugraheni, F., Utami, B., Nursalsabila, Z., Mahardiani, L., & Tanghal, A. B. (2025). Effectiveness of Ethno-STEM-Based Science Teaching with the Project-Based Learning Model on Students' Scientific Literacy. *Jurnal Inovasi Pendidikan IPA*, *11*(2), 435–453.

Nasution, T. A., Imran, A., & Lestari, S. A. (2019). Otomatisasi Rumah Garam Kubus (Timah Gabus) Sinergi dalam Upaya Meningkatkan Produktivitas Garam Lokal. *Talenta Conference Series: Energy and Engineering (EE)*, *2*(3).

Novitasari, M. A., & Raida, S. A. (2025). Integrasi Kearifan Lokal Kayangan Api di Bojonegoro dalam Pembelajaran IPA Kontekstual Tingkat SMP/MTs. *PSEJ (Pancasakti Science Education Journal)*, *10*(2), 117–127.

Nurfaizah, D. A., Sarawati, T., & Aminatun, T. (2025). Exploring Two Decades of Indigenous Knowledge Integration in Science Education: A Bibliometric and Systematic Literature Review. *Science and Education*, *4*, 315–326.

Nurjumiati, N., Yulianci, S., Nurhairunnisah, N., & Ningsyih, S. (2026). Effectiveness of Ethno-Inquiry-Interactive Physics Multimedia Using the Gopa Game to Improving Students' Numeracy Literacy. *Jurnal Pendidikan Fisika Dan Teknologi*, *12*(1), 113–123.

Puspita, D., Totti, Y., & Suyanto, M. S. (2025). Analisis Kandungan Mikroplastik Pada Garam Terestrial Dari Bledug Kuwu, Jawa Tengah. *Science, Technology and Management Journal*, *5*(2), 88–92.

Putranto, T., Triastuti, W. E., Misbah, M. N., Yulianto, T., Yulianto, A. N., Pribadi, S. R. W., Ningrum, E. O., Arief, I. S., & Ariesta, R. C. (2024). Sistem Berkelanjutan Desalinasi Air Laut dan Produksi Garam Modern. *Sewagati*, *8*(6), 2477–2485.

Putri, V. Z., Rahmadea, S. A., Az-zahra, A. S., Kristiani, L., Fahzrial, L. H. I., & Ratnasari, Y. (2024). Analisis Pemahaman Konsep Perubahan Wujud Zat Melalui Pratikum Pembuatan Es Krim Putar. *Jurnal Belaindika: Pembelajaran Dan Inovasi Pendidikan*, *6*(2), 145–155.

Roy, G., Sikder, S., & Danaia, L. (2025). Adopting scientific literacy in early years from empirical studies on formal education: a systematic review of the literature. *International Journal of STEM Education*, *12*(1), 1–24. https://doi.org/10.1186/s40594-025-00547-1

Sari, Y., Supena, A., Yufiarti, Sari, R. P., & Iasha, V. (2020). The role of executive function in facing attention interference in elementary school students: Descriptive qualitative. *ACM International Conference Proceeding Series*, *January*. https://doi.org/10.1145/3452144.3452285

Sudirman, S., Sutikno, S., Indriyanti, D. R., Sumarni, W., & Rahayuningsi, M. (2025). Integration of Ethnoscience in Natural Science learning: Literacy Study. *Jurnal Penelitian Pendidikan IPA*, *11*(6), 68–77. https://doi.org/10.29303/jppipa.v11i6.9980

Sya'ban, M. F., Rahmat, A., Sriyati, S., & Sumarna, O. (2024). Research on Ethnoscience in Science Education: An Analysis of the Literature. *KnE Social Sciences*, *2024*, 1239–1248. https://doi.org/10.18502/kss.v9i13.16065

Wahyu Y., Edu A. L, & Taklal R. S. M. (2025). Integrating Local Culture And Ethnoscience In Manggarai-Based Stem Education To Enhance Science Literacy And Scientific Attitudes In The 21st Century. *Jurnal Ilmu Pendidikan (JIP)*, *31*(1), 87–94.