Ethno-SETS Learning Through Parijoto-Based Products: Connecting Science Concepts and Local Wisdom

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ABSTRACT

This study aims to explore the integration of local wisdom into science education through an Ethno-SETS (Science, Environment, Technology, and Society) approach based on parijoto (Medinilla magnifica) products, a culturally significant plant originating from the Mount Muria region, Indonesia. A descriptive qualitative method with an ethnographic approach was employed, supported by literature reviews and semi-structured interviews with local producers and community members. The findings indicate that the production of parijoto-based products, such as syrup, tea, and jam, embodies rich Ethno-SETS elements. The Science component is reflected in the understanding of antioxidant compounds, anthocyanin pigments, extraction processes, and food preservation principles. The Environment aspect is represented through sustainable cultivation practices, biodiversity conservation efforts, and community awareness of preserving parijoto as a local biological resource. The Technology component is evident in the application of processing equipment, sterilization techniques, packaging innovations, and product quality control. Meanwhile, the Society dimension is demonstrated through the cultural values, traditional beliefs, local economic activities, and the role of parijoto-based products in supporting community livelihoods and regional identity. The integration of these interconnected dimensions successfully contextualizes science learning by linking scientific concepts to students' socio-cultural environments. In conclusion, Ethno-SETS learning based on parijoto products has the potential to enhance students' scientific literacy, environmental awareness, critical thinking skills, and appreciation of local wisdom while simultaneously promoting cultural preservation and community-based entrepreneurship.
Keywords: Ethno-STEM, Parijoto, Local Wisdom, Science Learning.

INTRODUCTION

In the era of globalization and digital transformation, science education faces the fundamental challenge of staying relevant in the lives of learners. International research shows that traditional science learning that focuses on the delivery of abstract concepts without any connection to the cultural context and

real life of learners results in low science literacy and student engagement(Gonzales & Pascual, 2026). The PISA (Programme for International Student Assessment) report consistently shows that Indonesian students' achievement in science literacy is below the international average, reflecting the gap between formal curriculum and meaningful and contextual learning needs(Verawati & Wahyudi, 2024). Most global science education systems still rely on teacher-centered approaches and standardized academic materials, thus ignoring the great potential of local knowledge and cultural wisdom that exists within local communities(Gonzales & Pascual, 2026). This has an impact on students' lack of motivation to learn science and their inability to apply science concepts to solve real problems in their environment(Suhartini et al., 2019).

Local wisdom embedded in cultural practices and community traditions contains rich and applicable scientific knowledge, but is rarely systematically integrated into formal science curricula(Sarwi, Ahmadi, et al., 2025). This local knowledge develops through long-term interaction with the environment and has proven effective in addressing a wide range of practical challenges(Shidiq & Faikhamta, 2020). However, the process of transforming local knowledge into a meaningful source of learning in the context of science education requires a structured approach and culturally responsive pedagogy (Nirmala et al., 2024). Science learning that integrates local knowledge can not only enhance learners' conceptual understanding, but also strengthen their cultural identity, environmental awareness, and 21st-century skills (Sudirman et al., 2025). The main challenge lies in how to design and implement science learning that authentically connects abstract scientific concepts with learners' practical experiences and local cultural contexts, particularly in the context of processing local knowledge-based products(Sihombing et al., 2025).

Indonesia has an extraordinary cultural wealth and local knowledge, but the integration of local knowledge into science learning is still very limited and has not been explored systematically(Ali, 2025). The Merdeka Curriculum, which is designed to provide schools with flexibility in the contextualization of learning, opens up great opportunities to integrate local wisdom; However, the practice of implementation is still hampered by the limitations of teachers' understanding, the availability of culturally responsive learning materials, and the lack of empirical examples that show how the transformation of local knowledge can be carried out(Rosa et al., 2025). Science learning in Indonesian schools is still dominated by textual approaches that are disconnected from the life of the local community, so students find it difficult to relate science concepts to the traditional practices they see every day(Murniningsih et al., 2025). Furthermore, ethnography of science learning based on local traditional products, especially products that have high cultural, economic, and educational value, is still very rarely the focus of research and development of learning materials.

To comprehensively integrate local knowledge with formal science learning, a pedagogical framework is needed that recognizes the importance of cultural, environmental, and social dimensions in constructing scientific knowledge.

Approach Ethno-SETS (Ethnoscience-Science, Environment, Technology, and Society) offers an integral solution that incorporates: (1) learning ethnography (in-depth exploration of local knowledge and practice), (2) science concepts (reconstruction of scientific principles in local practice), (3) environmental dimension (understanding of ecological sustainability), (4) technological aspects (identification of local techniques and innovations), and (5) social and societal dimensions (understanding of the social impact of local practices)(Ahdan et al., 2025). This approach does not simply complement conventional science learning, but rather offers a pedagogical paradigm that places students as active knowledge creators who build understanding through dialogue between formal scientific knowledge and local cultural wisdom(Albar et al., 2025). Previous studies have shown that the integration of Ethno-SETS in learning can significantly improve science literacy, student engagement, conceptual comprehension, critical thinking skills, and environmental awareness(Bastian et al., 2025)(H. D. Sari et al., 2025).

In the last five years, research on the integration of local knowledge in science learning, particularly through ethnoscience and Ethno-SETS approaches, has seen a significant increase, especially in Indonesia(Sarwi, Fathonah, et al., 2025). Various studies have succeeded in identifying scientific concepts embedded in traditional practices from batik making, traditional food processing, herbal product making, to traditional games(Fitriyah et al., 2025),(Sidiq & Mumpuni, 2014). Research has also developed innovative learning models that integrate ethnoscience with SETS approaches, problem-based learning, and project-based learning, with results showing significant improvements in students' science literacy and critical thinking skills. The literature shows that Ethno-SETS-based learning is not only effective in improving cognitive aspects, but also affective aspects such as positive attitudes towards science, environmental awareness, and appreciation for local culture (Sakinah et al., 2025). The use of various digital technology-based learning media such as e-modules, augmented reality, and web-based interactive learning has also shown great potential in increasing engagement and learning outcomes when combined with ethnoscience content (Nurkhasyanah et al., 2025). However, most of the research still focuses on traditional food and culinary products; Research that specifically analyzes and develops science learning based on parijoto products, which is a typical local resource of the Muria Area with high cultural, economic, and educational value, is still very limited.

Although research on ethnoscience and Ethno-SETS has grown rapidly, there are some important research gaps to address. First, ethnoscience studies on parijoto products in particular have not received systematic attention, even though this product has high educational potential in science learning based on local wisdom. Second, there has not been much research that comprehensively maps all dimensions of SETS (science, environment, technology, society) in the process of processing local traditional products and analyzes how these dimensions can be reconstructed into contextual and meaningful science learning resources(Ali, 2025). Third, ethnographic approaches to explore local knowledge

of the community about parijoto products and their transformation into culturally responsive science learning materials are still very rare. Therefore, this study aims to: (1) identify the concepts of science contained in parijoto-based products through ethnographic and ethnoscientific approaches; (2) analyze the components of Ethno-SETS (science, environment, technology, society) in the parijoto processing process as part of an integrated local knowledge system; and (3) describe the potential of parijoto-based products as a learning resource for Ethno-SETS for the development of science learning that is meaningful, contextual, and responsive to local culture.

The novelty of this research lies in the systematic mapping of the Ethno-SETS concept in parijoto products, which has never been done before, second, an in-depth ethnographic approach to explore the local knowledge of the people of the Muria Area about parijoto processing and its transformation into scientific knowledge. Third, contribute to the development of Ethno-SETS-based science learning that utilizes distinctive local resources and is contextually relevant to students' lives.

The urgency of this research is based on several crucial reasons. First, in the context of the Independent Curriculum and Pancasila Student Profile, schools in Indonesia are mandated to develop meaningful, inclusive, and responsive learning to the local context; However, there are still many schools that have difficulty in identifying and developing authentic and pedagogical local learning resources (M. P. G. A. P. Sari et al., 2025). Second, the science literacy of Indonesian students who are still lagging behind at the international level requires an innovative, meaningful, and connected learning approach to students' real lives; Ethno-SETS-based learning has proven to be one of the effective approaches to addressing these challenges(Wibawanti et al., 2025),(Hasanah, 2020). Third, the local community of the Muria Area, especially parijoto processing MSME actors and parijoto farmers, have in-depth knowledge about this product that has not been systematically documented in the context of formal science learning; This research can be a bridge to preserve local knowledge while enriching science learning in schools(Wijayanti, 2025). Fourth, the integration of science learning based on local wisdom can contribute simultaneously to the achievement of multiple educational goals: increasing science literacy, strengthening cultural identity, developing environmental awareness and sustainability, and empowering local communities economically through meaningful learning resources(Mardatila et al., 2026). Thus, this research not only has academic significance, but also high practical and social significance in supporting the transformation of science education that is more inclusive, contextual, and responsive to local needs and potentials in Indonesia.

RESEARCH METHODS

This study uses a qualitative approach with ethnographic design to explore in depth the local knowledge of the community related to the cultivation, processing, and utilization of parijoto-based products (*Medinilla speciosa*) in the

Mount Muria area, Kudus Regency, Central Java. The ethnographic approach was chosen because it allows researchers to understand cultural practices, local values, and the construction of community knowledge that develops through experience and is inherited from generation to generation. Through this approach, researchers can reconstruct local knowledge into scientific concepts relevant to the Ethno-SETS (Science, Environment, Technology, and Society) framework.

The research was carried out for three months, from January to March 2026, in Colo Village, Dawe District, Kudus Regency, which is one of the centers for the cultivation and processing of parijoto in the Muria area. The presence of researchers in the field is carried out repeatedly through participatory observation to gain a deep understanding of community activities in cultivating and processing parijoto into various products, such as syrup, tea, and sweets.

The research informants were selected using purposive sampling techniques by considering their level of knowledge, experience, and involvement in parijoto cultivation and processing activities. To obtain richer data and achieve information saturation, snowball sampling techniques are also used to identify additional informants recommended by the main informant. The research informants consisted of parijoto farmers, MSME actors processing parijoto, tourism managers, and community leaders who have at least five years of experience in their fields. The informant data is presented in Table 1.

Table 1:
Characteristics of Research Informants

Code Information	Informant work	Experience
A1	Parijoto Farmers	8 Years
A2	Parijoto Farmers	10 Years
A3	Parijoto MSME Actors	6 Years
A4	Tour Manager	5 Years
A4	Parijoto Traders	5 Years
A6	Parijoto Trader	5 Years

The research data was collected through four main techniques. First, participatory observation is carried out directly on the process of cultivation, harvesting, processing, and marketing of parijoto products to identify scientific activities that develop in community practices. Second, semi-structured interviews aimed at exploring local knowledge, empirical experience, cultural values, and community understanding of the parijoto processing process. Third, documentation in the form of photos, videos, field notes, and supporting documents related to production activities and the use of parijoto. Fourth, literature studies are used to strengthen the interpretation of field findings and connect them with ethnoscience studies, Ethno-SETS, and science learning based on local wisdom.

Data analysis was carried out interactively using the Miles, Huberman, and Saldaña model which included three main stages, namely data condensation, data

display, and conclusion drawing and verification. At the data condensation stage, the results of observations, interviews, and documentation are transcribed, coded, and categorized based on themes related to the Ethno-SETS component. The coding process is carried out through the stages of open coding to identify initial concepts, axial coding to connect related categories, and selective coding to build key themes that explain the relationship between local knowledge of the community and science concepts. Furthermore, data is presented in the form of thematic matrices, Ethno-SETS mapping tables, and ethnographic narratives that illustrate the relationship between community cultural practices and science concepts. The final stage is carried out by verifying and interpreting the findings in order to gain a comprehensive understanding of the integration of the dimensions of Science, Environment, Technology, and Society in the processing of parijoto products.

The validity of the data is maintained through various trustworthiness strategies which include source triangulation, technique triangulation, and time triangulation. Source triangulation is carried out by comparing information obtained from farmers, MSME actors, tourism managers, and community leaders. The triangulation technique was carried out by comparing the results of observations, interviews, and documentation. In addition, the study applied member checking to confirm the suitability of the researcher's interpretation with the informant's views, peer debriefing through discussions with fellow researchers, and trail audits to document the entire research process systematically. Thick descriptions are also used to enable readers to assess the transferability of findings in similar cultural contexts (Morgan, 2024)(Coker, 2026)and (Espinoza-Freire, 2025).

RESULTS

The results and discussions were grouped into three important parts which included Indigenous Knowledge in Parijoto-Based Products, Analysis of Ethno-SETS Components in Parijoto Products, Potential of Parijoto Products as Ethno-SETS-Based Science Learning Resources, and Parijoto Product Potential as Ethno-SETS-Based Science Learning Resources. Interview and research activities related to parijoto products are presented in Figure 1.

Figure 1:
The results of interviews with Alammu MSMEs with syrup, tea, and candy products from parijoto fruit.

The results of interviews with parijoto MSME actors include several parijoto processed products including syrup, candy, tea and snacks. The results of observations and interviews show that the parijoto processing process contains elements of Science, Environment, Technology, and Society that are integrated with each other as shown in Table 2.

Table 2:
Ethno-SETS Component Mapping on Parijoto Products

Local Activities	Science	Enviroment	Technology	Society
Parijoto Cultivation	Plant growth and development, photosynthesis, biodiversity,	Conservation of local plants	Seeding and cultivation techniques	Community livelihood
Fruit harvesting	Fruit ripeness and yield quality	Utilization of local resources	Fruit selection technique	Farmer cooperation
Syrup making	Solutions, concentrations, anthocyanins, heating, addictive substances,	Reduction of crop waste	Blender, stove, filtration device	Local MSMEs
Parijoto tea drying	Heat transfer and evaporation	Energy use efficiency	Traditional ovens and dryers	The economic products of the community
Parijoto Candy	Concentration, solution, caramelization, addictive substances	Energy use efficiency	Non-stick pan, Foofgrade plastic	Local MSMEs
Product marketing	Product preservation and quality	Eco-friendly products	Digital media and modern packaging	Increased community income

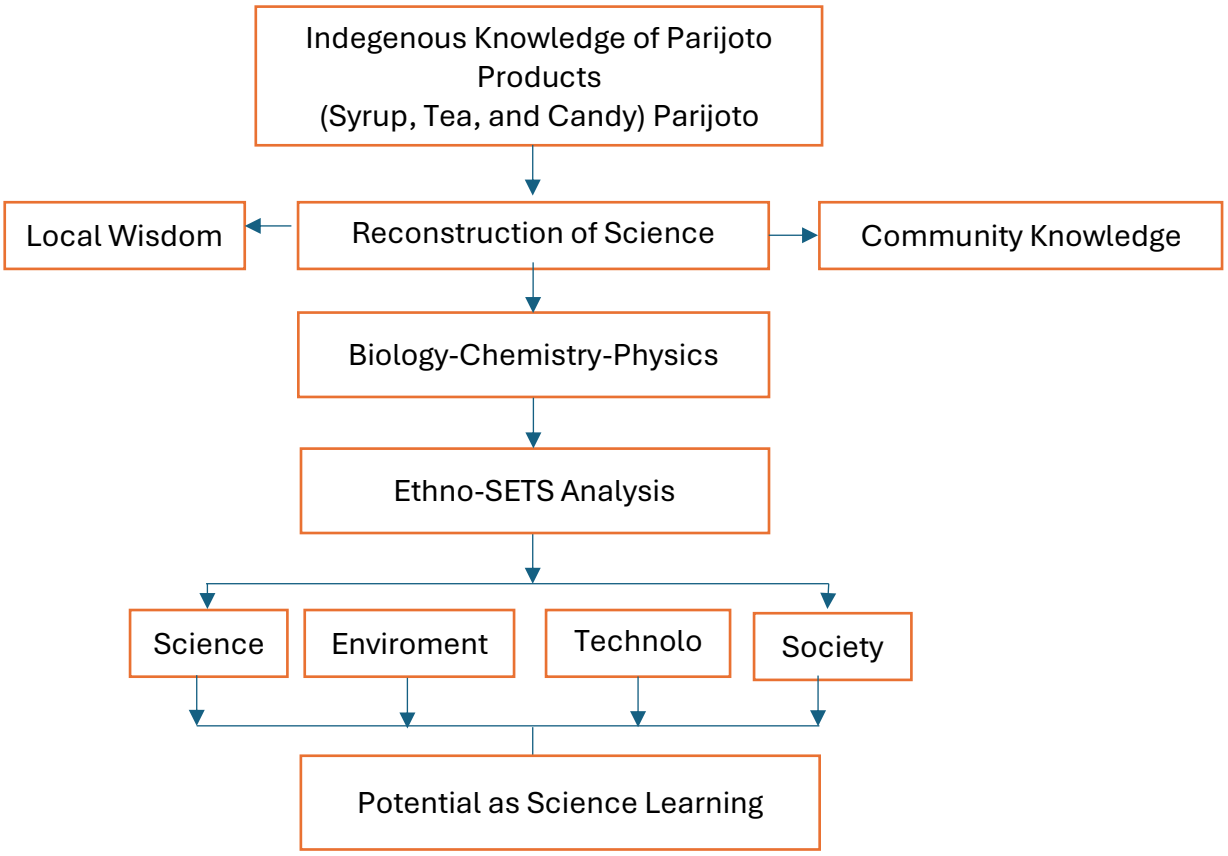
The analysis of the Ethno-SETS concept in the practice of making parijoto syrup has the potential to be a learning resource. The activities so far carried out by the community are scientific phenomena that can be explained by the concept of science. Therefore, the manufacture of parijoto syrup needs to be carried out scientific reconstruction as shown in Table 3.

Table 3:
Mapping Ethno-SETS scientific reconstruction of Parijoto syrup

Components	Field findings	Scientific reconstruction
Science	The fruit is chosen in dark purple color	Anthocyanins, fruit ripening
Enviroment	Growing in Muria	Ecological adaptation
Technology	Syrup making	Food Preservation
Society	Pregnant women's beliefs	Cultural Heritage

These findings validate the view that parijoto-based products, especially syrups, teas, and other processed products, contain tremendous Ethno-SETS learning **potential**, as it integrates science, environment, technology, and social impact in one practical context that is authentic and relevant to the lives of learners as shown in Figure 2.

Figure 2:
Ethno-SETS Concept Map in Science Learning



DISCUSSION

Indigenous Knowledge in Parijoto-Based Products

The results of the study show that the people in the Mount Muria area have a local knowledge system (*indigenous knowledge*) that develops through long-term interaction with the natural environment and is inherited from generation to generation through the cultivation practices, processing, and utilization of parijoto fruit (*Medinilla speciosa*)). This knowledge not only serves as a guideline in utilizing local resources, but also becomes part of the cultural identity of the Muria people.

In the aspect of cultivation, informant A1 explained that parijoto plants naturally grow well in the mountainous area of Muria which has humid and shady environmental conditions. According to the informant, the community believes that it is difficult for parijoto to develop optimally if it is planted in areas with different environmental characteristics. This knowledge is obtained through the empirical experience of the community who continuously observe the growth of plants in their natural habitat. These findings show the existence of local ecological knowledge formed through the close relationship between communities and their environment. This kind of ecological knowledge is a key characteristic *indigenous knowledge*, that is, knowledge that develops from collective experience and is passed down across generations through the practice of daily life (Gonzales & Pascual, 2026).

The local knowledge of the community is also reflected in the process of selecting raw materials. Informant A1 said that the parijoto fruit used as raw material for processed products is a perfectly ripe fruit with a dark purple color. People believe that fruits with this color have better quality than young fruits. The practice of selecting fruits based on visual characteristics shows that society has a traditional classification system to determine the quality of crops. The ability to recognize the ripeness level of fruit based on direct observation is a form of empirical knowledge that develops through repeated experience and is passed down from generation to generation. According to (Latip et al., 2024), the ability of local communities to identify the characteristics of organisms based on natural indicators is an important part of the system *local and indigenous knowledge* which has high educational value in contextual science learning.

In the processing aspect, informant A2 explained that the manufacture of parijoto syrup was initially carried out as an effort by the community to take advantage of the abundant harvest so that it did not suffer post-harvest damage. In addition to economic reasons, people also use these products because they believe that parijoto has health benefits, especially for pregnant women. Over time, this practice has developed into a local economic business that supports the sustainability of MSMEs in the Muria area. The findings show that local knowledge is not only related to the use of natural resources, but also reflects the community's adaptation strategy in managing crops to have economic added value. This is in line with the view (Yazidi & Rijal, 2024) that *indigenous knowledge*

serves as a mechanism for community adaptation to social, economic, and environmental conditions that continue to develop.

Another form of local knowledge is found in the process of processing parijoto tea. Informant A2 explained that the drying process was carried out using an oven because of the geographical conditions of the Muria area which tend to be foggy and have limited sunlight intensity. The use of the oven is the result of community adaptation to local environmental conditions so that product quality is maintained. These findings show that *indigenous knowledge* is dynamic and constantly evolving through the integration of local experiences with available technologies. Local knowledge is not always embodied in static traditional practices, but can be transformed according to the needs of the community without losing the underlying cultural value (Boardsworth et al., 2024).

In addition to the cultivation and processing aspects, this study found that there are cultural beliefs that are still alive in the community related to the benefits of parijoto for pregnant women. Informant A3 explained that the people of Muria believe that the consumption of fruit or parijoto syrup during pregnancy can help obtain healthy offspring and have a good level. These beliefs have been passed down from generation to generation and are part of the cultural traditions of the local community. In perspective *indigenous knowledge*, the belief represents a system of cultural knowledge that is formed through collective experience and is inherited as part of the identity of the community. Although some of these beliefs cannot be fully explained scientifically, their existence has important value in maintaining cultural sustainability and strengthening people's relationships with their local resources (Cahyaningsih et al., 2025) .

Overall, the research findings show that parijoto-based products contain various forms of *indigenous knowledge* which include ecological knowledge, knowledge of processing agricultural products, environmental adaptation strategies, and community cultural beliefs. This knowledge develops through empirical experience that lasts over a long period of time and is passed down between generations. The existence of *indigenous knowledge* in parijoto products is an important foundation in reconstructing science concepts and integrating them into Ethno-SETS-based science learning that is contextual and responsive to local culture.

Reconstruction of Science Concepts in Local Knowledge Parijoto

The results of the study show that various practices of cultivation and processing of parijoto-based products carried out by the Muria community contain scientific concepts that can be reconstructed into scientific knowledge in science learning. The reconstruction of science is carried out by connecting the empirical knowledge of the community with relevant concepts of biology, chemistry, and physics so as to produce a more comprehensive understanding of the relationship between local wisdom and modern science.

a. Reconstruction of the Concept of Biology

The practice of parijoto cultivation carried out by the community shows an empirical understanding of the relationship between environmental

characteristics and plant growth. Informant A1 explained that parijoto plants grow optimally in the mountainous area of Muria which has relatively low temperatures, high humidity, and light intensity that is not too strong. This knowledge can be reconstructed into biological concepts regarding environmental factors that affect plant growth and development, such as temperature, humidity, water availability, and light intensity.

Scientifically, plant growth is influenced by the interaction of genetic factors and environmental factors. Suitable environmental conditions will support the physiological activities of plants, including photosynthesis, respiration, and nutrient absorption (Taiz et al., 2023). The natural habitat of parijoto in mountainous regions suggests that this species has a certain ecological adaptation to humid and shady environments. Therefore, public knowledge about the location of parijoto growth is a form of empirical observation that is in line with the concept of plant ecology.

In addition, the community chooses perfectly ripe parijoto fruit with a dark purple color as the main raw material for processed products. The practice is related to the biological concept of the ripening process of fruit characterized by changes in color, texture, aroma, and content of secondary metabolites. The purple color of parijoto fruits indicates an increased accumulation of anthocyanin pigment during the ripening process. Anthocyanins belong to a group of flavonoids that function as natural antioxidants and play a role in giving red, purple, and blue colors to various types of fruits (Khoo et al., 2017). Thus, the visual indicators used by the community in selecting fruits actually reflect an empirical understanding of the physiological changes that occur during the ripening process.

Public belief in the benefits of parijoto for the health of pregnant women can also be attributed to the bioactive content contained in the fruit. Some studies report that parijoto fruit contains flavonoids, saponins, tannins, and phenolic compounds that have quite high antioxidant activity (Marliani et al., 2023). These antioxidant activities play a role in warding off free radicals and supporting body health. Although some of the community's beliefs are still in the cultural realm and have not been fully scientifically proven, the existence of bioactive compounds in parijoto shows that there is a biological basis that supports their use as a functional food.

b. Reconstruction of Chemical Concepts

The process of processing parijoto into syrup and tea contains various chemical concepts related to the properties of the compounds that make up food. Informant A2 explained that ripe parijoto fruit is processed into syrup to extend the shelf life while increasing its economic value. From a food chemistry perspective, the process involves the extraction of water-soluble compounds, the dissolution of sugars, and changes in chemical composition due to heat treatment. One of the important compounds found in parijoto fruit is anthocyanins. Anthocyanins are natural pigments that give fruits a purple color and are sensitive to temperature, pH, light, and oxygen (Aprodu & Banu, 2021). During the syrup

manufacturing process, overheating can lead to the degradation of anthocyanins so that the color of the product becomes paler and its antioxidant activity decreases. Therefore, the practice of people who avoid boiling for too long shows the existence of a form of empirical knowledge related to the stability of chemical compounds in food.

In addition, the addition of sugar in syrup making is also related to the concept of osmotic pressure and food preservation. High sugar concentrations can decrease water activity (*Water Activity*) thus inhibiting the growth of rotting microorganisms (Damodaran et al., 2017). Thus, the practice of making syrup carried out by the community not only aims to improve taste, but also functions as a preservation method that has a scientific basis.

c. Reconstruction of Physics Concepts

The concept of physics in the processing of parijoto-based products is mainly found in the heating and drying process. Informant A2 explained that the drying of parijoto tea was carried out using an oven because of the geographical conditions of the Muria area which are often foggy and have limited sunlight. The practice is related to the concept of heat transfer and the change in the form of substances.

In the drying process, the heat energy from the oven is transferred to the material through the mechanisms of conduction, convection, and radiation. The heat energy is used to evaporate the water content contained in the material so that the moisture content of the product decreases (Çengel & Ghajar, 2020). Reducing water content is an important factor in increasing the shelf life of products because the activity of microorganisms will decrease when the availability of free water decreases.

Another physics concept is found in the boiling process in syrup making. During heating, there is a transfer of heat energy from the heat source to the solution so that the temperature of the system increases. When the temperature reaches a certain point, some of the water molecules evaporate and cause a change in the concentration of the solution. This phenomenon is related to the concepts of heat, temperature, changes in the form of substances, and the transfer of thermal energy which are important materials in science learning. Overall, the reconstruction of the scientific concept shows that the cultivation and processing practices of parijoto that developed in the Muria community contain biological, chemical, and physical concepts that are integrated with each other. Local knowledge that was initially empirical can be explained through a modern scientific framework resulting in a conceptual bridge between *indigenous knowledge* and school science. These findings support the view that local wisdom has great potential as an authentic, contextual, and meaningful science learning context for students.

Analysis of Ethno-SETS Components in Parijoto Products

The results show that parijoto syrup not only represents local food products, but also reflects the integration of various dimensions of knowledge in line with

the Ethno-SETS framework (*Ethnoscience–Science, Environment, Technology, and Society*). This framework allows the cultural practices of the community to be reconstructed into a learning resource that connects the concept of science with the real-life context so that learning becomes more contextual and meaningful(Aikenhead & Michell, 2011) and (Parmin et al., 2024).

a. Science

The *science dimension* of parijoto syrup products is reflected through various scientific concepts contained in the cultivation and processing process. The Muria people empirically understood that the fruit used as a raw material for syrup must be harvested at a certain level of maturity characterized by a dark purple color. The local knowledge is related to the physiological process of fruit ripening that involves changes in the composition of secondary metabolites, especially anthocyanins as the main pigment that makes up fruit color.

In addition, the syrup manufacturing process involves various scientific phenomena, such as the extraction of bioactive compounds, the dissolution of sugars, the transfer of heat during heating, as well as changes in the moisture content and viscosity of the solution. Although society does not explain the process using formal scientific terminology, the practice does show an empirical understanding that develops through experience and repeated observation. From an ethnoscience perspective, this condition shows that local communities have actually built an observation-based knowledge system that can be reconstructed into a school science concept (Latip et al., 2024). These findings reinforce the view that local knowledge and modern science are not two conflicting systems, but can complement each other in building a more contextual and relevant scientific understanding to learners' lives(Aikenhead & Michell, 2011).

b. Environment

The environmental dimension can be seen from the close relationship between the existence of parijoto and the ecological conditions of the Mount Muria area. Based on the results of the interviews, the community understands that parijoto plants grow optimally in mountainous environments that have high humidity, relatively low temperatures, and limited light intensity. This knowledge develops through the community's long experience in observing the characteristics of plant natural habitats.

The attachment between the community and the environment shows the existence of ecological awareness that is part of the local knowledge system. The sustainability of parijoto syrup production is highly dependent on the preservation of plant habitats so that the community begins to make cultivation efforts to reduce the exploitation of wild plants in the Muria forest area. The practice shows that the use of local resources is not only oriented towards economic gains, but also considers aspects of environmental sustainability.

According to UNESCO (2024), the integration of local knowledge in natural resource management contributes to strengthening sustainability education (*Education for Sustainable Development*) because it encourages students to understand the mutual relationship between humans and the environment.

Therefore, parijoto syrup products can be a relevant learning context to develop environmental literacy and conservation awareness.

c. Technology

The *technology* dimension is reflected in various processing techniques used by the community to transform parijoto fruit into products with higher economic value. The results of the study show that the community develops simple processing technology through the process of washing, extraction, heating, mixing ingredients, packaging, and storing products.

The use of technology is a form of community adaptation to environmental challenges and local economic needs. For example, the heating process is carried out to increase the shelf life of the product, while the use of modern packaging bottles aims to expand the marketing reach. Although the technology used is relatively simple, the process shows the ability of the community to combine traditional knowledge with innovations that are developing in society.

In the perspective of Ethno-SETS, technology is not understood solely as the use of modern tools, but also as a representation of human ability to utilize knowledge to solve problems of daily life (Yazidi & Rijal, 2024). Thus, the production process of parijoto syrup shows how local technology develops through the interaction between empirical experience, social needs, and the potential of available resources.

d. Society

The *society dimension* is the most prominent component in parijoto syrup products because it is directly related to cultural values, local identity, and economic activities of the Muria community. The results of the interviews show that the public believes that parijoto has special benefits for pregnant women and is related to the hope of obtaining healthy and well-behaved offspring. These beliefs have been passed down from generation to generation and have become part of the cultural identity of the local community.

In addition to cultural value, parijoto syrup also has an important socio-economic function. This product is one of the leading commodities of local MSMEs and supports the religious tourism sector in the Muria area. The presence of parijoto-based products not only increases the economic value of local fruits, but also strengthens regional identity through the promotion of local culture and potential to tourists.

According to (Cahyaningsih et al., 2025), the integration of local culture in community economic activities plays an important role in maintaining cultural identity while strengthening the social resilience of the community. In this context, parijoto syrup not only functions as a consumer product, but also as a medium for the inheritance of knowledge and cultural values between generations. Overall, the Ethno-SETS analysis shows that parijoto syrup products integrate the dimensions of *science, environment, technology,* and *society* holistically. The integration shows that local food processing practices not only contain scientific concepts, but also reflect the complex relationship between people, the environment, technology, and culture. Therefore, parijoto syrup has strong

potential as an Ethno-SETS-based science learning context that is able to bridge scientific knowledge with the reality of local people's lives.

The Potential of Parijoto Products as a Resource for Learning Science Based on Ethno-SETS

The results of the study show that parijoto-based products have strong potential to be developed as a learning resource for Ethno-SETS-based science because it contains the linkage between local knowledge, science concepts, environmental conditions, processing technology, and socio-cultural values of the community. The integration of these various aspects allows students to learn science concepts through phenomena that are close to daily life so that learning becomes more contextual and meaningful. This approach is in line with the development of modern science education which emphasizes the importance of connecting scientific knowledge with the cultural and environmental experiences of learners.

a. Relevance to the Science Curriculum

In the context of the Independent Curriculum, science learning is directed at the development of conceptual understanding, science process skills, and students' ability to relate science to real life. Parijoto products have the potential to become a relevant learning context for various science learning outcomes at the junior high and high school levels. For example, the parijoto cultivation process can be used to study the factors that affect plant growth and development, the interaction of living things with the environment, and biodiversity. Meanwhile, the process of making parijoto syrup and tea can be used to study the concept of substances and their changes, heat and heat transfer, solutions, bioactive compounds, and food processing technology.

These findings support the view that local knowledge can be a bridge that connects the formal curriculum to the realities of learners' lives. The integration of local cultural contexts into science learning allows learners to understand that science concepts do not stand in the abstract, but are present in the practices of people's daily lives.

b. Potential in the Implementation of Ethno-SETS Learning

The Ethno-SETS approach places local culture as the starting point of learning to connect the dimensions of *Science, Environment, Technology,* and *Society*. Based on the results of the research, parijoto products meet these characteristics because they contain a scientific concept that can be reconstructed from the cultural practices of the Muria people.

In the *science dimension*, students have the potential to learn the concepts of biology, chemistry, and physics contained in the cultivation and processing of parijoto. In the *environmental dimension*, students can understand the relationship between the habitat of the Muria mountains and the sustainability of the growth of parijoto plants. In *the technology* dimension, students can study various techniques for processing agricultural products into value-added products. Meanwhile, in the *society* dimension, students can explore cultural

values, local beliefs, and community economic activities that develop around parijoto products.

The integration of these four dimensions has the potential to produce a more holistic learning experience compared to learning that only focuses on mastering concepts. Several studies show that *learning based on local and indigenous knowledge* is able to create learning that is more contextual, relevant, and close to students' life experiences.

c. The Potential for Science Literacy Development

Parijoto products also have the potential to support the development of students' science literacy. Through the exploration of parijoto cultivation and processing activities, students can learn to identify problems, observe phenomena, collect data, interpret information, and explain phenomena based on scientific evidence. These activities are an important component of the science literacy framework that emphasizes the ability to use scientific knowledge to understand and make decisions in daily life.

In addition, the use of local contexts allows learners to see the relevance between science and their own socio-cultural environment. This condition has the potential to increase student involvement in the learning process because the material studied has a closeness to their experience. A number of studies report that the integration of ethnoscience in science learning has the potential to support the development of science literacy through more contextual and meaningful learning.

d. Potential to Increase Environmental Awareness

The existence of parijoto that grows distinctively in the Mount Muria area provides an opportunity for students to understand the relationship between organisms, habitats, and environmental sustainability. Through Ethno-SETS-based learning, students have the potential to develop awareness that the preservation of parijoto plants depends on the ecological conditions of their habitat. This understanding can be the basis for the growth of environmental care and awareness of the importance of local biological resource conservation.

Learning that integrates local and environmental wisdom has been reported to have the potential to strengthen the sustainability perspective as learners not only learn ecological concepts theoretically, but also see their implementation in people's lives. Thus, parijoto can function as a learning context that supports the development of *environmental awareness* contextually.

e. Potential to Foster Concern for Local Potential and Cultural Preservation

In addition to scientific and environmental aspects, parijoto-based learning has the potential to increase students' appreciation of the local potential of their region. Through the exploration of parijoto products, students can recognize the richness of local biodiversity, understand the economic value of regional resources, and identify the role of the community in maintaining the sustainability of traditional products.

Furthermore, the integration of local knowledge in science learning has the potential to be a means of cultural preservation because it provides space for

students to understand, appreciate, and document the knowledge inherited by the community. In the context of modernization and increasingly strong globalization, learning that accommodates *indigenous knowledge* is important to maintain the sustainability of cultural heritage that is threatened with erosion. Research shows that the internalization of local knowledge in science curricula has the potential to strengthen cultural identity while bridging the relationship between traditional knowledge and modern science.

Overall, parijoto-based products have the potential to become a Ethno-SETS-based science learning resource that is contextual, authentic, and relevant to the characteristics of Indonesian students. The integration of science, environment, technology, and community aspects contained in parijoto products has the potential to support the development of science literacy, environmental awareness, concern for local potential, and simultaneous cultural preservation. Therefore, the use of parijoto products in science learning can be one of the innovative alternatives to implement science learning that is responsive to local culture and the demands of 21st century education.

Overall, this study shows that the integration of local potentials such as Parijoto in Ethno-SETS-based science learning has the potential to strengthen the connection between the concepts of science, local wisdom, environment, technology, and society contextually within the framework of the Independent Curriculum. This approach not only supports the development of students' science literacy through meaningful and contextual learning experiences, but also has the potential to increase environmental awareness, concern for local potential, and cultural preservation as part of the community's scientific-social identity. Thus, Ethno-SETS learning can be seen as a relevant pedagogical strategy to bridge modern scientific knowledge with indigenous knowledge, so that science learning becomes more holistic, adaptive, and sustainability-oriented.

CONCLUSION

This ethnographic research has succeeded in identifying and mapping science concepts that are integrated in parijoto-based products in the Muria Region, as well as analyzing the four components of Ethno-SETS Science, Environment, Technology, and Society holistically. The findings show that the community's local knowledge of parijoto cultivation and processing contains significant scientific dimensions (biology, chemistry, and physics) that can be reconstructed into a meaningful and contextual source of science learning. Parijoto products represent an integrated knowledge system, connecting the principles of science with environmental sustainability, technological innovation, and socio-economic empowerment of local communities. The Ethno-SETS approach is proven to offer authentic pedagogical solutions for integrating local knowledge into formal science learning, potentially simultaneously improving science literacy, environmental awareness, cultural identity, and 21st century skills. This research provides an empirical blueprint and adaptable methodology to develop Ethno-SETS-based science learning in other local contexts in Indonesia,

supporting the implementation of an Independent Curriculum that is responsive to the culture and potential of local communities.

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