

Indigenous ecological knowledge (IEK) of the Osing tribe in Kemiren village as a teaching material

M. Mistianah^{a,1}, Diyah Ayu Widyaningrum^{a,2}, Ismi Nurul Qomariyah^{a,3,*}, Dwi Budiono^{a,4}

^aDepartment of Biology Education, Faculty of Exact and Sport, Universitas Insan Budi Utomo, Jl. Citandui No 46, Purwanto, East Java 65126, Indonesia

¹mistianah@uibu.ac.id; ²diyahayuwidyaningrum@uibu.ac.id; ³isminurulqomariyah@uibu.ac.id;

⁴dwibudiono@uibu.ac.id

*Corresponding author

Citation: Mastinah, M., Widyaningrum, D., Qomariyah, I. N., & Budiarto, D. (2024). Indigenous ecological knowledge (IEK) of the osing tribe in Kemiren Village as a teaching material. (*RaDEn*), 4(2), 1187-1201.
<https://doi.org/10.22219/raden.v4i2.36631>

Received: 28 September 2024

Revised: 6 December 2024

Accepted: 9 December 2024

Published: 21 December 2024

Abstract: The lack of integration of Indigenous Ecological Knowledge (IEK) into formal education hinders the preservation and transmission of valuable environmental and cultural practices. The purpose of this study was to develop biology teaching materials that incorporate the Indigenous Ecological Knowledge of the Osing tribe, especially for high school students in Kemiren village, Bayuwangi regency. This study used a Research and Development (R&D) approach combined with descriptive research methods. Data were collected from five traditional leaders in Kemiren village, Banyuwangi regency; who maintain sacred traditions such as the *Buyut Cili* site and the *Rebo Wekasan* ritual, who were selected as key informants. Data collection instruments included structured interview guides, observation checklists, and documentation tools such as photos and video recordings to capture cultural practices. The results of the study indicate that the concept of the IEK of the Osing tribe can be used in the development of teaching materials in the form of Student Worksheets (LKPD). So that it can be used as an alternative learning resource for high school students in Kemiren Village to better understand their culture and local wisdom.

Keywords: indigenous ecological knowledge; learner worksheets; Osing tribe; teaching materials



Copyright © 2024, Mistianah et al.

This is an open access article under the CC-BY-SA license

1. Introduction

Indigenous Knowledge (IK) encompasses a broad range of observations, innovations, practices, and beliefs developed by Indigenous Peoples through direct interaction with their environment. It integrates biological, physical, social, cultural, and spiritual systems, developed over centuries and passed down across generations (Charles & Cajete, 2020). Indigenous Ecological Knowledge (IEK), a subset of IK, specifically refers to the relationship between Indigenous communities and their surrounding ecosystems. The Osing tribe, recognized as the native tribe of Banyuwangi, has preserved its traditions and customs across several sub-districts, including Glagah District, where Kemiren Village is located. This village is notable for its rich natural resources, such as spring ecosystems and agroecosystems. The Osing community's strong connection with their environment, particularly in their agricultural practices and sustainable use of natural resources (Gobena et al., 2022; Nursafitri et al., 2020).

In the field of education, there is a growing recognition that integrating local wisdom, such as IEK, into the curriculum can make learning more meaningful and contextually relevant. According to Pascua et al., (2017); Sartini, (2004) describes local wisdom as a cultural product that embodies universal values, in accordance with the Widodo, (2017) underscores the importance of Student Worksheets (LKPD) in fostering active student engagement and enhancing their understanding of concepts. Despite these insights, there has been little focus on incorporating IEK into high school biology teaching materials, especially in relation to local biodiversity and cultural heritage.

The previous studies have extensively documented the importance of Indigenous Knowledge and its potential applications. gaps remain in the educational context. Research has explored the preservation of IEK (Madonsela et al., 2024; Zulfadrim et al., 2019), but there is a lack of practical application in formal education, particularly in high school biology teaching materials. Contextual Focus (Prasetyaningrum, 2016; Sumarmi, 2015); The majority of studies on the Osing tribe focus on cultural preservation and environmental practices, without directly linking them to curriculum development. Practical Tools (Rahayu et al., 2024; Zulia et al., 2022); Although local wisdom's universal values are recognized, specific tools like *LKPD* that translate IEK into actionable and engaging learning resources for students remain underdeveloped. This research addresses the identified gaps by integrating the IEK of the Osing tribe into biology teaching materials for high school students. By focusing on Kemiren Village, with its rich spring and agroecosystems, this study develops Student Worksheets (*LKPD*) that incorporate local wisdom and IEK. This approach aims to; (1) Foster environmental and cultural awareness among students; (2) Enhance the relevance and effectiveness of biology education through locally contextualized learning materials; (3) Preserve and transmit the IEK of the Osing tribe to younger generations in a structured educational setting. This research is crucial to bridge the gap between traditional ecological knowledge and modern education, ensuring that Indigenous wisdom contributes to sustainable learning and environmental stewardship.

Kemiren village has school facilities ranging from pre-school to high school/vocational high school level (*PAUD, SMK/SMA/MA*). Biology learning in schools is more meaningful and easier for students to understand if it is linked to local wisdom. Local wisdom is the truth that exists or remains constant in an area. Local wisdom is a combination of the sacred values of God's word and various existing values. Local wisdom is formed as the cultural superiority of local communities and geographical conditions in a broad sense. Local wisdom is a cultural product of the past that should be continuously used as a guide for life. Even though it has local value, the value contained in it is considered very universal (Abdullah & Khan, 2023; Sartini, 2004). Local wisdom related to Indigenous Ecological Knowledge (IEK) can be part of high school biology teaching materials. One of the materials related to IEK is biodiversity. The teaching materials developed in this research are Student Worksheets (*LKPD*). *LKPD* is a student activity in learning to apply or practice the knowledge they have acquired. The *LKPD* is very important to determine the success of students in absorbing and mastering the knowledge that has been given (Widodo, 2017).

The integration of Indigenous Ecological Knowledge (IEK) into formal education, particularly in the context of biology education, represents a significant frontier in both educational research and sustainable development. Recent studies have highlighted the importance of local wisdom in fostering environmental awareness and cultural preservation, yet its application in high school curricula remains underexplored (Lusianawati et al., 2023). By developing culturally relevant teaching materials, such as Student Worksheets (*LKPD*) that incorporate IEK, this research responds to an increasing call for curriculum innovation that bridges traditional knowledge with modern science education. Additionally, the role of IEK in shaping students' perceptions of biodiversity and sustainability is an emerging area of study with considerable promise. Incorporating IEK into the curriculum offers students not only scientific knowledge but also an understanding of the value of local ecosystems and the role of indigenous practices in ecological conservation.

The future benefits of this research are far-reaching; By connecting local wisdom with modern biology education, it can contribute to greater environmental stewardship and cultural appreciation among students. This research will provide teachers with practical tools to make biology education more relevant and engaging, potentially leading to a more sustainable approach to environmental education. Furthermore, it can serve as a model for

other regions to integrate Indigenous knowledge into curricula, creating a ripple effect that extends beyond the local context. The purpose of this research is to develop biology teaching materials that incorporate the Indigenous Ecological Knowledge of the Osing tribe, specifically for high school students in Kemiren Village. Through the creation of Student Worksheets (LKPD) based on IEK, this research aims to enhance the relevance and effectiveness of biology education, while preserving and transmitting the cultural and ecological wisdom of the Osing tribe to future generations.

2. Materials and Methods

2.1 Types of research

Development research produces products with a series of trials in the field so that the resulting product is suitable for use and meets product development standards. The development model that will be planned in this research follows the path of (Thiagarajan et al., 1974). The 4-D development model has steps, namely Define, Design, Develop, and Disseminate or in popular language, the 4-P model, namely defining, designing, developing and disseminating. This research is limited to the design stage of book products, teaching modules and LKPD. The final stage is activity evaluation. The development of teaching materials follows the 4D development model. The flow of product development stages is depicted in Figure 1.

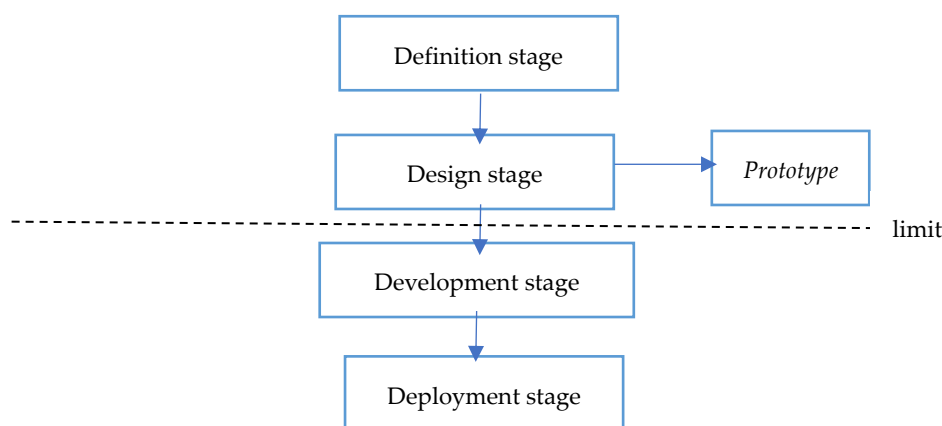


Figure 1. Product development flow

2.2 Research Subjects and Objects

The participants for this study included, the SMA 1 Banyuwangi students, and socialization of IEK to teachers, and traditional leaders of the Osing tribe in Kemiren Banyuwangi, were involved in the small-scale practicality and effectiveness testing.

2.3 Data Types and Sources

The data utilized in this research consists of both primary and secondary sources. Primary data includes the results of a needs analysis. The techniques used in this study are observation, interviews. Secondary data is obtained from documentation study, included analysis sheets of materials and other relevant learning resources.

2.4 Data collection technique

The Needs Analysis in the Define stage employed several tools: (1) structured interview guides and analysis interview result respondent; (2) Observation checklists or a knowledge assessment; and (3) documentation tools such as photographs and video recordings to capture cultural practices and a literature review analysis sheet. The validity test involved two experts, each in fields of material the ecosystem in Kemiren Village, development and manufacture of teaching material products in the form of IEK-based books, teaching modules and student worksheets (LKPD), and socio-scientific

issues. Experts were asked to assess the content of the book being developed, along with a section for providing feedback and suggestions.

2.5 Data Analysis Techniques Data Analysis Techniques

The collecting data was subsequently using qualitative and descriptive metode. Then, the result of data analysys of validity and practicality worksheet (*LKPD*). The preliminary stage includes the analysis of initial knowledge about IEK in students of SMA 1 Banyuwangi and the socialization of IEK to teachers and traditional leaders of the Osing tribe in Kemiren village, Banyuwangi regency. The core stage includes interviews with traditional leaders of the Osing tribe in Kemiren Village, documentation of the ecosystem in Kemiren Village, development and manufacture of teaching material products in the form of IEK-based books, teaching modules and student worksheets (*LKPD*).

3. Results

Most of the Osing tribe people live in Kemiren Village, Banyuwangi. Based on the results of interviews with traditional leaders of the Osing tribe and observations and documentation, it was found that the livelihood of the Osing tribe was mostly as farmers. Various varieties of rice plants are agricultural products from Kemiren Village. The rice field ecosystem and spring ecosystem are ecosystems found in Kemiren Village. The research stages are depicted in [Figure 2](#).

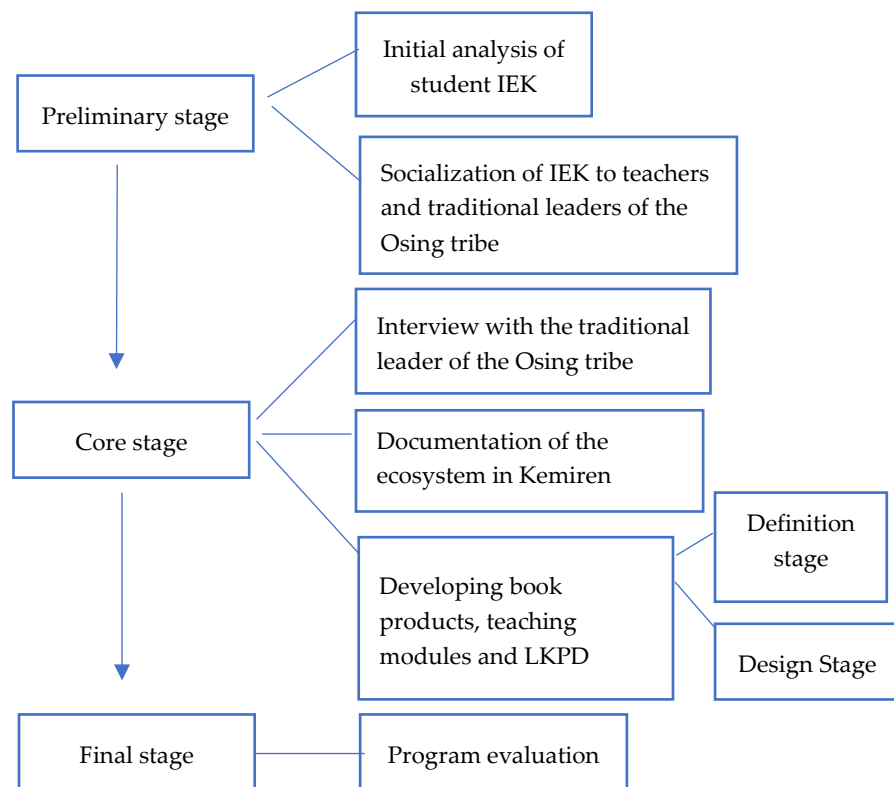


Figure 2. Design of research stages

The product design stage. At this stage a product prototype is produced. In the product design stage, a prototype of the Student Worksheet (*LKPD*) integrating Indigenous Ecological Knowledge (IEK) of the Osing tribe was developed. The appearance of the cover on the *LKPD* is shown in [Figure 3](#).

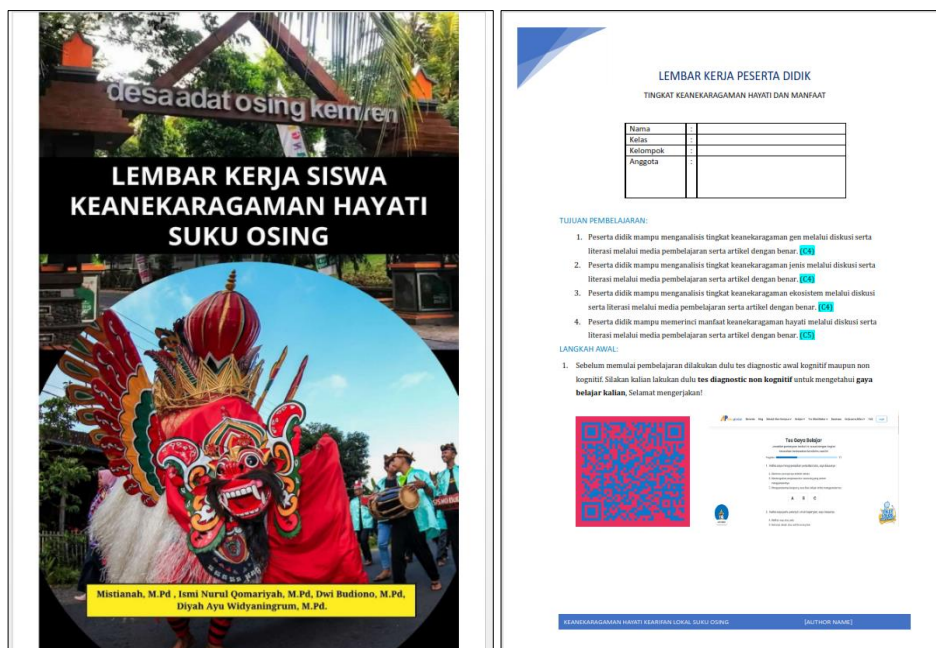


Figure 3. Cover and some of the content Student Worksheet (LKPD)

The design process emphasized aligning the LKPD with the Problem-Based Learning (PBL) model to foster critical thinking, collaborative learning, and real-world problem-solving skills among students. The LKPD contains (a) General information components include: General information on teaching tools, initial competencies, Pancasila student profiles, facilities and infrastructure, target students, number of students, learning model approaches; (b) Core components include: general learning outcomes, phase E based on elements, learning activities and learning assessment. The learning model contained in the LKPD is the PBL (Problem Based Learning) model. IEK content on worksheet (LKPD) presented in Table 1.

Table 1. IEK content on worksheet (LKPD)

No.	Topic	IEK	Scientific Knowledge
1.	Happy Rebo Wekasan	Rebo wekasan is a celebration held on Wednesday in the last week of the month of Safar which takes place at each spring point. This aims to ensure that the water that comes out of the spring is water that residents believe will protect them from disease. Residents are prohibited from taking water from springs/turning on PAM water at home on Wednesdays from morning to noon. The salvation event is held from morning to noon at the spring point/partly held around the great-grandmother's site on Wednesday. Next, the residents prayed and ate together with <i>pecel pitik</i> rice. The Rebo Wekasan tradition teaches residents to (1) maintain the ecosystem/environment in a compact manner, especially the spring environment which is an important	Some action plans regarding biodiversity are: (1) Reducing the rate of decline/real damage to biodiversity through increasing the sustainability of ecosystem functions and balance so that biodiversity conservation can be restored by 2010. (2) Increasing the efficiency and sustainability of utilization and reducing degradation of biodiversity resources. (3) Effective conservation efforts (protection of life-supporting ecosystems, preservation of germplasm, use based on conservation), monitoring circulation continuous biodiversity and the provision of strict

No.	Topic	IEK	Scientific Knowledge
		resource for the livelihood of the Osing tribe community in Kemiren Village, (2) Increasing the efficiency of using clean/belik water sources for ecosystem sustainability, (3) it is believed that natural sanctions will be received by residents who do bad things to the environment, (4) involvement of residents in the <i>rebo wekasan</i> event is a symbol of the solidarity of the Osing tribe residents in Kemiren village in protect the environment, (5) There is no written policy, but residents still comply with regulations regarding environmental preservation based on the beliefs and teachings of their ancestors.	sanctions for any violations. (4) Effective community and local community involvement in biodiversity management. (5) Map the potential and availability of biodiversity in the context of sustainable stewardship and use starting in 2004. (6) Integrating an ecosystem approach in making biodiversity management policies since 2003 (Sunarmi, 2014).
2.	Rice field ecosystem	The livelihood of most of the Osing tribe in Kemiren Village is rice farming. The results of the research show that there are 5 varieties of local rice that still exist, namely the Pelang Abang, Genjah Arum, Pelang Cemeng / Bahak, Hoing Jaher and Ketan Cemeng varieties. Meanwhile, there were (do not exist) as many as 8 varieties, namely Hoing Cantel, Untup Ruyung, Ketan Kutuk, Rondo Jeblok, Bali Klungkug, Sri Kuning, Rumpuk Bali and Ketan Sampang.	The various rice varieties are an example of gene-level diversity.
3.	Rice field processing	A series of agricultural activities are always preceded by salvation. The villagers of Kemiren treat water and soil well and with a salvation ritual sefforts when harvesting are good. According to the informant, the stages of agriculture include seedling (ngurit), land plowing (nyingkal), planting (tandur), fertilizing and matun, and harvesting (nggampung). Treat and utilize the environment well and efficiently to get results from a good environment.	Increasing the efficiency and sustainability of utilization and reducing the degradation of biodiversity resources (Sunarmi, 2014).
4.	Ecosystem in Kemiren village	The ecosystem in Kemiren village mostly includes rice fields and spring areas. There are many sources of clean water (belik) in Kemiren village that are still well treated.	Different types of ecosystems are ecosystem-level diversity.
5.	Trust in the site of the great-grandfather of chili	Residents who will carry out activities such as cutting down trees must also hold a salvation to avoid bendu (sanctions from nature). Waga brings offerings (offerings) at the site of the	Integrating an ecosystem approach in making biodiversity management policies since 2003 (Sunarmi, 2014).

No.	Topic	IEK	Scientific Knowledge
		great-grandfather of chili. The ecosystem/environmental management policy in the Osing tribe in Kemiren Village does not exist but residents still comply with environmental conservation rules based on residents' belief in the spirit of the great-grandfather of the chilli who is believed to come to residents who do not do good to the environment. Residents also believe that they will get bad luck/calamity if they damage the environment.	

3.1 Rabo Wekasan Celebration as a Form of Indigenous Ecological Knowledge (IEK) in Preserving the Spring Environment

The Indigenous Ecological Knowledge (IEK) of the Osing tribe is how they can utilize the environment, especially spring areas (springs) for rice farming irrigation. The tradition of protecting springs is known as *rabo wekasan*. The *rabo wekasan* tradition is the traditional knowledge and skills of the Osing tribe which has been passed down from one generation of ancestors to the next until today. Prasytaningrum, (2016); Zulia et al., (2022) stated that the community held the *Rabo Wekasan Seletan* tradition which was held around the great-grandmother Cili site on Wednesday of the last Sunday. According to informant *Rebo Wekasan*, which means the last Wednesday, it is a ritual procession carried out every year on the night of the last Wednesday in the month of Sapar in the Hijri calendar. Wednesday *wekasan* is a celebration held at every spring/*belik* point. This aims to ensure that the water that comes out of the spring is water that is protected from disease. The ecosystem of rice fields and spring areas can be seen in Figure 4.



Figure 4. (a) Rice field ecosystem in Kemiren village; (b) Spring area ecosystem

The Osing tribe strictly obeys the rules. This can be seen from the many well-maintained clean water sources (*belik*), especially in Kemiren Village. These *beliks* all appear along the banks of the “Sobo River” (44 *beliks*) and Gulung River (37 *beliks*) which border Kemiren Village from the east and west positions. indigenous people uphold the rules more because they believe that there will be bad things or misfortune for them (Rahayu et al., 2024). Some of the *beliks* are used for household purposes such as washing, bathing, and are also used to supply clean water to residents' homes which is channeled through pipes. The clean water distribution management system is known as *PAM*. The source of *PAM* to meet the clean water needs of the Kemiren village community comes from three different places, namely from the large river *belik* in Kampung Anyar Village, one source comes from the *belik* on the banks of the Sobo river, and one source comes from the *belik* on the banks of the Gulung river. Apart from that, there is also a large *belik* on the

banks of the Gulung river in Kemiren Village to meet the clean water needs of the people of Banjar Sari Village.

On Tuesday or the day before the “*Rabo Wekasan*” celebration was held, residents had started taking water from the spring/belik to meet their needs. For residents' homes that have water from PAM, residents have started turning on the water taps to fill water sources according to their needs. From Wednesday morning until noon, residents are prohibited from taking water from springs and are prohibited from turning on the water taps. After 12.00 noon, residents are allowed to take water or turn on the tap. Most residents also scramble to take the first water at the spring point on Wednesday because the first water taken on Wednesday is believed to have the property of repelling evil. belief in myths or what is applicable in society is used to maintain something that is believed to be true, these are the values of local wisdom in the form of morals and ethics (Fitria, 2023; Maran et al., 2022).

The *Rebo Wekasan* tradition teaches residents to; (1) maintain the ecosystem/environment in a compact manner, especially the spring environment which is an important resource for the livelihood of the Osing tribe community in Kemiren Village, (2) Increase the efficiency of using clean/pure water sources for ecosystem sustainability, (3) it is believed that natural sanctions will be received by residents who do bad things to the environment, (4) the involvement of residents in the *rebo wekasan* event is a symbol of the solidarity of the Osing tribe residents in Kemiren village in protecting the environment, (5) There is no written policy, but residents still comply regulations regarding environmental conservation based on the beliefs and teachings of ancestors.

An informant said: although some residents/communities do not bring blessings rice and chicken whit traditional *sambal* known as (*pecel pitik*), everyone is allowed and encouraged to take part in the celebration event. Apart from *pecel pitik*, other dishes are *jenang putih* end *jenang abang* (sticky snack) placed in a *takir* (a container made from gedang leaves) and market snacks. The basic ingredients of *jenang abang* an *jenang putih* are rice flour and Javanese sugar, while *jenang putih* is rice flour and a little salt. *Jenang putih* and *jenag abang* has a meaning as a symbol of repelling disaster, while market snacks including fried bananas, *klopong*, fried sweet potatoes, *getuk* and other snacks intended as symbols of the descendants of the Prophet Adam are still busy like a busy market (Figure 5). Snacks in traditional Javanese ceremonies, especially slametan, are symbols of worship or religion. (Lutfi & Ilham, 2022; Rohmah, 2018).

The tradition of the “*Seletan Rabo Wekasan*” community can be interpreted as meaning that the community must always protect the environment, especially the spring area. Through this activity it can be said that the indigenous people of Kemiren Village have unity in protecting the environment. *Rabo wekasan* is also found in several areas. In Japanese village areas, Kudus with processions includes the *tahtiman al-Qur'an bil ghoib* (an activity of reciting the 30 juz (Lutfi & Ilham, 2022; Rohmah, 2018). The *banyu salamun* carnival, and the distribution of *banyu salamun*. The spring environment is an environment that must always be preserved. This is related to the need for water which is important for agricultural and household activities. This is because most of the residents of Kemiren village earn their living as farmers. Sufficient water can make agricultural crops fertile and bring prosperity to the residents of Kemiren village.

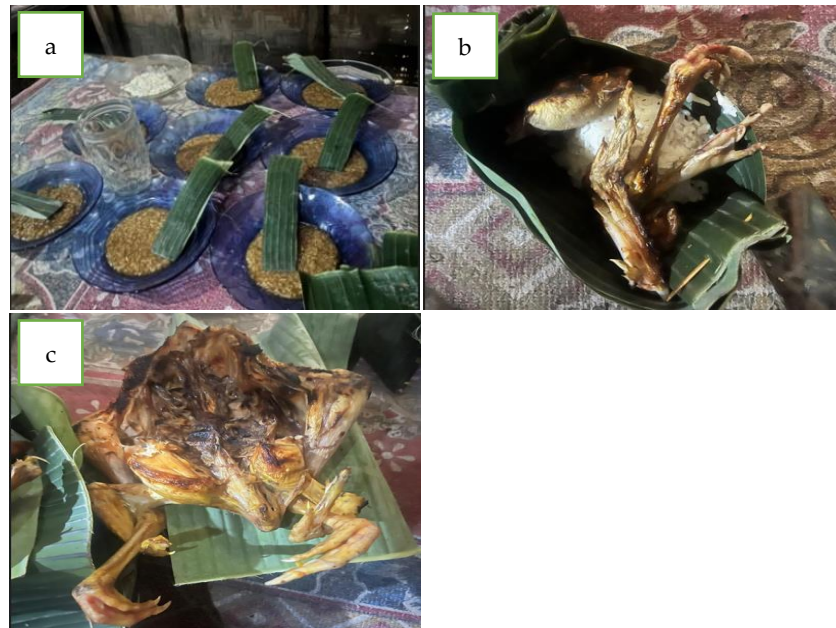


Figure 5. Servings at the traditional *rebo wekasan* event; (a) *Jenang abang* and *Jenang putih* (stikey snack); (b) *Pecel pitik* rice placed in a banana leaf; and (c) *Pecel pitik* (chicken with traditional sambal)

4. Discussion

4.1 The Relationship Between Trust in Chilean Great-grandfather Sites and Environmental Conservation

The Buyut Cili site is sacred to the residents. The Buyut Cili site is a sacred place because women who are menstruating are prohibited from entering the site. Residents who have bad intentions and cause damage are believed to be visited by the spirit of Buyut Cili. Every resident who will have a wish and their wish has been granted will visit the Buyut Cili site by bringing *pecel pitik*, *sego golong* and *jenang abang*. Residents who are going to cut down trees must also hold a thanksgiving to avoid *bendu* (sanctions from nature). This belief many symbol can be a prevention against damage to nature and the environment (Lutfi & Ilham, 2022). need to respect the integrity of local wisdom values and value them appropriately into practical solutions for environmental resource management (Saylor et al., 2017).

4.2 IEK on Rice Field Agroecosystems

Agroecosystem is an artificial ecosystem within the scope of agriculture such as rice fields and gardens. In it, humans cultivate land or land to plant one or more types of seasonal or non-seasonal plants. Like an ecosystem, there are two main components in it, namely living and non-living components. These living components are plants that are managed by humans, while those that support them to stay alive are non-living components (Cameron, 2022). Agricultural activities are activities that most residents of Kemiren village do. Rice is the Osing tribe's largest agricultural product (Prasetyaningrum, 2016). The results of the research show that there are 5 varieties of local rice that still exist, namely: *the Pelang Abang*, *Genjah Arum*, *Pelang Cemeng/Bahak*, *Hoing Jaher* and *Ketan Cemeng* varieties. Meanwhile, there were 8 varieties that existed (do not exist), namely; *Hoing Cantel*, *Untup Ruyung*, *Ketan Kutuk*, *Rondo Jeblok*, *Bali Klungkug*, *Sri Kuning*, *Rumpuk Bali* and *Ketan Sampang*. A series of agricultural activities are always preceded by safety. The residents of Kemiren village treat the water and land with a ritual of salvation so that the harvest will be good. According to informants, the stages of agriculture include seeding (*ngurit*), plowing the land (*nyingkal*), planting (*tandur*), fertilizing and maturing, and harvesting

(*ngampung*). Sometimes in managing agroecology, solutions based on local wisdom are needed and this must be respected (Saylor et al., 2017).

The nursery stage includes selecting rice seeds, soaking, drying and sowing. Soaking is done for 24 hours, then dried in the sun for 24 hours until the seed coat cracks. Then the seeds are sown in a plot of land under waterlogged conditions until the seeds are ready to be planted. The seeding process takes around 20 days until it is ready to be planted. The plowing or clearing stage is carried out using a tractor. The day before, the rice fields were irrigated with water and left overnight, then plowed with a tractor. The *slametan* ritual, namely anchoring *nyingal*, is carried out before the *nyingkal* activity is carried out. There are those who serve *jenang abang*, *jenang lemu* (sticky snack), *pecel pitik*, *sego* savory and *sego* ablution depending on the teachings passed down from their ancestors (Dzofir, 2017). The meaning of the *slametan* is a prayer so that the process of plowing the fields will run smoothly (Lutfi & Ilham, 2022). The food served is eaten together, apart from that it is also placed where the water that flows through the rice fields enters. This is done as an offering to *Dewi Sri* (Goddess of Rice). This *slametan* ritual must be carried out because it is a teaching from the ancestors and if it is not carried out it is believed that the owner of the rice field will experience bad luck (Fitria, 2023). The expropriated land will be leveled. When the land has been leveled, weeds called *gundo* can grow. *Gundo* must be cleaned from the soil when the rice seeds are ready to be planted. *Gundo* can be used as a vegetable to eat.

During the *tandur*, a *slametan* is also held, namely a *tabuh tandur* with offerings of *kinangan* (betel leaves mixed with betel lime, gambier and areca nut) and rice placed on banana leaves that have been shaped into squares. The land that has been leveled is then irrigated with water again before the rice planting process. The process of irrigating the soil with water is carried out 5 days before rice is planted. Rice is planted 20-25 cm apart with two or three rice seeds. The distribution of water sources from springs to rice fields is done using a dam system. The water flow rate can be regulated so that it is not too heavy by using a barrier in the form of a *gedebog* (banana tree trunk) or *blarak* (coconut leaf). The process of fertilizing rice is carried out after 15-16 days of planting and when the rice is two months old. *Matun* is a process for cleaning weeds. The process of cleaning weeds can be done by pulling them out, stepping on them, and applying medicine. When the rice is 2.5 months old, the rice is not ready to be harvested even though it is full. This is because rice is likened to a woman and full rice is likened to a woman who is pregnant. Farmers make fruit salad which is placed in the rice fields as an offering. Apart from that, chicken whit traditional sambal (*pecel pitik*) is also served. After that there is also *slametan pitonan*, previously used as payment of wages for farm workers using the harvest. Empowerment of indigenous communities in the Rebo Wekasan tradition can be seen as a form of community harmony (Maran et al., 2022).

Once the rice is 3 months and 10 days old, the rice is ready to be harvested. Before it is harvested, there is a ritual of anchoring *nggampung*. The rice is cut into 5 leaves, then braided like a woman's hair, a comb, a mirror and powder are also provided and placed in a hut in a rice field in Kemiren village. Harvested rice is dried in the sun first, called *mencar*. Rice that has been dried in the sun is then tied. Five bundles of rice are then tied together, called *ringgen*. Five *ringgen* tied together is called a *senggi*. Before taking it home, offerings (*nganyari*) are provided. The rice harvesting process is carried out using the *ani-ani* tool. The Kemiren Wetan agricultural process is based on hereditary rules and they do it to honor their parents or predecessors (Charles & Cajete, 2020; Prasetyaningrum, 2016).

The *slametan* tradition is also carried out in several areas, although in different ways, such as in the village of Petungsewu, Wagir District, Malang Regency, where it is called the *pari* picking salvation. Congratulations are held at harvest time. The tradition is carried out by preparing offerings first. Then the traditional leaders and village elders together went to the rice fields that were ready to be harvested, bringing offerings in the form of food and ritual tools for praying. The next process is to place the offerings in the rice fields

after praying, then pour water into every corner of the rice fields, burn incense while reciting the mantra. The straw and incense that had been burned were also read, then the traditional elders cut a bunch of rice and after they had carried out the ritual, the traditional elders together with the community leaders returned to the house and placed the tied rice into the rice barn (Maran et al., 2022; Wilson et al., 2015).

According to Jumari et al., (2012), the processing of rice fields in the Samin Kudus community in Central Java, namely the preparation of rice seeds (*wineh*), is an important stage. The type used is a superior rice variety but they make their own rice seeds to plant. Overcoming pest attacks with offerings (magical supplications) so that the pests do not come to people's plants again. In harvest management, the tradition of sharing the results applies. The harvest is divided for four purposes, namely: for wine, for clothing, for food and for garlic. The parts for *wineh* (seedlings) are always prepared for the next planting season. The part for clothing is for daily needs other than food, for example to buy fertilizer, for social needs and other household needs. The part for food is for the family's food/food needs. The last part of the *bawon* is the part that helps with rice harvesting. the existence of rules that are obeyed, makes every process of traditional practice provide justice and mutual trust in terms of welfare (Juujärvi et al., 2020).

4.3 IEK in the Osing Tribe as Teaching Material

Teaching materials play a crucial role in the learning process, serving as systematic resources designed to facilitate independent or group learning while aligning with curriculum requirements (Magdalena et al., 2020). In this research, the teaching materials developed were Student Worksheets (*LKPD*) based on the Indigenous Ecological Knowledge (IEK) of the Osing tribe in Kemiren Village. This approach aims to connect students' learning experiences with local cultural and ecological wisdom, making biology education more meaningful and contextually relevant. Ecological-based cultural wisdom is a contextual learning resource that can be an alternative to exploring knowledge (Adisaputera et al., 2023).

4.3.1 Design and Development Process

The development process began with a thorough needs analysis at the define stage, involving 40 students through questionnaires assessing their prior knowledge and understanding of IEK. The results revealed a gap in students' familiarity with local wisdom, highlighting the urgency for teaching materials that integrate IEK. This was followed by a curriculum analysis, focusing on identifying the *CPL* (*Capaian Pembelajaran Lulusan*), key tasks, and concepts relevant to high school biology. Additionally, an analysis of student characteristics was conducted to ensure the *LKPD* met their cognitive and learning needs (Widodo, 2017). Contextuality needs to be considered in creating materials and introducing teaching materials to meet the competency needs of students (Listiadi, 2022).

The content of IEK included in the *LKPD* was carefully curated to align with the independent curriculum implemented in senior high schools (*SMA/MA*). The *LKPD* integrates aspects of the Osing tribe's ecological practices, such as agroecosystems and water management, with biological concepts like biodiversity and ecosystem interactions, presented (Table 1). This alignment ensures that the teaching materials not only preserve cultural knowledge but also meet the educational standards required for high school biology. Integrating important aspects of experiential practice into learning can be the basis for thinking about a learning resource product (Ajani, 2023; Wilujeng et al., 2019).

4.3.2 Discussion on the Value of IEK-Based Teaching Materials

From an educational perspective, the development of *LKPD* based on IEK provides a multidimensional learning experience. Contextual Learning: By incorporating real-life examples of local ecological practices (Ardoin & Heimlich, 2021), students gain a better understanding of abstract biological concepts, enhancing retention and comprehension. Cultural Preservation: The *LKPD* serves as a medium to document and transmit the

ecological knowledge of the Osing tribe to younger generations, preserving their heritage while fostering a sense of pride and identity among students. Knowledge of local wisdom is important because it is a means for students to better understand and love their culture (Pamenang, 2021). Environmental Awareness: Linking biology lessons with the ecological practices of the Osing tribe cultivates a deeper appreciation for sustainable living and conservation efforts. Habits and systematic educational and research activities can improve the ecological culture level of students in the process of forming biological knowledge (Arbuzova et al., 2023; Prasetyo et al., 2018).

4.3.3 Broader Implications of the Research

This research moves beyond the scope of community service by emphasizing curriculum innovation and pedagogical development. Down streaming of learning resource products should be from research and good practices have been disseminated, one of which is through community service activities (Kurniadi et al., 2024). It contributes to the state of the art in educational research by demonstrating how traditional knowledge can be effectively integrated into modern teaching practices (Hermundsdottir & Aspelund, 2022). The LKPD developed here could inspire similar initiatives in other regions, promoting the inclusion of Indigenous Knowledge in education at a national or even global level.

4.3.4 Challenges and Opportunities

Despite its potential, integrating IEK into teaching materials poses challenges, such as ensuring the alignment of local wisdom with curriculum requirements and overcoming limited access to comprehensive documentation of Indigenous practices. However, these challenges also present opportunities for collaboration between educators, researchers, and local communities. For instance, teachers and students could be involved in field-based learning activities, enabling direct interaction with the ecosystems and practices discussed in the LKPD. In developing teaching materials, whatever their form and type, it is necessary to refer to the main reference source, namely the curriculum objectives that students must master (Magdalena et al., 2020; Sufiyandi, 2020). In addition, when developing teaching materials, you also need to consider student characteristics so that the teaching materials can be learned well by students (Wulandari et al., 2020).

5. Conclusion

The Osing tribe in Kemiren Village has indigenous ecological knowledge (IEK) related to their livelihoods, most of whom are farmers. IEK in the form of knowledge about spring ecosystem conservation using the *rebo wekasan* tradition; *belik* which is a source of clean water that flows to residents' homes through a PAM system; belief in chili great-grandparents who are ancestors who will come to them if residents do bad things to the environment; The agricultural processing system includes seeding (*ngurit*), plowing the land (*nyingkal*), planting (*tandur*), fertilizing and maturing, and harvesting (*ngampung*). IEK content is integrated into teaching materials in the form of worksheet LKPD so that it is hoped that it will make it easier for students to understand material related to biodiversity.

Authors Contribution: All research; Mistianah, Diah Ayu Widyaningrum, Ismi Nurul Qomariyah, and Dwi Budiono, the activities including data collection, analysis, and the development of teaching materials, were conducted transparently and independently. The institutions and individuals involved in this research have no competing interests or financial relationships that could influence the study's outcomes.

Conflict of Interest: The authors declare no conflict of interest.

Acknowledgements: This article was made possible through the collaborative efforts and support of several institutions and individuals. We extend our heartfelt gratitude to Universitas Insan Budi Utomo for providing academic and administrative support, as well as valuable feedback during the research and development stages of this study. We would also like to express our deep appreciation to the Ministry of Education, Culture, Research, and Technology of Indonesia (Kemdikbudristek) for their funding and policy frameworks, which enabled the exploration and integration of Indigenous Ecological Knowledge into educational materials. Lastly, we thank the Osing community in Kemiren Village for sharing their invaluable knowledge and traditions, which served as the foundation for this research, and all educators who contributed to piloting the teaching materials in their classrooms. This work aims to bridge the gap between traditional ecological wisdom and formal education, ensuring that local knowledge continues to enrich and inspire future generations.

6. References

- Abdullah, A., & Khan, S. M. (2023). Traditional ecological knowledge sustains due to poverty and lack of choices rather than thinking about the environment. *Journal of Ethnobiology and Ethnomedicine*, 19(1). <https://doi.org/10.1186/s13002-023-00640-1>
- Adisaputera, A., Gafari, M. O. F., Astuti, W. W., & Assalam, M. H. (2023). Creating new knowledge based on the ecological teaching material in Indonesian language education. *JOALL (Journal of Applied Linguistics and Literature)*, 8(2), 398–414. <https://doi.org/10.33369/joall.v8i2.26964>
- Ajani, O. A. (2023). The role of experiential learning in teachers' professional development for enhanced classroom practices. *Journal of Curriculum and Teaching*, 12(4), 143–155. <https://doi.org/10.5430/JCT.V12N4P143>
- Arbuzova, E. N., Loshenko, V. I., Nazarov, S. V., Poleshchuk, P. V., & Sakharov, A. V. (2023). Cross-subject integration of biology and ecology in course work. *E3S Web of Conferences*, 420. <https://doi.org/10.1051/e3sconf/202342006034>
- Ardoin, N. M., & Heimlich, J. E. (2021). Environmental learning in everyday life: Foundations of meaning and a context for change. *Environmental Education Research*, 27(12), 1681–1699. <https://doi.org/10.1080/13504622.2021.1992354>
- Cameron, L. (2022). Indigenous ecological knowledge systems – Exploring sensory narratives. *Ecological Management and Restoration*, 23(S1), 27–32. <https://doi.org/10.1111/emr.12534>
- Charles, C., & Cajete, G. A. (2020). Wisdom traditions, science and care for the earth: Pathways to responsible action. *Ecopsychology*, 12(2), 1–6. <https://doi.org/10.1089/eco.2020.0020>
- Dzofir, M. (2017). Agama dan tradisi lokal (studi atas pemaknaan tradisi rebo wekasandi desa Jepang, Mejubo, Kudus). *IJTIMAIYA: Journal of Social Science Teaching*, 1(1), 112–128. <https://doi.org/10.21043/ji.v1i1.3104>
- Fitria, T. N. (2023). Generation z's perception of Javanese oral tradition of myth and taboo ora ilok in javanese society. *Paradigma: Jurnal Kajian Budaya*, 13(3), 458–468. <https://doi.org/10.17510/paradigma.v13i3.1282>
- Gobena, G., Urge, M., Hundie, D., & Kumsa, D. (2022). Identification and evaluation of agro-ecological variation in dry matter yield and nutritional values of local grasses used as livestock feed in Adola Reedde, Guji Zone, Ethiopia. *Journal of Applied Animal Research*, 50(1), 369–379. <https://doi.org/10.1080/09712119.2022.2080212>
- Hermundsdottir, F., & Aspelund, A. (2022). Competitive sustainable manufacturing - Sustainability strategies, environmental and social innovations, and their effects on firm performance. *Journal of Cleaner Production*, 370(August), 133474. <https://doi.org/10.1016/j.jclepro.2022.133474>
- Jumari, Setiadi, D., Purwanto, Y., & Guhardja, E. (2012). *Etnoekologi masyarakat samain Kudus Jawa Tengah*. 14(1), 7–16. <https://doi.org/10.14710/bioma.14.1.7-16>

- Juujärvi, S., Kallunki, E., & Luostari, H. (2020). Ethical decision-making of social welfare workers in the transition of services: The ethics of care and justice perspectives. *Ethics and Social Welfare*, 14(1), 65–83. <https://doi.org/10.1080/17496535.2019.1710546>
- Kurniadi, R., Dewi, N., Liputo, M. A., Keguruan, F., & Jambi, U. (2024). Unlocking applied research potential : A case study of downstream strategy. *BIO Web of Conferences* 146, 01030 (2024) *BTMIC 2024*, 01030(13), 1–12. <https://doi.org/10.1051/bioconf/202414601030>
- Listiadi, A. (2022). Contextual teaching material development model. *ScienceRise: Pedagogical Education*, 1(1(46)), 4–11. <https://doi.org/10.15587/2519-4984.2022.250891>
- Lusianawati, H., Mokodenseho, S., Saputra, D. G., & Pujowati, Y. (2023). Tracking the impact of local wisdom in sustainable cultural heritage conservation: A bibliometric bpproach. *West Science Social and Humanities Studies*, 1(03), 115–126. <https://doi.org/10.58812/wsshs.v1i03.251>
- Lutfi, K., & Ilham, L. (2022). Symbol analysis of the wekasan rebo tradition and trust of the Japanese Village Community, Mejobo District, Kudus Regency. *Jurnal Setia Pancasila*, 3(1), 1–10. <https://doi.org/10.36379/jsp.v3i1.280>
- Madonsela, B. S., Semanya, K., & Shale, K. (2024). A review of indigenous knowledge systems and their application in sustainable solid waste management. *World*, 5(2), 219–239. <https://doi.org/10.3390/world5020012>
- Magdalena, I., Sundari, T., Nurkamilah, S., & Ayu Amalia, D. (2020). Analisis bahan ajar. *Jurnal Pendidikan Dan Ilmu Sosial*, 2(2), 311–326. <https://ejournal.stitpn.ac.id/index.php/nusantara/article/view/828/570>
- Maran, M. D. J., Alim Ba'diya Kusufa, R., & Meviana, I. (2022). Tradisi "selamatan petik pari" sebagai wujud nilai religius masyarakat desa Petungsewu, kecamatan Wagir, kabupaten Malang. *Jurnal Sosial Teknologi*, 2(2), 167–173. <https://doi.org/10.36418/jurnalsostech.v2i2.292>
- Nursafitri, H., Nursafitri, H., Pageh, I. M., & Wirawan, I. G. M. A. S. (2020). Perubahan sosial masyarakat suku osing di desa Kemiren sebagai media pebelajaran sosiologi. *Jurnal Pendidikan Sosiologi Undiksha*, 2(3), 180–189. <https://doi.org/10.23887/jpsu.v2i3.28957>
- Pamenang, F. D. N. (2021). Local wisdom in learning as an effort to increase cultural knowledge: Students' perception as prospective teachers. *IJJET (International Journal of Indonesian Education and Teaching)*, 5(1), 93–101. <https://doi.org/10.24071/ijjet.v5i1.3050>
- Pascua, P., McMillen, H., Ticktin, T., Vaughan, M., & Winter, K. B. (2017). Beyond services: A process and framework to incorporate cultural, genealogical, place-based, and indigenous relationships in ecosystem service assessments. *Ecosystem Services*, 26, 465–475. <https://doi.org/10.1016/j.ecoser.2017.03.012>
- Prasetyaningrum, P. (2016). Tradisi rebo pungkasan di desa Lebaksiu Lor kecamatan Lebaksiu Kabupaten Tegal. *Sutasoma: Journal of Javanese Literature*, 4(2), 1–6. <https://journal.unnes.ac.id/sju/index.php/sutasoma%0A>
- Prasetyo, B., Chikmawati, T., Walujo, E. B., & Amzu, E. (2018). Ethnoecology: The traditional landscape of osing tribe in Banyuwangi, Indonesia. *Biodiversitas*, 19(6), 2003–2009. <https://doi.org/10.13057/biodiv/d190604>
- Rahayu, M. I. F., Susanto, A. F., & Sudiro, A. (2024). the principle of local wisdom as a basic framework in the formation of cosmic religious environmental law. *Indonesia Law Review*, 14(2), 85–98. <https://scholarhub.ui.ac.id/cgi/viewcontent.cgi?article=1563&context=ilrev>
- Rohmah, U. N. (2018). Penggunaan ayat-ayat al-qur'an dalam ritual rebo wekasan studi living Qur'an di desa Sukoreno kec. Kalisat kab. Jember. *Al-Bayan: Jurnal Ilmu Al-Qur'an Dan Hadist*, 1(1), 66–91. <https://doi.org/10.35132/albayan.v1i1.4>
- Sartini. (2004). Menggali kearifan lokal Nusantara sebuah kajian filsafati. *Jurnal Filsafat*, 37(2), 111–120. <https://doi.org/10.22146/jf.33910>

- Saylor, C. R., Alsharif, K. A., & Torres, H. (2017). The importance of traditional ecological knowledge in agroecological systems in peru. *International Journal of Biodiversity Science, Ecosystem Services and Management*, 13(1), 150–161. <https://doi.org/10.1080/21513732.2017.1285814>
- Sufiyandi, M. F. (2020). Some basic principles in designing materials for students of english for Specific purpose. *International Journal of Islamic Education, Research and Multiculturalism (IJIERM)*, 2(1), 1–18. <https://doi.org/10.47006/ijierm.v2i1.19>
- Sumarmi, S. (2015). Local wisdom of osing people in conserving water resources. *Komunitas*, 7(1), 43–51. <https://doi.org/10.15294/komunitas.v7i1.3429>
- Sunarmi. (2014). Melestarikan keanekaragaman hayati melalui pembelajaran di luar kelas dan tugas yang menantang. *Jurnal Pendidikan Biologi*, 6(1), 38–49. <https://media.neliti.com/media/publications/117974-ID-melestarikan-keanekaragaman-hayati-melal.pdf>
- Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). *Instructional development for training teachers of exceptional children*. <https://files.eric.ed.gov/fulltext/ED090725.pdf>
- Widodo, S. (2017). Pengembangan lembar kegiatan peserta didik (LKPD) berbasis pendekatan saintifik untuk Meningkatkan keterampilan penyelesaian masalah lingkungan sekitar peserta didik di sekolah Dasar. *Jurnal Pendidikan Ilmu Sosial*, 26(2), 189–204. <https://doi.org/10.17509/jpis.v26i2.2270>
- Wilson, N. J., Todd Walter, M., & Waterhouse, J. (2015). Indigenous knowledge of hydrologic change in the Yukon river basin: A case study of Ruby, Alaska. *Arctic*, 68(1), 93–106. <https://doi.org/10.14430/arctic4459>
- Wilujeng, I., K.P., Z., & Suryadarma, I. (2019). Integrating local wisdom in natural science learning. *1st International Conference of Innovation in Education (ICoIE 2018)*, 178(ICoIE 2018), 182–186. <https://doi.org/10.2991/icoie-18.2019.42>
- Wulandari, D., Sundari, W., & Ellysafny, C. A. P. (2020). Integrating local wisdom into ELT materials for secondary school students in Semarang. *PAROLE: Journal of Linguistics and Education*, 10(1), 14–21. <https://doi.org/10.14710/parole.v10i1.14-21>
- Zulfadrim, Z., Toyoda, Y., & Kanegae, H. (2019). The integration of Indigenous knowledge for disaster risk reduction practices through scientific knowledge: Cases from Mentawai Islands, Indonesia. *International Journal of Disaster Management*, 2(1), 1–12. <https://doi.org/10.24815/ijdm.v2i1.13503>
- Zulia, R., Masiroh, F., & Aulia, A. S. (2022). Tradisi rabu wekasan dalam persepsi milenial. *Panangkaran: Jurnal Penelitian Agama Dan Masyarakat*, 6(2), 242–253. <https://doi.org/10.14421/panangkaran.v6i2.2852>