



Implementation of Ethnoscience-Based PjBL on Science Literacy Learning Outcomes

Anisatul Hidayah¹, Mohamad Agung Rokhimawan^{1*}, Rudi Suherman²

¹Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia

²University of Sydney, Australia

*Correspondence to: mohamad.rokhimawan@uin-suka.ac.id

Abstract: Science education develops quickly and is rooted in the 21st Century. The learning carried out focuses on active students and produces something with PjBL. This study determines how Ethnoscience-based PjBL learning impacts scientific literacy learning outcomes. The study used a descriptive qualitative method. Data collection techniques used interviews, observation, and documentation. This study used descriptive analysis methods through data reduction, data presentation, and conclusions drawing. The study results show that students' scientific literacy learning outcomes using Ethnoscience-based PjBL can deliver students with processing abilities, scientific attitudes, communicating results, and paying attention to socio-culture in the area around students. Using this PjBL facilitates students to gain knowledge and skills through project development and implementation involvement. Projects with complex assignments will encourage students to design, solve problems, make decisions, and display ethnoscience-based products by combining culture with science in the learning process.

Keywords: PjBL; ethnoscience, learning outcomes, science literacy, elementary school.

Recommended citation: Hidayah, A., Rokhimawan, M. A., & Suherman, R. (2024). Implementation of Ethnoscience-Based PjBL on Science Literacy Learning Outcomes. *Journal of Innovation in Educational and Cultural Research*, 5(3), 398-407.

INTRODUCTION

Education in the 21st Century is one of the difficulties that education prepares students to handle (Muliastri, 2020; Tamin et al., 2022). The Industry Revolution 4.0, which significantly influenced the field of education, was intimately tied to learning during that century (Ichsan et al., 2020; Rusmansyah et al., 2023). Additionally to imparting knowledge, education also guarantees that students possess specific skills (Yunianto et al., 2020). The majority of them have knowledge of science. One of the fundamental abilities required to have a competitive life is scientific literacy (Kaehler et al., 2020). Making learning literate is a goal of the literacy movement (Muliastri, 2020). Science literacy, based on the capacity to participate in the Programme for International Student Assessment (PISA) and scientific discussions, is the ability to apply scientific knowledge to identify obstacles and draw conclusions from the facts (OECD, 2019). Knowing scientific concepts and methods well enough to make decisions based on them daily is called scientific literacy (Haerani et al., 2020). In order for students to apply their knowledge to problems in modern society related to science and technology as well as to grasp science as a concept and solve them, scientific literacy in learning must be developed (Ihsan & Jannah, 2021; Khery et al., 2020). The most recent PISA results for 2018 nonetheless demonstrate that scientific literacy is still a problem for Indonesian pupils. Indonesia is ranked 70th globally for scientific literacy out of 78 nations (Kaehler et al., 2020; Sadoglu, 2018).

Present knowledge still does not support the notion that improving scientific literacy is essential. Scientific literacy aims to increase students' knowledge by applying scientific principles meaningfully (Ihsan & Jannah, 2021; Jufrida et al., 2020; Khery et al., 2020). Nevertheless, according to opposing viewpoints, students are still not doing their best to comprehend the contents and knowledge they learn in class and apply it to their daily lives (Dewi et al., 2021). Students still are not accustomed to focusing on scientific literacy issues because educational resources and quizzes are frequently not based on them (Fuadi et al., 2020). Weak scientific literacy is associated with poor cognitive learning outcomes (Kulsum et al., 2020). The success of the learning process is reflected in the learning outcomes. The learning is deemed poor if student learning outcomes fall short of the minimum standards (Asy'syakurni et al., 2021; Wahyuni & Yusmita, 2020). Lower cognitive learning results from students' struggles to comprehend abstract material concepts and failure to apply the theory in real-world situations (Pitnelly et al., 2021; Sutrisna, 2021).

Utilizing suitable and cutting-edge learning models is one way to enhance the cognitive consequences of education and scientific literacy. The project-based learning (PjBL) approach can offer direct and focused learning on the students' experiences. The methodology encourages student participation in project planning and execution, which helps them acquire information and skills. Complex projects motivate students to create,

address issues, make choices, and present work (Kulsum et al., 2020; Nugraha, 2022). Accordingly, the PjBL model allows students to express and carry out their concepts, which catalyzes learning new ideas (Irfan, 2019).

The technique also impacts the learning quality in addition to the learning model. Ethnoscience is a scientific method that can enhance scientific literacy and learning outcomes (Wiradintana, 2018). According to the notion of science, ethnoscience is information derived from culture and included in society (Suswati, 2021). A culture's language, traditions, traditional foods, moral principles, customs, and laws developed with the aid of science can all be found to include this information (Nuralita, 2020). Ethnoscience learning, which integrates science and culture in the learning process, can potentially revolutionize the field of education. Due to their exposure to local culture and wisdom, students participating in ethnoscience-based learning will have a stronger understanding of scientific principles (Lathifah et al., 2019). In order to promote scientific literacy, students can also apply science concepts and relate content to existing knowledge (Ulfah et al., 2020; Zannatunna'imah et al., 2021). Scientific literacy is also required in science learning for students to develop scientific process skills, scientific attitudes, and the capacity to express a topic scientifically (Siregar et al., 2020).

The PjBL approach can significantly increase student learning outcomes, according to numerous research that has demonstrated its efficacy in the classroom (Nuraini & Waluyo, 2021). According to research by Hamidah et al. (2021), using the PjBL paradigm resulted in a substantial change in knowledge-learning results. The PjBL model impacts students' scientific literacy, according to an additional study by Anggraeni (2020) and Hasbie and Istyadji (2018). Other research has also proved the efficiency of ethnoscientific education (Sholahuddin et al., 2021; Wibowo & Ariyatun, 2020). Wulandari et al. (2018) find that ethnoscience-based chemistry instruction can raise students' levels of scientific literacy. Nuralita (2020) and Winarti et al. (2018) show that ethnoscience-based learning significantly affects cognitive learning outcomes.

Scientific literacy skills are essential skills that students have to integrate their understanding of concepts with science (Irawan et al., 2020). This scientific literacy is implemented in science learning. According to Fadhil and Rokhimawan (2020) and Yuniarto and Rokhimawan (2021), science subjects are a body of information logically organized to discuss various natural events. The chosen manner of instruction has an impact on this scientific literacy. The chosen manner of instruction has an impact on this scientific literacy. This technique has an impact on students' motivation to learn (Wardhani et al., 2020). According to the previous definition, earlier studies have examined how the PjBL model or ethnoscience-based learning affects learning outcomes in science or literacy. There has not been any research on how adopting ethnoscience-based PjBL has improved science literacy learning results in primary schools. As a result, this research aims to ascertain how adopting PjBL based on ethnoscience affects student learning outcomes in scientific literacy. This will also gauge how well students respond to the ethnoscience-based PjBL paradigm.

METHODS

This study employed descriptive qualitative research methods. Rich, well-supported explanations and descriptions of human processes can be found in qualitative data (Miles et al., 2014). One can maintain chronological flow, identify which events had what effects, and develop insightful interpretations using qualitative data (Tampubolon, 2023). Furthermore, high-quality qualitative data aid researchers in moving past preliminary ideas and creating or revising frameworks for thought. They also increase the likelihood of coincidental discoveries and novel integrations. Ultimately, the results of thoroughly examined qualitative research possess an attribute known as "undeniability" (Miles et al., 2013). Research with a scientific foundation and the goal of interpreting phenomena using techniques is called qualitative research (Sugiyono, 2017). This research was conducted while studying in class V of one of the elementary schools in Yogyakarta for the 2023 academic year. The research subjects were students in class V at one of the elementary schools in Yogyakarta.

In obtaining field data, researchers used several steps to gather data: 1) observation, which serves as a guide. Researchers can observe and know the learning process through the ethnoscience-based PjBL model. 2) interview, which aims to know and understand the clarity of learning phenomena in finding data validity through informants as owners of information sources; and 3) documentation, which aims to support observation and interview techniques to obtain valid data. The instrument in this study focuses on implementing ethnoscience-based PjBL for scientific literacy learning outcomes.

The purpose of the data collection method used above was to obtain data in the field relevant to the research focus, namely the implementation of ethnoscience-based PjBL on students' scientific literacy learning outcomes. Furthermore, the data is processed and analyzed to become the research results. This study uses data analysis techniques in the form of critical analysis methods using the Miles and Huberman models. Qualitative data analysis is carried out interactively and continuously to find saturated data through several reductions of information, presentation of information, and conclusion are some of the processes (Herdiansyah, 2020). This aims to obtain research data regarding implementing ethnoscience-based PjBL on students' scientific literacy learning outcomes.

Table 1. The indicators of this research have been agreed upon in the forum group discussion class

Aspect	Indicator	Information
PjBL	Student-centered (learning) long-term (long-term). Integrated with real issues Develop real-world skills.	Observation
Ethnic	Classification of the environment or social situation encountered. Environmental classification structure, both physical and social. The principle of creating or constructing events to gather individuals or crowds.	Observation
PjBL based on Ethnoscience	Classification of environmental or social situations by learning is student-centered. Classification structure with issues in the long term. Create or build to develop real-world skills.	Observation and Interview
Science Literacy Learning Outcomes	Conduct an effective literature search. Solve problems using skills. Understand and interpret learning outcomes. Make inferences and predictions and draw conclusions based on the learning outcomes carried out.	Observation and Interview

The following explains the indicators for this research, which were agreed upon in the class group discussion forum. First, Project-based learning (PjBL) is a form of active, student-centered instruction characterized by student autonomy, constructive inquiry, goal setting, collaboration, communication, and reflection in real-world practice (De Florio, 2016; Kokotsaki et al., 2016). Based on three constructivist principles, learning is context-specific; learners actively participate in learning and accomplish their goals via social interactions. The sharing of knowledge and understanding of learning is a student-centered method of instruction. It is regarded as a specific kind of inquiry-based learning in which the learning environment is given using real-world situations and realistic questions that result in significant educational experiences (Al-Khatib et al., 2023; Marnewick, 2023; Petitjeans, 2024). To be able to respond to inquiries and work through issues, students must actively seek knowledge. The instructor is a facilitator in the interim (Jääskä & Aaltonen, 2022; Liu et al., 2022). In order to foster student collaboration and creativity, teachers aim to provide students with the investigative skills necessary to solve problems in the real world and come up with long-term solutions (Marnewick, 2023; Krajcik & Shin, 2022). Thus, it may be said that Project-based learning (PjBL) possesses the following indicators: 1) student-centered (learning), 2) long-term, 3) integrated with real issues, and 4) developing real-world skills. The final results of observations made during the learning process indicate this.

Ethnoscience is the subject of the second indicator; scientific knowledge from community culture passed down from generation to generation is learning with an ethnoscience approach (Kencanawati & Angela, 2022). Ethnoscience studies are critical to carry out because they reveal the characteristics of a region that should be preserved, considering that Indonesia consists of various tribes and diverse cultures (Sudarmin, 2014). An approach through reconstructing local community wisdom becomes a strategy for fostering an ethnic learning environment that integrates training planning with community culture. One form of training through ethnoscience requires the ability to combine indigenous knowledge with scientific knowledge. The main goal is to put forward a system characterized by unique community knowledge (Parmin & Fibriana, 2019). Thus, it may be said that ethnicity possesses the following indicators: 1) Classification of the environment or social situation encountered; 2) Environmental classification structure, both physical and social; and 3) The principle of creating or constructing events to gather individuals or crowds. The final results of observations made during the learning process indicate this.

The third indicator concerns PjBL based on ethnoscience; several studies have been conducted to explore society's culture regarding science and its changes. Studies show that many cultural practices in society are educationally related. Culture is related to the typical traditions or cultural heritage of a region in various forms, such as language, religion, and several activities that support the social life of the indigenous people of a region. Culture consists of elements of signs, symbols, and meaning. Symbols and meanings are things that have similarities and lie between them and are general. Every culture or ethnic group has these three unique elements, and the culture of each region also has characteristics that differentiate it from others. What is meant by "learning with an ethnoscience approach" is science education that emphasizes national identity, local cultural characteristics, and customs (Leat et al., 2022). Studying ethnoscience is very important because Indonesia is

home to various tribes and traditions that need to be preserved (Kencanawati & Angela, 2022; Sudarmin, 2014). Thus, PjBL based on ethnoscience possesses the following indicators: 1) Classification of environmental or social situations by learning student-centered; 2) Classification structure with issues in the long term; and 3) Create or build to develop real-world skills. The final results of observations and interviews made during the learning process indicate this.

The last indicator is science literacy learning outcomes; this is related to the 2013 curriculum, which must be responsive to developments in science, culture, technology, and art that can build students' curiosity and ability to utilize it appropriately and require students to implement the results the learning they get at school to the community (Permendikbud No. 70 of the Year 2013; Ministry of Education and Culture, 2012). In line with the previous curriculum objectives, increasing cultural education and local excellence provides opportunities for educational units to develop competencies following students' characteristics, thus calling on teachers to develop learning and utilize local wisdom as a learning resource (Sulistri et al., 2020). Plus, in practice, project-based learning requires students to be active in learning so that students will be able to find ideas and complete the best projects. Thus, teachers must create an interesting learning process (Kencanawati & Angela, 2022; Sulistri et al., 2020). The curriculum plays a role as a medium in developing regional culture. So, it can be said that the curriculum provides opportunities for students to learn from local culture about various vital values and provide opportunities to participate in and develop cultural values. Local values become cultural values used in everyday life. According to Sudarmin (2014), the development of the 2013 science curriculum is currently in effect, which pays attention to local culture science as a source of science learning. One way is to provide learning media that can "reconstruct science knowledge based on culture or ethnoscience" (Sudarmin, 2014). Thus, it may be said that science literacy learning outcomes possess the following indicators: 1) Conduct an effective literature search; 2) Solve problems using skills; 3) Understand and interpret learning outcomes; and 4) Make inferences and predictions and draw conclusions based on the learning outcomes carried out. The final results of observations and interviews made during the learning process indicate this. The sources and results of these four indicators were agreed upon from the forum group discussion class results.

RESULT AND DISCUSSION

Based on the findings of the in-class research V at one of the elementary schools in Yogyakarta, the implementation of using the PjBL paradigm for ethnoscience-based learning The results of scientific literacy education were divided into several stages. The stages are as follows:

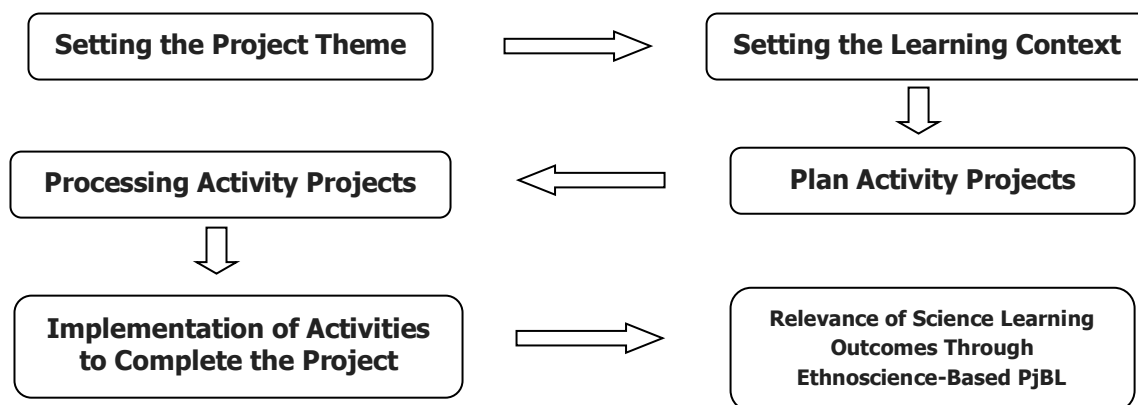


Figure 1. Stage of science literacy education

PjBL learning addresses related problems in the environment around students, which aligns with PjBL's goal of integrating the knowledge gained by students in class and implementing it in the real world with student-made solutions to existing problems. The class V instructor, P1, stated that the first step is to choose the project's theme. This is done to suit the lesson plan. As well as learning outcomes in the form of targeted student abilities from the learning process carried out in conjunction with activities (projects) carried out by students. In addition to the selection of culture, local knowledge, and societal issues are discussed with students.

The description of the explanation for P1 above states that the initial stage is to determine the project theme. As stated by P1, this is done so that the completed learning projects (activities) are appropriate for the intended students' skills. The students should then be able to complete the project tasks, thus choosing problems that exist in the community and are presented. Thus, students can overcome their problems in themselves, the environment, and society. This was also strengthened based on the findings of observations. Ethnoscience-based PjBL learning was carried out in a student-centered manner. This can be seen when learning takes place;

students are more active than the teacher in the classroom. The role of the teacher in the classroom is to act as a facilitator and monitor when project activities occur. The learning that is carried out is integrated with real issues facing students, thus making learning meaningful so that students remember project activities carried out in the long term. The learning process focuses on developing real-world skills (life around students).

PjBL supports students' accumulation of knowledge and abilities through participation in project conception and implementation since it offers hands-on experience. Students are encouraged to develop, solve problems, make decisions, and display goods as a result (Kulsum et al., 2020; Nugraha, 2022; Rusmansyah et al., 2023). Accordingly, this ethnoscience-based PjBL instructs science based on culture, conventional knowledge, and societal issues in order to help students comprehend and apply the concepts they learn in class to difficulties they encounter in daily life (Haerani et al., 2020; Lathifah et al., 2019; Rusmansyah et al., 2023).

This process integrates students' abilities to construct more complex ideas or material so that they are set in the learning context. This contains material that allows students to develop abilities according to project-based learning activities. It also provides limitations that aim at the adequacy and depth of the material to achieve the targeted student competencies. The teacher of class V, P1, stated that the next step is determining the learning context after determining the project theme. This contains any material that can help students develop competencies following the targeted competencies to complete the planned project activities more easily. It also aims to provide students with knowledge using the maximum amount of time.

The description of the P1 explanation above states that the learning context is determined by the selection of material used to achieve the targeted abilities. This helps to maximize time in the process of learning. For learning, context is given the knowledge to complete the project activities. Establishing a learning context serves as a guide for teachers to achieve targeted student abilities. Another function is to determine learning resources, learning methods, and how relevant the material is to problem-solving projects in the real-life context of students. The learning process creates knowledge by selecting the proper learning context in line with the above. This has to do with how adequate and in-depth the information is. The adequacy of the material relates to the range of the material that students study. At the same time, the depth of the content refers to the specificity of the concepts that students must understand. The knowledge in this learning environment will enable students to complete these project-based learning activities that integrate science and culture and pique their interest because it is relevant to their daily lives (Mirnawati et al., 2021; Nuralita, 2020; Rusmansyah et al., 2023).

In this stage, referred to as "designing a plan for the project," teachers and students work together with a joint agreement regarding activity rules and a selection of supporting activities to answer essential questions and determine what tools and materials are needed to complete the project activities. In addition, teachers and students create a schedule of activities together to collaborate in compiling a schedule of activities to complete the project. One of them is making a timeline, or the processing time naturally adjusted to the student's ability to complete the project, and making a deadline for completing the project so that students use their time to the fullest to complete the project. This is in line with what P1, a teacher of class V, stated: "In the next stage, project planning, students and I make rules that must be mutually agreed upon regarding the project activities carried out, namely the schedule of activities, the amount of time required, and project submission limits. This stage also aims to stimulate them to be able to answer essential questions and know the tools and materials needed to do the project".

The description of the P1 explanation above states that at the project planning stage, this activity is carried out to make rules that are mutually agreed upon between the teacher and students. This is also strengthened in line with the findings of observations. By connecting it to the environmental condition it was dealing with, ethnoscience-based PjBL learning was carried out. This is evident when the teacher asks the class about the state of the river after explaining the water cycle, and most of the pupils respond that most of the water is hazy or polluted. The teacher also asked about the condition of the water in the neighborhood. Then, the teacher gave a group activity to make clean water by processing filthy water. When finished, present it in front of the other groups. In line with this, PjBL is also doing this to improve student collaboration and communication skills (Dinda & Sukma, 2021). The teacher asks students to discuss project activities. Thus, the teacher can focus on paying attention to students and guiding those who experience problems in planning project activities.

The next stage is processing project activities; this stage sequences project activities, starting with essential questions. Names start with the essential question, specifically in the form of questions that prescribe activities for pupils to complete. Because of this, the instructor must be aware of his obligations to oversee the student's progress on their projects as they are being completed and to supervise their actions. Completed by carrying out project assignments according to the project activity arrangement, as determined by P1, class V instructor. My questions serve as assignments for students to complete. In addition, when the project activities are running in the classroom, you must be able to monitor the activities and progress of student projects. This seeks to direct project activities that do not follow the students' plans.

The description of the explanation for P1 above states that at the stage of processing the project, the activities carried out are to ask questions essential as assignments to students to carry out project-based activities. This is also strengthened in line with the findings of observations. By connecting it to the environmental scenario encountered, where the student's role is student-centered, ethnoscience-based PjBL learning is accomplished. This is evident during the learning process when students participate more actively in group discussions and ask and answer questions. The methods, resources, and materials that the students utilize for the project on turbid river water are up to them. As a result, students take an active role in developing their talents. At this stage, the teacher is also tasked with monitoring the activities and development of students during these activities. It is intended that teachers can assist students in minimizing mistakes when carrying out these project activities. So that the project can be completed smoothly and on time. This learning encourages students to participate actively in project activities and makes them creative and collaborative in completing their project activities (Lestari & Juanda, 2019; Rusmansyah et al., 2023).

After processing project activities, the next stage is implementing activities for students to complete projects according to a predetermined design. The teacher constantly supervises students; when students experience problems, the teacher provides solutions and helps students. After that, the completed project is written up as a project activity report. The report contains the name of the project, the material underlying the project, the relationship between the project and the materials, the tools and materials used, and the procedures for making and utilizing the resulting project. After that, the teacher makes an assessment (assesses the outcome) to aid teachers in assessing how well students are meeting competency standards and their development and providing feedback regarding the level of understanding achieved by students. Then, reflect on the experience gained (or evaluate the experience) by the teacher from the actions taken and the outcomes of the student projects that were completed from the beginning till the course of learning is completed. Furthermore, teachers and students discuss how to evaluate or improve performance during the learning process.

This aligns with what P1, the class V instructor, said: "The next stage is finishing student projects by what they designed. I keep an eye on them in the hopes that if there are any issues, they will be fixed right away. Then, in order to explain them to their peers, students write reports about project activities they have completed that include the name of the activity, the material, the relationship between the material and the project, tools, and equipment materials, the process of the activities, and how the projects are used. The continued process assessment from the beginning to the end of the student presentation now evaluates what they got, their experiences, and their feelings while working on the activity project.

The description of the P1 explanation above states that it is essential for the teacher to constantly monitor students' progress in carrying out the project to minimize obstacles that could occur. In addition, students must understand the purpose of carrying out this activity project, how it relates to the material, the use of the project, and the experience they get when doing it directly. This is also strengthened considering the outcomes of observations. Ethnoscience-based PjBL learning is carried out using practical literature, as seen when the teacher asks students to read books in a corner that can help them carry out project activities. Completing the activity project, students were invited to report their findings to other groups to form conclusions based on their learning outcomes about scientific literacy. Ethnoscience-based PjBL implementation can provide benefits to students and the surrounding community, where this is the main essence of the purpose of education to provide direct experience and turn culture and local wisdom into meaningful, engaging, and fun learning in order to increase students' motivation for learning with ethnoscience-based PjBL (Nuralita, 2020; Rusmansyah et al., 2023).

Learning activities carried out by students are very useful in their lives because they help students remember various vital points in their learning. In addition, learning with the scientific method found in PjBL provides students with the skills to become lifelong learners. In addition, knowledge helps survive competence in knowledge-based 21st-century developments (Lightner et al., 2021; Safrizal et al., 2020). As a result of learning scientific literacy obtained through PjBL in MI and SD, it is hoped that it can be adapted for use by science students to overcome several difficulties (Rusmansyah et al., 2023) in line with the primary objective of holding basic education, which is to develop students' abilities to acquire the basic knowledge and skills needed to lead a social life and have the self-skills to continue to a higher level of education (Sulistiyowati et al., 2020). An elementary school is an effective place for implementing scientific literacy because it is where learning begins. Thus, scientific literacy should be maintained so that it grows and sticks with students.

By cultivating scientific literacy at the basic education level, it is hoped that students will have a spirit of experimentation as well as a strong desire to learn and observe so that they can survive and not be left behind in the current development of the 21st Century (Marnewick, 2023; Siregar et al., 2020). Since everything in this century is open, students must be able to independently research information from various sources, solve issues independently, and apply numerous scientific principles while remaining open-minded, logical, and cooperative. Teachers and students can use their immediate surroundings as a source of knowledge to help

children learn science firsthand. To help students understand and apply the science they learn in class to difficulties they meet in their daily lives, ethnoscience-based PjBL teaches science based on culture, folklore, and societal issues (Dasmo et al., 2022; Haerani et al., 2020; Lathifah et al., 2019; Rusmansyah et al., 2023).

Science education can be developed by relying on the uniqueness and distinctiveness of an area so that students do not view science as a foreign culture to their studies but rather as part of the culture and local wisdom of the area where they live (Kencanawati & Angela, 2022; Rumadan et al., 2023; Setiyaningsih et al., 2021; Syahmani et al., 2022). As a system of studying original knowledge from community culture and natural events related to local communities, "ethnoscience become a new way for students to see culture from a scientific perspective" (Amundson, 1982; Syahmani et al., 2022). By integrating culture and wisdom, Local media in learning media can provide meaningful learning and students' interest in learning science. Based on this description, it is necessary to conduct research based on deep ethnoscience dimensions of regional culture and local wisdom towards science in science in the form of an ethnoscience-based project. In addition to its attractiveness and convenience, project-based learning Ethnoscience is expected to broaden students' insight into culture and wisdom locally through science learning, thereby giving rise to ease in understanding concepts. This research aims to examine ethnoscience-based learning projects that are feasible and interesting for elementary school students to use.

CONCLUSION

Using the study's findings as evidence, integrating culture and science into the learning process encourages students to create products based on ethnoscience, address issues, make choices, and display them. This is because ethnoscience-based PJBL is based on a particular field of study. Because it combines science with culture in the learning process, ethnoscience-based PJBL learning is a way to give pupils the skills, information, and abilities they require through participation in project conception and implementation.

REFERENCES

- Al-khatib, A., Marie Malhaire, J., Dauvé, S., & Jérôme Fougères, A. (2023). Project-based Learning for Engineering Students in The Context of Industry 4.0: Application to Automotive Assembly System. *Proceedings of the Design Society*, 3, 2965-2974.
- Amundson, R. (1982). Science, ethnoscience, and ethnocentrism. *Philosophy of Science*, 49(2), 236-250.
- Anggraeni, S. A. (2020). The Effort of School Pricipak in Improving Quality of Learning Through Non-Thematic Learning Supervision in Elementary School. *Proceedings of the 6th International Conference on Education and Technology (ICET)*, 346-350.
- Asy'syakurni, N. A., Rusilowati, A., & Sudarmin, S. (2022). The Development of Evaluation Tools to Measure Students' Science Literacy on the Solar System Theme. *Journal of Innovative Science Education*, 11(1), 78-86.
- Dasmo, D., Okyrandi, I. Y., Fitrian, A., Mulyaningsih, N. N., Widyantun, F., & Astuti, I. A. D. (2022). Analisis Persepsi kebutuhan Guru SMA dalam Mengimplementasikan Model Proyek Based Learning (PjBL) Terintegrasi Budaya Lokal. *Jurnal Inovasi Pendidikan Fisika Dan Riset Ilmiah*, 6 (2), 113-118.
- De Florio, I. (2016). *Effective Teaching and Successful Learning (Bridging the Gap between Research and Practice)*. Cambridge University Press.
- Dewi, C. C. A., Erna, M., Haris, I., & Kundera, I. N. (2021). The effect of contextual collaborative learning based ethnoscience to increase student's scientific literacy ability. *Journal of Turkish Science Education*, 18(3), 525-541.
- Dinda, N. U., & Sukma, E. (2021). Analisis Langkah-langkah Model Project Based Learning (PjBL) Pada Pembelajaran Tematik Terpadu di Sekolah Dasar Menurut Pandangan Para Ahli (Studi Literatur). *Journal of Basic Education Studies*, 4 (2), 44-62.
- Fadhil, I., & Rokhimawan, M. A. (2020). Analisis Materi IPA Kelas IV Tema Indahny Kebersamaan Dengan HOTS. *Jurnal Ilmiah Didaktika*, 21 (1), 100-110.
- 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.
- Haerani, S. A. S., Setiadi, D., & Rasmi, D. A. C. (2020). Pengaruh model inkuiri bebas terhadap kemampuan literasi sains. *Jurnal Pijar MIPA*, 15(2), 140-144.

- Hamidah, H., Leny, L., & Hamid, A. (2021). Analisis Berpikir Kritis dan Hasil Belajar pada Model Project Based Learning dengan Pendekatan Science, Technology, Engineering and Mathematics (STEM) Materi Sel Volta. *JCAE (Journal of Chemistry And Education)*, 4(3), 101-107.
- Hasbie, M., & Istyadji, M. (2018). Penerapan Model Project Based Learning (PjBL) Dalam Pembelajaran Sistem Koloid Untuk Meningkatkan Self Efficacy dan Kemampuan Berpikir Kritis Peserta Didik. *JCAE: Journal of Chemistry and Education*, 2 (2), 50–56.
- Herdiansyah, H. (2020). *Metodologi Penelitian Kualitatif untuk Ilmu Psikologi*. Salemba Humanika.
- Ichsan, I. Z., Hasanah, R., Ristanto, R. H., Rusdi, R., Cahapay, M. B., Widiyawati, Y., & Rahman, M. M. (2020). Designing an Innovative Assessment of HOTS in the Science Learning for the 21st Century. *Jurnal Penelitian dan Pembelajaran IPA*, 6(2), 211-224.
- Ihsan, M. S., & Jannah, S. W. (2021). Analisis Kemampuan Literasi Sains Peserta Didik Dalam Pembelajaran Kimia Menggunakan Multimedia Interaktif Berbasis Blended Learning. *EduMatSains: Jurnal Pendidikan, Matematika, Dan Sains*, 6 (1), 197–206.
- Irawan, F., Zubaidah, S., & Sulisetijono, S. (2020). Pengaruh Model Pembelajaran Remap STAD terhadap Pemberdayaan Keterampilan Literasi Sains Peserta Didik. *Jurnal Pendidikan*, 5 (8), 86–92.
- Irfan, M. (2019). Pengaruh Penerapan Metode Resitasi Terhadap Hasil Belajar Kognitif Siswa SMA. *BIOMA: Jurnal Biologi Dan Pembelajarannya*, 1 (1), 47–55.
- Jääskä, E., & Aaltonen, K. (2022). Teachers' experiences of using game-based learning methods in project management higher education. *Project Leadership and Society*, 3, 100041.
- Jufrida, J., Basuki, F. R., Kurniawan, W., Pangestu, M. D., & Fitaloka, O. (2019). Scientific literacy and science learning achievement at junior high school. *International Journal of Evaluation and Research in Education*, 8(4), 630-636.
- Kaehler, J., Hahn, I., & Koeller, O. (2020). The development of early scientific literacy gaps in kindergarten children. *International journal of science education*, 42(12), 1988-2007.
- Kencanawati, I., & Angela, L. (2022). Reconstruction of Community Knowledge in the Process of Making Potato Dodol Kerinci on the Criteria of Product Halalness Using Ethnoscience Approach. *Scientiae Educatia: Jurnal Pendidikan Sains*, 11 (2), 107–118.
- Khery, Y., Indah, D. R., Aini, M., & Nufida, B. A. (2020). Urgensi pengembangan pembelajaran kimia berbasis kearifan lokal dan kepariwisataan untuk menumbuhkan literasi sains siswa. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, 6(3), 460-474.
- Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving schools*, 19(3), 267-277.
- Krajcik, J. S., & Shin, N. (2022). *The Learning Sciences* (3rd ed.). The Cambridge Handbook of the Learning Sciences.
- Kulsum, N. N. S., Surahman, E., & Ali, M. (2020). Implementasi model discovery learning terhadap literasi sains dan hasil belajar peserta didik pada sub konsep pencemaran lingkungan. *Biodidaktika: Jurnal Biologi Dan Pembelajarannya*, 15(2), 55–65.
- Lathifah, N. H., Kusasi, M., & Rusmansyah, R. (2019). Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar Hidrokarbon Menggunakan Model Pembelajaran Problem Based Learning (PBL). *Journal of Chemistry and Education*, 3 (1), 1–9.
- Leat, D., Thomas, U., Hayward, K., & A'Echevarria, A. de. (2022). *Hope Under Neoliberal Austerity*. Cambridge University Press.
- Lestari, I., & Juanda, R. (2019). Komparasi Model Pembelajaran Problem Based Learning dan Project Based Learning terhadap Hasil Belajar Siswa Pada Materi Perangkat Keras Jaringan Internet Kelas IX SMP Negeri 5 Sungai Kakap Kabupaten Kubu Raya. *Efektor*, 6 (2), 127–135.
- Lightner, A. D., Heckelsmiller, C., & Hagen, E. H. (2021). Ethnoscience expertise and knowledge specialisation in 55 traditional cultures. *Evolutionary Human Sciences*, 3, e37.
- Liu, C., Yao, L., & Chen, Q. (2022). Machine Learning Based Tracking of Single Nanoparticle Vibrations from a Projected 3D Moiré Lattice. *Microscopy and Microanalysis*, 28(S1), 94-95.

- Marnewick, C. (2023). Student experiences of project-based learning in agile project management education. *Project Leadership and Society*, 4, 100096.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2013). *Qualitative Data Analysis: A Methods Sourcebook* (3rd ed.). Sage publications.
- Miles, M. B., Huberman, A. M., Saldanna, J., & State University, A. (2014). *Qualitative Data Analysis (A Methods Sourcebook)* (3rd ed.). Sage Publications.
- Mirawati, M., Fuldiaratman, F., & Yusnidar, Y. (2021). Penerapan Model Project Based Learning (PjBL) Berbasis Etnosains Pada Materi Koloid Dan Kaitannya Dengan Kemampuan Berpikir Kreatif Siswa Di SMA Negeri 2 Kota Jambi. *Jurnal Penelitian Pendidikan Kimia: Kajian Hasil Penelitian Pendidikan Kimia*, 8 (1), 85–96.
- Muliastri, N. K. E. (2020). New Literacy Sebagai Upaya Peningkatan Mutu Pendidikan Sekolah Dasar di Abad 21. *Pendasi: Jurnal Pendidikan Dasar Indonesia*, 4 (1), 115–125.
- Nugraha, D. M. D. P. (2022). Hubungan Kemampuan Literasi Sains Dengan Hasil Belajar IPA Siswa Sekolah Dasar. *Jurnal Elementary*, 5 (2), 153–158.
- Nuraini, N., & Waluyo, E. (2021). Pengembangan Desain Instruksional Model Project Based Learning Terintegrasi Keterampilan Proses Sains Untuk Meningkatkan Literasi Sains. *Jurnal IPA Dan Pembelajaran*, 5 (1), 101–111.
- Nuralita, A. (2020). Analisis Penerapan Model Pembelajaran berbasis Etnosains dalam Pembelajaran Tematik SD. *Mimbar PGSD Undiksha*, 8 (1), 1–8.
- OECD. (2019). *PISA 2018 Assessment and Analytical Framework*. OECD Publishing.
- Parmin, P., & Fibriana, F. (2019). Prospective Teachers' Scientific Literacy through Ethnoscience Learning Integrated with the Indigenous Knowledge of People in the Frontier, Outermost, and Least Developed Regions. *Jurnal Penelitian Dan Pembelajaran IPA*, 5(2), 142. <https://doi.org/10.30870/jppi.v5i2.6257>
- Petitjeans, C. (2024). The Set of Elementary Tensors is Weakly Closed in Projective Tensor Products. *Bulletin of the Australian Mathematical Society*, 1-8.
- Pitnelly, W., S., Elisa, E., Zurweni, Z., & A., M. (2021). Peningkatan Kemampuan Literasi Sains Siswa Menggunakan Model Pembelajaran Contextual Teaching and Learning Berbantuan Google Classroom Dimasa Pandemi Covid-19 pada Mata Pelajaran Kimia. *Journal of the Indonesian Society of Integrated Chemistry*, 13 (1), 58–65.
- Rumadan, N. S., Asmaningrum, H. P., & Sumanik, N. B. (2023). Development of Student Worksheet with an Ethnoscience Approach to Wati Plants Through Liveworksheet Applications. *IJ CER: International Journal of Chemistry Education Research*, 7(1). <https://doi.org/doi: 10.20885/ijcer.vol7.iss1.art5>
- Rusmansyah, R., Leny, L., & Sofia, H. N. (2023). Improving Students' Scientific Literacy and Cognitive Learning Outcomes through Ethnoscience-Based PjBL Model. *Journal Of Innovation in Educational and Cultural Research*, 4 (1)(1), 1–9. <https://doi.org/10.46843/jiecr.v4i1.382>
- Sadoglu, G. P. (2018). Engineering Students' Opinions on Science Literacy. *Universal Journal of Educational Research*, 6 (8), 1819–1830.
- Safrizal, S., Zaroha, L., & Yulia, R. (2020). Kemampuan Literasi Sains Siswa Sekolah Dasar di Sekolah Adiwiyata (Studi Deskripsi di SD Adiwiyata X Kota Padang). *JNSI: Journal of Natural Science and Integration*, 3 (2), 215–223.
- Setiyaningsih, Y., Dijaya, R., & Suprianto, S. (2021). Ethnoscience Based Augmented Reality on Botanical Garden. *JUITA: Jurnal Informatika*, 9 (2), 173–180.
- Sholahuddin, A., Hayati, N., R., I., P., S., & E., S. (2021). Project-Based Learning on Ethnoscience Setting to Improve Students' Scientific Literacy. *The 4th International Conference on Mathematics and Science Education (ICoMSE) 2020*, 1–8.
- Siregar, T. R. A., Iskandar, W., & Rokhimawan, M. A. (2020). Literasi Sains Melalui Pendekatan Saintifik Pada Pembelajaran IPA SD/MI Di Abad 21. *Modeling: Jurnal Program Studi PGMI*, 7 (2), 243–257.
- Sudarmin, S. (2014). Pendidikan karakter, etnosains dan kearifan lokal (konsep dan penerapannya dalam penelitian dan pembelajaran sains). Fakultas Matematika Dan Ilmu Pengetahuan Alam Unnes.
- Sugiyono, S. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

- Sulistri, E., Sunarsih, E., & Utama, E. G. (2020). Pengembangan Buku Saku Digital Berbasis Etnosains di Sekolah Dasar Kota Singkawang. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, 6 (3), 522–531.
- Sulistyowati, S., Reffiane, F., & Handayani, D. E. (2020). Pengaruh Model Project Based Learning Berbasis Etnosains Tema Ekosistem Terhadap Aktivitas Belajar Siswa. *Jurnal Pendidikan Surya Edukasi (JPSE)*, 6 (2), 120–132. <https://doi.org/10.37729/jpse.v6i2.6802>
- Suswati, U. (2021). Penerapan Problem Based Learning (PBL) Meningkatkan Hasil Belajar Kimia. *TEACHING: Jurnal Inovasi Keguruan Dan Ilmu Pendidikan*, 1 (3), 127–136.
- Sutrisna, N. (2021). Analisis Kemampuan Literasi Sains Peserta Didik SMA Di Kota Sungai Penuh. *Jurnal Inovasi Penelitian*, 1 (12), 2683–2694.
- Syahmani, S., Rahmatilah, J., Winarti, A., Kusasi, M., Iriani, R., & Prasetyo, Y. D. (2022). Development of Guided Inquiry Lesson Based on Ethnoscience E-Modules to Improve Students' Problem-solving Ability in Chemistry Class. *Journal of Innovation in Educational and Cultural Research*, 3(4), 670–682.
- Tamin, K. B., Ubadah, U., & Mashuri, S. (2022). Tantangan Pendidikan dalam Era Abad 21. *Prosiding Kajian Islam Dan Integrasi Ilmu Di Era Society 5.0 (KIIIES 5.0) Pascasarjana Universitas Islam Negeri Datakarama Palu*, 1, 338–342.
- Tampubolon, M. (2023). *Metode Penelitian*. Global Eksekutif Teknologi.
- Ulfah, A., Rusmansyah, R., & A., H. (2020). Meningkatkan Self-Efficacy dan Kemampuan Berpikir Kreatif Siswa Melalui Model Project Based Learning pada Materi Koloid. *JCAE: Journal of Chemistry and Education*, 3 (3), 90–96.
- Wahyuni, A., & Yusmita, E. (2020). Perancangan Instrumen Tes Literasi Kimia Pada Materi Asam dan Basa. *Jurnal Edukimia*, 2 (3), 106–111.
- Wardhani, Y. S., Wayuni, S., & Rasyad, A. (2020). Analisis Dampak Permainan Problematika Sains terhadap Kecakapan Proses Sains Anak 5-6 Tahun. *Jurnal Pendidikan*, 5 (7), 953–961.
- Wibowo, T., & Ariyatun, A. (2020). Kemampuan Literasi Sains Pada Siswa SMA Menggunakan Pembelajaran Kimia Berbasis Etnosains. *Edusains*, 12 (2), 214–222.
- Winarti, A., Almubarak, A., & K., M. (2018). Inovasi Pembelajaran Kimia Berbasis Etnosains. *Banjarmasin: Program Studi Pendidikan Kimia FKIP ULM*.
- Wiradintana, R. (2018). Revolusi Kognitif Melalui Penerapan Pembelajaran Teori Bruner Dalam Menyempurnakan Pendekatan Perilaku (Behavioural Approach). *Oikos: Jurnal Kajian Pendidikan Ekonomi Dan Ilmu Ekonomi*, 2 (1), 47–51.
- Wulandari, P., Hartdiyati, E., & A., N. (2018). Efektifitas Pembelajaran Transpor Membran Bermuatan Etnosains Terhadap Hasil Belajar Kognitif dan Minat Berwirausaha Pada Siswa SMA. *Jurnal Ilmiah Biologi*, 7 (1), 53–64.
- Yunianto, T., & Rokhimawan, M. A. (2021). Analisis Kesesuaian Materi IPA dalam Buku Siswa Kelas IV Semester 1 SD/MI dengan Kuriukulum 2013. *EduHumoniora: Jurnal Pendidikan Dasar*, 13 (1), 43–51.
- Yunianto, T., Suyadi, S., & Suherman, S. (2020). Pembelajaran Abad 21: Pengaruhnya terhadap Pembentukan Karakter Akhlak melalui Pembelajaran STAD dan PBL dalam Kurikulum 2013. *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*, 10 (2), 203–214.
- Zannatunna'imah, S., Leny, L., & A., H. (2021). Pengaruh Model Pembelajaran Experiential Learning Melalui Google Classroom Terhadap Keterampilan Proses Sains dan Motivasi Belajar Peserta Didik pada Materi Hidrolisis Garam. *JCAE: Journal of Chemistry and Education*, 4 (3), 93–100.