



The Development of Science Module Integrated with Ethnoscience of Singo Barong Mask to Improve Scientific Literacy and Cultural Preservation Attitudes

Jihan Jihannita^{1*}, Wirawan Fadly², Rahmi Faradisya Ekapti², Dewi Luthfiana³, Asri Widowati¹

¹Universitas Negeri Yogyakarta, Indonesia

²Institut Agama Islam Negeri Ponorogo, Indonesia

³Nagoya University, Japan

*Correspondence to: jihanznita@gmail.com

Abstract: The low achievement of scientific literacy and the attitude of cultural preservation requires innovation in implementing science education in schools. This research aims to develop integrated science modules on Singo Barong mask ethnoscience teaching materials to improve scientific literacy and cultural preservation attitudes. This study measures the feasibility of the module and its effectiveness in improving scientific literacy and cultural preservation attitudes. This research used Borgh and Gall's (1960) model with six stages. The study was conducted in class VII using a non-equivalent one-group pretest-posttest trial design. The results of module effectiveness are obtained from the pretest-posttest analysis of students. The instruments given were in the form of scientific literacy questions and cultural preservation attitude questionnaires. Based on the analysis of scientific literacy and cultural preservation attitudes, students using the developed modules have increased, as indicated by the gain value obtained in the medium category. The results of module validation are carried out by four expert lecturers and one science teacher, and practicality assessment by students. The results of feasibility and practicality obtained excellent assessment. In conclusion, the integrated science module of Singo Barong mask ethnoscience is suitable for the science learning process to improve scientific literacy and cultural preservation attitudes.

Keywords: science learning, module, ethnoscience, scientific literacy, cultural preservation attitudes

Recommended citation: Jihannita., Fadly, W., Ekapti, R. F., Luthfiana, D., & Widowati, A. (2024). The Development of Science Module Integrated with Ethnoscience of Singo Barong Mask to Improve Scientific Literacy and Cultural Preservation Attitudes. *Journal of Innovation in Educational and Cultural Research*, 5(2), 356-363.

INTRODUCTION

Implementing science learning leads to the achievement of science literacy and the essence of science known as the Nature of Science (NOS) (Afacan & Çanlı, 2019; Bybee & McCrae, 2011). NOS leads to the implementation of sustainable learning by realizing the scientific literacy ability of students. The attainment of scientific literacy is generally valued and recognized among educators as a desirable learning outcome. The measurement results of the Program for International Student Assessment (PISA) organized by the Organization for Economic Cooperation Development (OECD) in 2022 obtained a low score for Indonesian scientific literacy achievement and decreased compared to 2018. Specifically, the level of achievement in each aspect is 18% of Indonesian students have mathematical skills at level 2 out of 69% of other OECD countries. 25% of students with literacy skills at level 2 out of 74% of other OECD countries, and 34% with science skills at level 2 out of the OECD country average of 76%. So, it can be concluded that the results of Indonesian scientific literacy are still far behind (The Programme for International Student Assessment, 2023). The implemented Emancipated Curriculum encourages learning to achieve science literacy through classroom learning and school culture (Kamila & Sabir, 2021). Science literacy is achieved by having a set of teaching materials that support learning in the classroom. Integrating culture into teaching materials is one way to improve students' science literacy (Dewi et al., 2019; Sulistri et al., 2020; Suprpto et al., 2021). Teaching materials developed in schools have not been designed according to the real-life context of students. Most science textbooks only emphasize basic conceptual knowledge that is far from the real-life context of learners (Ardianti & Raida, 2022; Yuliana et al., 2021).

Indonesia, as a multicultural archipelagic country, cannot be separated from the richness of the indigenous culture of each region. Ponorogo, a city in East Java, is famous for the performance art of Reog Ponorogo, which has become a national cultural icon and is in the process of recording world cultural heritage through UNESCO. Along with the times, cultural preservation has become a challenge for society in general. Based on the results of interviews with reog craftsmen, it is known that there is often damage to the property of Singo Barong masks, which are the main attributes of reog performances. The Singo Barong mask, consisting of the head of the barongan and the *dhadak merak*, often suffers damage to the *dhadak merak* due to deliberately plucking peacock feathers during reog performances. This action leads to a low appreciation of

society for its own culture. This also shows the low attitude of cultural preservation owned by the community.

Science is a way of lending to nature (Aikenhead & Ogawa, 2007). Science is shaped and built from what is learned and understood from the surrounding environment/preconceptions, with culture and reason understood as the foundations of knowledge constructivism. Learning design that connects the reality of cultural background with scientific knowledge is one of the learning innovations that can be done. His practice in science learning is known as an "ethnoscience" approach. Ethnoscience deals with the original knowledge of culture as the basis of realistic construction that links culture with advanced scientific knowledge. Classrooms that recognize children's backgrounds in the pre-learning process can be used to design learning that results in a comprehensive understanding of how nature works in the reality of learners' cultural lives (Gondwe & Longnecker, 2015; Abonyi et al., 2014).

The importance of the ethnoscience approach in the implementation of education aims so that community culture is not lost and is relevant to the purpose of science, which is oriented towards mastering knowledge, skills, values, and attitudes so that students can participate in the environment (Schunke, 1988). Ethnoscience-based learning is carried out by observing the culture in the community to reconstruct further scientific concepts that can ultimately foster students' conservation character values (Suprpto et al., 2021). Ethnoscience learning influences learning, namely: 1) positive influences in the form of regional cultural appreciation will arise if the learning in schools being studied is in harmony with the cultural knowledge of everyday learners, 2) student-centered learning will run effectively because the process of assimilation and accommodation of learning from students in the process of building more meaningful understanding (Good, 1995; Review et al., 2018). Research related to ethnoscience in science learning leads to implementing learning using innovative learning models and teaching materials. In Indonesia, some ethnoscience research leads to forms of local potential such as traditional medicine, tangible culture, wisdom values, and simple technology. The diversity of local potential and culture in each region allows ethnoscience learning to continue to be explored widely. This follows research conducted by Zidny et al. (2020), which shows that indigenous knowledge offers a rich and authentic context for science learning.

Several previous studies related to the integration of ethnoscience in science learning have been carried out for several achievements of learning objectives. The research of Parmin et al. (2017), which developed local culture-based assessment instruments, simultaneously impacted students' scientific attitudes and science process skills in science learning in elementary schools. Sumarni and Kadarwati (2020) state that PjBL ethnoscience-STEM-based learning can improve students' critical and creative skills. The development of ethnoscience-based LKPD carried out by Walidah and Rahmatan (2023) can improve students' learning outcomes and positive responses. Yuliana et al. (2021) research that developed ethnoscience-integrated picture books has proven effective in increasing scientific literacy. The overall research has a positive impact as an ethnoscience effect on learning. Learning with an ethnoscience approach requires supporting teaching materials that integrate culture to understand science concepts. The module is one of the teaching materials developed in this study. Modules are self-study packages that include a series of learning experiences planned for learners and are systematically designed to help learners achieve learning goals (Kosasih, 2020). The module developed consists of a complete, stand-alone unit and a series of learning activities to attain specific and clear objectives, especially on achieving scientific literacy and cultural preservation attitudes. Modules are chosen as one type of teaching material that can increase students' activeness in building in-depth knowledge.

Based on this description, research related to developing the integrated science module of Singobarong Mask ethnoscience is considered necessary. The modules developed can contribute to the availability of contextual teaching materials close to students' culture. Hopefully, the modules developed can serve as a reference for teachers to make science learning innovations based on ethnoscience approaches. The integrated science module of Singo Barong mask ethnoscience was created by reconstructing scientific concepts related to the concept of Substances and their Changes. The modules developed are expected to produce effective science learning that improves students' scientific literacy and cultural preservation attitude. The innovation of ethnoscience in this study is novel because it integrates the Singo Barong mask culture into science learning, which has never been done in previous research.

METHODS

This research is classified into development research (R&D) characteristics using Borg and Gall's (1960) framework. The development stages were only done through 6 out of 10 existing stages. These stages were research and information collecting, planning, developing a preliminary product form, preliminary field testing, main product revision, and main field testing. The research and information collecting stage was conducted by conducting a literature study to analyze journals and related articles. Field studies were also performed to determine the constraints and needs of product development for the learning process. The second stage of planning contained curriculum and material analysis, analysis of the ethnoscience context of Singo Barong

masks, and formulation of specific learning objectives. A preliminary product form was developed by designing an integrated science learning module of Singo Barong mask ethnoscience. The fourth stage of preliminary field testing was carried out by validating the products developed by four expert lecturers and one science subject teacher. The results of product revision were used as improvements in product improvements developed in the fifth stage of main product revision. The sixth stage was carried out with limited trials of products developed for one test class consisting of 30 learners. The trial design used one group pretest-posttest. The results of the limited trial also produced pretest-posttest scores on scientific literacy and questionnaires of students' cultural preservation attitudes. The practicality of teaching materials was also assessed through questionnaires by students and three science teachers.

Data collection techniques included (1) feasibility assessment of the modules developed, (2) scientific literacy tests, and (3) cultural preservation attitude questionnaires. Three expert lecturers and one science teacher carried out the feasibility assessment of the material classification concept module and its changes. Aspects of module assessment developed for expert validation of material included aspects of presentation, content, language, and graphics. The assessment score consisted of 4 categories of rating scales, namely very less (score 1), less (score 2), good (score 3), and very good (score 4). Written tests were used to measure learners' scientific literacy of the concept of Substances and their Changes. The written test was conducted using ten multiple-choice questions and five essay questions. The assessment scores of each question were 0 and 1 for multiple-choice questions and 1-4 for essay questions. This written test was given twice, namely before using the development product (pretest) and after using the development product (posttest).

The questionnaire consisted of (1) a questionnaire of student responses about product feasibility, (2) a questionnaire of teachers' responses to product feasibility, and (3) a questionnaire of students' cultural preservation attitudes. Aspects of assessing feasibility questionnaires by students and teachers included learning implementation and teaching materials' readability. Some aspects of assessing the attitude toward cultural preservation of students include cultural protection, cultural development, and cultural utilization. Student and teacher response questionnaires have four categories of assessment scales. While the cultural preservation attitude questionnaire consists of 5 rating scales. The instruments used to collect data included (1) module validation sheets, (2) pretest and posttest sheets, (3) student and teacher response questionnaire sheets, and (4) cultural preservation attitude questionnaire sheets. Data collection instruments can be seen in [Table 1](#).

Table 1. Instruments of Data Collection

Types of Instrument	Types of Data	Description
Module Eligibility Questionnaire	Quantitative data and qualitative data	Data to measure module feasibility with a score range of 4
Pretest and posttest sheets	Quantitative data	Analysis of gain from pretest and posttest scientific literacy learners
Student and teacher's response questionnaire	Quantitative data and qualitative data	Data to measure module feasibility with a score range of 4
Questionnaire of cultural preservation attitude	Quantitative data	Analysis of gain from pretest and posttest attitudes of cultural preservation of learners

Data analysis techniques for module feasibility were carried out with the following steps: (1) tabulation of all data obtained from expert validators and science teachers; (2) tabulate all data obtained from student and teacher response questionnaires. The validation assessment is then calculated using Aiken's V index to determine the category of validation results for four aspects of module assessment, namely: feasibility of presentation, feasibility of content, language, and graphics. The level of category validation using Aiken's v index was discovered by [Guilford](#) (1956), as shown in [Table 2](#).

Table 2. Category of *Aiken's V* Index

<Index> Aiken's V	Category
0,80 < V < 1,00	Very High
0,60 < V < 0,80	High
0,40 < V < 0,60	Medium

Pretest and posttest instrument sheets of learners' scientific literacy and cultural preservation attitudes to determine the effectiveness of the products developed. The data analysis was done by determining the normalized gain of the given scientific literacy pretest and posttest assessments. There are three criteria for calculating gain: low, medium, and high ([Hake, 1999](#)). Science process skills increase if the gain obtained reaches the good-medium category. The normalized gain criteria are shown in [Table 3](#).

Table 3. Category of N-gain Index

<Index> g	Category
$g \geq 0,7$	High
$0,3 \leq g < 0,7$	Medium
$G < 0,30$	Low

RESULT AND DISCUSSION

This research aims to produce integrated science module products for Singo Barong mask ethnoscience to improve scientific literacy and cultural preservation attitudes. The research data is described using six stages of the Borg & Gall development model (Borg & Gall, 1960). The description of the stage of development is as follows. The research and information collecting stage is conducted by conducting a literature study to analyze journals and articles related to product development keywords. Field studies are also performed to determine the constraints and needs of product development for the learning process. The second stage of planning results in an analysis of the curriculum and material developed in the module. The curriculum uses an independent curriculum with material on Substances and Changes in grade 7 junior high school. Analysis of the ethnoscience context of Singo Barong masks was carried out through the interview stage to mask craftsmen to explore ethnoscience aspects of the material and process of making masks. The results of ethnoscience context analysis are presented in Table 4.

Table 4. Analysis Science and Ethnoscience Concept

Analysis	Science Concept
Singo Barong mask consists of 2 parts, namely barongan head and dhadak merak	-
The head of the barong is made of raw materials of cowhide, horsetail, paint, dhadap wood, and marble	Characteristics of substances and matter
Dhadak merak is made of bamboo, peacock feathers, and bird ornaments	Characteristics of substances and matter
The cowhide and horsetail used are carried out a preservation process	Chemical changes
Bamboo for dhadak merak, cut to the appropriate size and woven using mattress thread	Physical changes
The tiger pattern on the head of the barongan is obtained from the sprayed/drawn paint	Characteristics of substances and matter

A preliminary form of the product will be developed by designing an integrated science learning module for Singo Barong mask ethnoscience. The integrated science module of Singo Barong mask ethnoscience is designed with 12 components, namely: 1) front and back covers, 2) concept-building activities, 3) independent activities, 4) supporting presentations (literacy proficiency columns), 5) self-tests, 6) group project activities, 7) supporting presentations (QR Code, problem analysis web link), 8) independent study schedules, 9) summaries, 10) exercises on scientific literacy questions, 11) glossary, and 12) bibliography. All components of the module are designed to train students' scientific literacy and cultural preservation attitudes. The display of the developed science module can be seen in Figure 1.

**Figure 1.** Science Module-based Ethnoscience of Singo Barong Mask

The fourth stage of preliminary field testing is carried out by validating the products developed by four expert lecturers and one science subject teacher. The results of the science module quality test are validated to determine the feasibility of the PjBL model science module integrated with Singo Barong Mask ethnosience. Module assessment includes aspects of the feasibility of presentation, feasibility of content, language, and graphics. The results of the validation of science modules by experts and science teachers are presented in Table 5.

Table 5. Result of the Validation

Aspect	Category	Aiken's V	Description	Category
Feasibility of Appearance	Serving technique	0.97	Valid	High
	Supporting Appearance	0.97	Valid	High
	Appearance of teaching	1.00	Valid	High
Feasibility of Content	Conformity of the material to CP	0.95	Valid	High
	Updates to the material	0.93	Valid	High
	Encourage the curiosity	1.00	Valid	High
Language	Straightforward	0.98	Valid	High
	Communicative	0.98	Valid	High
	Suitability to the development of learners	1.00	Valid	High
Graphical	Module cover design	0,97	Valid	High
	Content design	0,97	Valid	High

Table 4 shows that the overall results of the science module aspect assessment get an Aiken's V rating of more than 0.85 with valid information and high categories. The category obtained in each aspect is high because it exceeds the range of 0.85 values. This means that expert assessment of the science modules that are made quality for use, with high categories for all aspects of existing assessment, namely feasibility of presentation, feasibility of content, language, and graphics. Even so, suggestions are used to improve the developed product, the fifth stage of the main product revision development. The sixth stage is carried out with limited trials of products developed for 1 test class consisting of 30 learners. The trial design uses one group pretest-post test. The results of the limited trial also produced pretest-post test scores on scientific literacy and questionnaires of students' cultural preservation attitudes.

Learning was held in three meetings, with the first meeting delivering material on the characteristics of substances on the material for making Singo Barong masks. A group division was conducted at this first meeting to start project planning. Before and after learning, students are given pretest and posttest questions, totaling 15 questions consisting of 10 multiple-choice questions and five essay questions. The questions provided are questions arranged based on indicators of scientific literacy. The results of the average scientific literacy ability in the limited trial class showed differences before and after using the learning tools developed. The average scientific literacy score before learning was 37.03, and after learning using the developed device, an average scientific literacy ability of 58.37 was obtained. This means that the products developed help students develop scientific literacy skills. The difference between pretest and posttest results is analyzed from the N-Gain presented in Table 6.

Table 6. N-Gain Difference Results of Scientific Literacy

Pretest	Posttest	N-Gain	Category
37.03	58.37	0.34	Medium

The implementation of further limited trials was also used to see the results of the ability of students' cultural preservation attitudes. The results of students' cultural preservation attitudes in limited trials are presented in Table 7.

Table 7. N-Gain Difference Results of Cultural Preservation Attitudes

Pretest	Posttest	N-Gain	Category
52.63	67.30	0.31	Medium

The results show that students' cultural preservation attitude is in the medium category. The average value of cultural preservation attitudes before learning was 52.63, and after learning using the developed tools, obtained an average scientific literacy ability of 67.30. This means that the products developed help learners develop the ability of cultural preservation attitudes. The effectiveness of the integrated science module of Singo Barong mask ethnosience can be seen from the comparison of n-gain scores obtained from the ability of scientific literacy and cultural preservation attitudes of students. Based on the development results, both abilities get the medium n-gain category, meaning that the ethnosience integrated science module effectively improves

students' scientific literacy and cultural preservation attitudes. Modules that integrate ethnoscience are developed by translating original science into scientific concepts/knowledge reconstruction. Through the reconstruction of original knowledge, scientific concepts will be applied to deepen the mastery of students' scientific concepts (George, 2001). This certainly shows that the culture that has taken root in our nation has values that are very beneficial to the lives of mankind.

George (2001) explains there are four considerations in planning curriculum content that connects culture and science education: 1) traditional knowledge and technology can be explained in conventional science terms, 2) traditional knowledge can most likely be explained by conventional science, 3) conventional science can be made with traditional knowledge, although the basic principles are different, and 4) Some traditional knowledge cannot be explained in terms conventional science. The meaning of scientific literacy in terms of classroom practice and learner learning, according to Smith et al. (2012), is: 1) the language of science that focuses on communication, (2) ways to engage and motivate students to effectively learn science and work scientifically, (3) the process of identifying science in the real world and using science knowledge to understand the world, (4) train learners to function, relate to, and contribute as the society of which they are a part. The students' responses to using the integrated science module Singo Barong mask ethnoscience were analyzed based on learning implementation and teaching materials' readability. In the aspect of learning implementation, it is known that learning outcomes using modules developed can increase student learning motivation. High student interest positively influences cognitive learning achievement (Okwara & Upu, 2017; Sultana & Zaki, 2015). This is closely related to how cognitive processes occur when new information stored in memory must be interconnected and expand the information to find possible answers in new situations (Brookhart & Nitko, 2019; Ramadhan et al., 2019).

The ethnoscience learning process has a positive impact on achieving better learning outcomes. The Singo Barong mask culture, which is close to the lives of students, becomes information available in the students' environment and has the potential to be integrated into the science learning process. This positive impact should be a curriculum practice that reflects the knowledge and understanding of the community where the school is located and where the learner and his or her family live (Rincon & Clavijo-Olarte, 2016; Olarte & Ramirez, 2016). Communities have accumulated cultural and historical knowledge in a collection of essential knowledge and skills for their survival and well-being (Ewing, 2014; Rincon & Clavijo-Olarte, 2016).

Regarding the readability of teaching materials, it is known that the presentation of material in the developed science module encourages class discussion activities, stimulates curiosity, and increases the interest/interest of students in learning science concepts. In addition, using modules also trains students to be active and independent in processing scientific knowledge (Tahya et al., 2022; Vembriarto, 1981). This can happen because the modules developed contain elements of the cultural environment close to students' lives and contribute to the implementation of learning (Powell et al., 2009; Topaloğlu & Kiyici, 2015). Ethnoscience-integrated modules can incorporate alternative forms of knowledge, support preserving local culture and ecology, and respect diversity. The theoretical understanding presented seeks to encourage accepting and affirming students' cultural identity while developing a critical perspective (Avery & Hains, 2017). This research produces innovative teaching materials explicitly developed and expected to encourage concepts contextual to the community's life around students.

CONCLUSION

The integrated science module of Singo Barong mask ethnoscience developed has proven suitable for science learning. The ability of students to practice scientific literacy and cultural preservation has increased after the learning process is carried out using the modules developed. The increase in scientific literacy is indicated by the N-gain score obtained at 0.34 in the medium category. Increased cultural preservation attitudes are shown from an N-gain score of 0.31 in the medium category. This improvement means that the science module has been developed effectively to improve scientific literacy and cultural preservation. The students' responses are also positive when learning through modules.

REFERENCES

- Abonyi, O. S., Achimugu, L., & Njoku, M. (2014). Innovations in science and technology education: A case for ethnoscience-based science classrooms. *International Journal of Scientific and Engineering Research*, 5(1), 52-56.
- Afacan, Ö., & Çanlı, D. Ş. (2019). Application of "the nature of science" box event examples to middle school seventh-grade students. *International Journal of Evaluation and Research in Education*, 8(2), 221–228.

- Aikenhead, G. S., & Ogawa, M. (2007). Indigenous knowledge and science revisited. *Cultural Studies of Science Education*, 2, 539-620.
- Ardianti, S. D., & Raida, S. A. (2022). The effect of project-based learning with ethnoscience approach on science conceptual understanding. *Journal of Innovation in Educational and Cultural Research*, 3(2), 207–214.
- Avery, L. M., & Hains, B. J. (2017). Oral traditions: A contextual framework for complex science concepts—laying the foundation for a paradigm of promise in rural science education. *Cultural Studies of Science Education*, 12, 129-166.
- Borg, W. R., & Gall, M. D. (1960). *Educational research: An introduction*. David McKay Company, Inc.
- Brookhart, S. M., & Nitko, A. J. (2019). *Educational assessment of students*. Pearson Publisher.
- Bybee, R., & McCrae, B. (2011). Scientific literacy and student attitudes: Perspectives from PISA 2006 science. *International Journal of Science Education*, 33(1), 1464–5289.
- 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.
- Ewing, B. (2014). Rich and purposeful mathematical knowledge of mothers and children in a Torres Strait Islander community. *SpringerPlus*, 3, 1-11.
- George, J. (2001). Culture and science education: A look from the developing world. An *ActionBioscience.org*.
- Gondwe, M., & Longnecker, N. (2015). Scientific and cultural knowledge in intercultural science education: Student perceptions of common ground. *Research in Science Education*, 45(1), 117–147.
- Good, R. (1995). Comments on multicultural science education. *Science Education*.
- Guilford, J. P. (1956). *Fundamental statistics in psychology and education* (3rd ed.). McGraw-Hill.
- Hake, R. R. (1999). *Analyzing change/gain score*. Indiana University.
- Kamila, S. S., & Sabir. (2021). Pembelajaran literasi sains berbasis proyek di masa pandemi Covid-19. *Dirjen PAUD, Pendidikan Dasar, dan Pendidikan Menengah Kemendikbudristek*.
- Khoiri, A., & Sunarno, W. (2018). Pendekatan etnosains dalam tinjauan fisafat. *SPEKTRA: Jurnal Kajian Pendidikan Sains*, 4(2), 145.
- Kosasih, E. (2020). *Pengembangan bahan ajar*. Bumi Aksara.
- Okwara, O. K., & Upu, F. T. (2017). Effects of ethno-science instructional approach on students' achievement and interest in upper basic science and technology in Benue State. *International Journal of Scientific Research in Education*, 10(1).
- Parmin., Sajidan., Ashadi., Sutikno., & Fibriana, F. (2017). Science integrated learning model to enhance the scientific work independence of student teachers in indigenous knowledge transformation. *Jurnal Pendidikan IPA Indonesia*, 6(2), 365–372.
- Powell, K. C., Kalina, C., & Powell, K. C. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, 130(2), 241-250.
- Purwasih, D., Wilujeng, I., Membalik, V., & Hasan, S. (2022). Learning instructional using webbed models based on local potential “Pulau Kembang” to enhance ecological literacy skill. *Jurnal Inovasi Pendidikan IPA*, 8(2), 131–141.
- Ramadhan, S., Mardapi, D., Prasetyo, Z. K., & Utomo, H. B. (2019). The development of an instrument to measure the higher-order thinking skill in physics. *European Journal of Educational Research*, 8(3), 743–751.
- Rincon, J., & Clavijo-Olarte, A. (2016). Fostering EFL learners' literacies through local inquiry in a multimodal experience. *Colombian Applied Linguistics Journal*, 18(2), 67.
- Schunke, S. (1988). The small restoration. A practical case. *Das Dental-Labor. Le Laboratoire dentaire. The Dental Laboratory*, 36(2), 167-174.
- Sharkey, J., Clavijo Olarte, A., & Ramírez, L. M. (2016). Developing a deeper understanding of community-based pedagogies with teachers: Learning with and from teachers in Colombia. *Journal of Teacher Education*, 67(4), 306-319.

- Smith, K. V., Loughran, J., Berry, A., & Dimitrakopoulos, C. (2012). Developing scientific literacy in a primary school. *International Journal of Science Education*, 34(1), 127–152.
- Sulistri, E., Sunarsih, E., Guna Utama, E., & Moseki, R. (2020). The development of digital pocketbook based on the ethnoscience of the Singkawang City to increase student's scientific literacy on heat matter and its transfer. *Journal of Education, Teaching, and Learning*, 5.
- Sultana, M., & Zaki, S. (2015). Proposing project-based learning as an alternative to traditional ELT pedagogy at public colleges in Pakistan. *International Journal for Lesson and Learning Studies*, 4(2), 155–173.
- Sumarni, W., & Kadarwati, S. (2020). Ethno-STEM project-based learning: Its impact on critical and creative thinking skills. *Jurnal Pendidikan IPA Indonesia*, 9(1), 11–21.
- Suprpto, N., Prahani, B. K., & Cheng, T. H. (2021). Indonesian curriculum reform in policy and local wisdom: Perspectives from science education. *Jurnal Pendidikan IPA Indonesia*, 10(1), 69–80.
- Tahya, D., Dahoklory, F. S., & Dahoklory, S. R. (2022). Development of local wisdom-based chemistry modules to improve students' science process skills. *Jurnal Penelitian Pendidikan IPA*, 8(2), 731–739.
- The Programme for International Student Assessment. (2023). *PISA 2022 results factsheets Indonesia PUBE*. <https://oecdch.art/a40de1dbaf/C108>
- Topaloğlu, M. Y., & Kiyıcı, F. B. (2015). The opinions of science and technology teachers regarding the usage of out-of-school learning environments in science teaching. *Journal of Turkish Science Education*, 12(3), 31–50.
- Vembriarto, S. (1981). *Pengantar pengajaran modul*. Yayasan Pendidikan Paramita.
- Walidah, M., & Rahmatan, H. (2023). Penerapan lembar kerja peserta didik berbasis etnosains untuk meningkatkan hasil belajar di SMP Negeri 8 Banda Aceh. *Jurnal Pendidikan Sains Indonesia*, 11(1), 84–95.
- Yuliana, I., Cahyono, M. E., Widodo, W., & Irwanto, I. (2021). The effect of ethnoscience-themed picture books embedded within context-based learning on students' scientific literacy. *Eurasian Journal of Educational Research*, 2021(92), 317–334.
- 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 and Education*, 29(1), 145–185.