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Reviving Local Wisdom in Environmental Education: A Case Study of the Dayak Deah Community

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ABSTRACT

This study investigates the local wisdom of the Dayak Deah community in environmental management as a strategy for sustainability in the context of modernization. It examines how Indigenous knowledge, local resources, skills, values, solidarity, and decision-making mechanisms influence environmental education and sustainable practices. Data were collected from 346 community members across three villages in South Kalimantan, Indonesia, through surveys and interviews, and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with triangulation for validation. The results show that local knowledge ($\beta = 0.251$, $p < 0.001$), local resources ($\beta = 0.246$, $p < 0.001$), skills ($\beta = 0.116$, $p = 0.019$), and values ($\beta = 0.157$, $p = 0.002$) significantly contribute to environmental education, whereas solidarity ($\beta = 0.084$, $p = 0.093$) and decision-making mechanisms ($\beta = 0.068$, $p = 0.153$) have positive but non-significant effects. The model explains $R^2 = 0.377$, indicating that 37.7% of the variation in environmental education is accounted for by these dimensions of local wisdom. Traditional practices such as shifting cultivation, sustainable harvesting of forest products, herbal medicine, weather forecasting, water management, hunting, and forest conservation are deeply embedded in local knowledge and customary law. Social cohesion through collective work and rituals further supports these practices. In conclusion, Dayak Deah's local wisdom provides a valuable model for sustainable ecology. Incorporating these practices into environmental education and policy can enhance ecological awareness, promote sustainable livelihoods, and preserve Indigenous knowledge for future generations.

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INTRODUCTION

Indonesia is one of the largest archipelagic countries in Asia, comprising over 17,000 large and small islands. This geographical diversity has contributed to Indonesia's rich cultural landscape, characterized by a wide variety of ethnic groups, religions, languages, and traditions (Uyuni et al. 2024). Koentjaraningrat categorizes culture into three forms: artifacts and socio-facts, which manifest and become deeply rooted in society as local wisdom (Dasfordate et al. 2020, Rachman 2021).

Formed from knowledge, values, and activities that uniquely emerge and develop within a society, local wisdom is passed down through generations to adapt to the environment. This process creates diversity, making each form of wisdom distinct (Pesurnay 2018, Wardhani et al. 2023). Referring to the concept of tradition, local wisdom in Indonesia plays a tangible role as a frontline force in conserving and preserving natural resources (Soraya & Harahap 2024).

The concept of sustainability has evolved alongside various biological and socio-economic ideas, emerging as a response to reckless production systems (Chizmar et al. 2025). According to the IPBES report, nature is declining globally at an unprecedented rate, with species extinction accelerating and expected to continue unless human interactions with nature change (Abas et al. 2022). Exploiting nature without considering sustainability increases disaster vulnerability.

This issue is prevalent in countries rich in natural resources, leading to significant economic losses, as well as the destruction of biodiversity and disruption of social life within these communities (Kumar et al. 2021, Warsame et al. 2024).

According to the Ministry of Environment and Forestry, "South Kalimantan lost about 62.8% of its natural forest between 1990 and 2019, leaving only 14% of its original natural forest cover" (Jong 2021). This figure specifically refers to primary natural forests, which explains why the percentage is so small, as it excludes secondary forests and plantations. Other studies have highlighted that the province has also experienced large-scale forest conversion driven by the expansion of coal mining concessions, which has significantly contributed to habitat degradation and biodiversity loss (Iqbal et al. 2022). In addition to mining, agricultural expansion, particularly oil palm and rubber plantations, has become a major driver of deforestation, accounting for approximately 3.14 million hectares, or 20% of Indonesia's total forest loss between 2000 and 2021, most of which occurred in Kalimantan (Wulffraat et al. 2014). Satellite imagery further confirms this trend, showing that between 2015 and 2020, forest cover in South Kalimantan decreased from 1,431,528 ha to 1,120,273 ha, with an average annual loss of 62,251 ha, alongside the rapid growth of smallholder plantations that reached 1,258,113 ha in 2020 (Mardianis et al. 2022). The ecological consequences of deforestation are directly linked to the devastating floods that struck South Kalimantan in January 2021. Research on the Barito watershed demonstrated that the conversion of primary and secondary swamp forests into plantations and mining areas increased flood-prone zones by more than 313,000 ha, causing severe inundation in eight out of ten districts, as intense rainfall combined with degraded land cover amplified surface runoff and reduced the soil capacity to absorb water (Adi & Savitri 2022). Despite these variations, both sources consistently highlight the severe reduction in forest ecosystems in the province, which contributes to the increasing frequency of floods and other ecological disasters (Sutrisno et al. 2025).

Considering this phenomenon, the role of indigenous communities and local wisdom is crucial for protecting biodiversity and maintaining ecosystem health (Armstrong et al. 2021). The results of the systematic review indicate that Indigenous communities employ practical and efficient methods of environmental management. This management is reflected in six aspects: local values, local knowledge, local skills, local resources, decision-making mechanisms, and community solidarity, which collectively comprise the dimensions of local wisdom (Uspayanti et al. 2021, Abas et al. 2022, Wardhani et al. 2023).

As a manifestation of local wisdom practices in environmental management in Indonesia, the Baduy community in Banten lives conventionally by isolating itself from external influences to preserve its forests (Kenedy & Deffinika 2022, Mulyadi et al. 2022). Furthermore, in South Sulawesi, the Ammatoa Kajang tribe is known for its "pasang ri kajang" principle, which involves protecting its customary forest from encroachment and external exploitation. They believe that the forest embodies Mother Earth, integrating nature as an essential part of their spiritual lives (Surtikanti et al. 2017, Marliana & Amir 2021). Both communities have demonstrated that adherence to local wisdom can maintain environmental balance despite the pressures of modernization and exploitation temptations.

In addition to the Baduy and Ammatoa, the Dayak people in Kalimantan also sustain their traditional way of life, ensuring its continuity through local wisdom and environmental stewardship (Azhari 2019, Suprianto & Bakri 2023). One of the Dayak sub-tribes inhabiting South Kalimantan is called Dayak Deah (DD). They reside in the Upau and Muara Uya Districts of Tabalong Regency and parts of Balangan Regency, specifically Gunung Riyut and Liyu. Historically, they have maintained a close relationship with their natural environment, particularly forests, which serve as their primary livelihood source. They uphold a fundamental principle: "The land is the mother, the forest is the father, and water is the blood." This belief binds the Dayak Deah to customary laws and obligates them to protect their land and environment.

Although Dayak Deah›s local wisdom in environmental conservation holds great potential, it has yet to receive adequate attention from Indonesia's younger generation, particularly in Tabalong, South Kalimantan. Based on the ecological awareness index data, the awareness level among the youth in Tabalong remains relatively low (Ifansyah et al. 2023). Previous research has shown that children and adolescents in this region have yet to fully recognize the local wisdom values passed down by their ancestors. Despite living near the Dayak Deah community, public participation in environmental conservation remains suboptimal. However, the local values upheld by the Dayak Deah people have the potential to serve as a localized solution for preserving ecological sustainability. Based on the above discussion, this study aims to analyze the influence of local wisdom on environmental education to support a sustainable environment within the Dayak Deah Tribe.

MATERIALS AND METHODS

This study was conducted in the Pangelak, Kinarum, and Kaong villages in the Upau District, Tabalong Regency,

South Kalimantan, Indonesia. A location map is shown in Fig. 1. These three villages were selected because they serve as centers for developing indigenous traditions and culture, and key areas for distributing the Dayak Deah indigenous community in Tabalong Regency.

This study focused on adult members (aged ≥ 18 years) of the Dayak Deah community residing in three selected villages, with a total population of 3,396 individuals (BPS 2024). Referring to Krejcie and Morgan's sample size table, a minimum of 346 respondents was required to achieve statistical adequacy and maintain the generalizability of the results. We applied a stratified random sampling technique to obtain this number. Household lists provided by village administrations served as the sampling frame, and stratification was performed to secure proportional representation across the three villages: 118 respondents from Pangelak, 112 from Kinarum, and 116 from Kaong. Respondents were eligible if they had been permanent residents of the village for at least five years, were 18 years of age or older, and expressed willingness to participate in the study.

The demographic profile of the respondents shows that slightly more than half were male (52.3%), while females accounted for 47.7%. In terms of age, the largest group was between 30 and 44 years (35.8%), followed by those aged 45–59 years (28.3%), 18–29 years (20.8%), and 60 years or older (15%). With respect to occupation, most respondents (81%) worked as farmers, reflecting the agrarian nature of the Dayak Deah community. A further 16% were engaged in private sector employment or small-scale entrepreneurship, and only 3% were employed as civil servants or as teachers.

This study employed a mixed-methods approach, combining qualitative and quantitative techniques to provide a comprehensive understanding of the Dayak Deah community's local wisdom in relation to environmental sustainability. The qualitative strand involved field observations and semi-structured interviews conducted between August 2024 and January 2025. Six key informants were purposively selected for their cultural knowledge and community roles, including the Head of the Dayak Deah Customary Council, a member of the Indigenous Peoples Alliance of the Archipelago (AMAN) and oral tradition expert, a male *Balian* (traditional healer), a female *Balian*, the Head of Kaong Village, and a community representative.

The quantitative strand was conducted using a structured questionnaire survey administered between January and

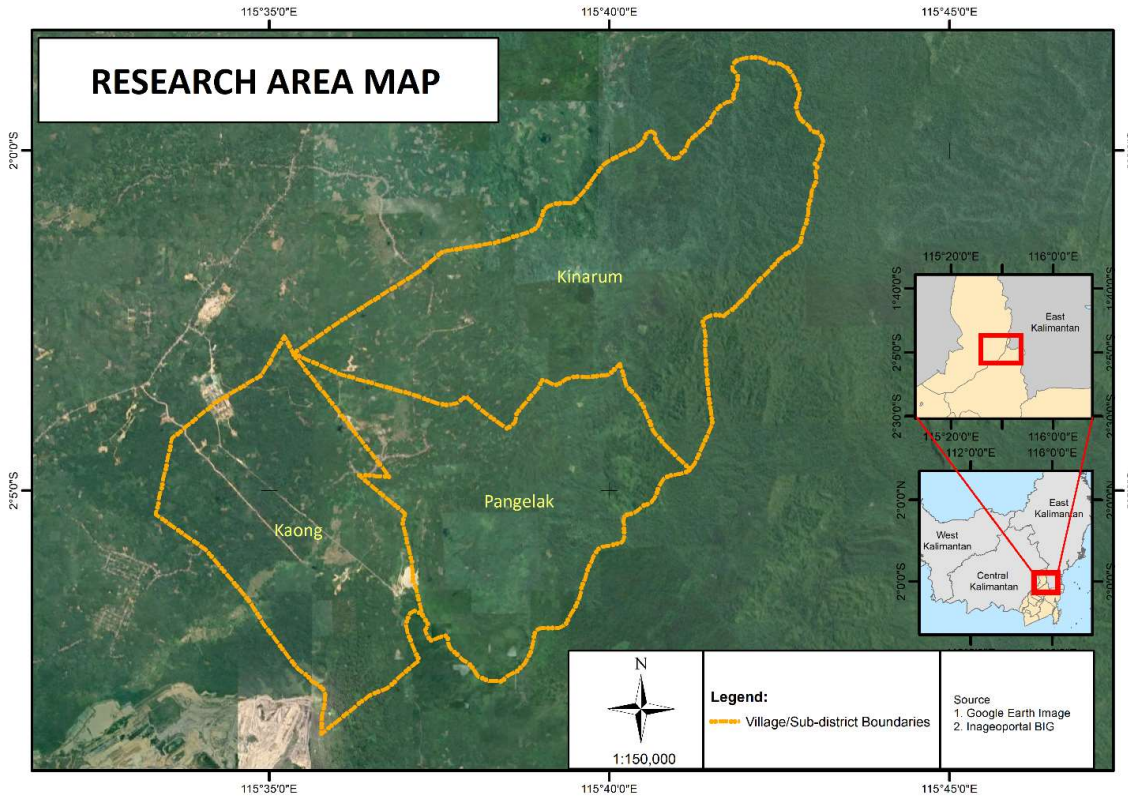

Fig. 1: Map of the research location.

March of 2025. The instrument consisted of 34 items measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The variables assessed included local knowledge, values, skills, resources, decision-making systems, solidarity, and environmental education.

The data were analyzed using Structural Equation Modeling (SEM). The hypotheses of this study are as follows:

1) Local Knowledge (LK) influences Environmental Education (EE)
2) Local Value (LV) influences Environmental Education (EE)
3) Local Skill (LS) influences Environmental Education (EE)
4) Local Resources (LR) influences Environmental Education (EE)
5) Mechanism of local decision-making (MD) influences Environmental Education (EE)
6) Local Society Solidarity (LD) influences Environmental Education (EE).

The questionnaire used to measure the six dimensions of local wisdom was adapted from a previously developed and validated instrument (Wardhani et al. 2024). The original instrument consisted of 34 items with established reliability and validity [insert the reference]. For this study, the questionnaire was translated and back-translated to ensure linguistic and cultural accuracy for the Dayak Deah context, followed by a pilot test to confirm its clarity and relevance to the target population. During the main data collection, all 34 items were retained as they met the required criteria for factor loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). This approach ensured comprehensive, reliable, and replicable measurements of the six dimensions, thereby supporting the robustness of the study's findings.

Additionally, for the interview data, data validation was conducted using source triangulation, which involved comparing the interview findings from different informants with the observations made during the research process. The data were analyzed using the three-stage approach proposed by Miles and Huberman (Salmona & Kaczynski 2024). First, data reduction was performed by selecting only essential observations and interview findings that served as the study's foundation. Next, the data were organized according to the required dimensions to facilitate the analysis and guide meaningful conclusions. Finally, conclusions were drawn based on the organized and interpreted data (Salmona & Kaczynski 2024).

In addition to source triangulation for validation, this study integrated qualitative and quantitative data using a mixed-methods framework. Qualitative analysis followed Miles and Huberman's three-stage model (Salmona & Kaczynski 2024), consisting of data reduction, data display, and conclusion drawing. Interview transcripts were subjected to *open coding* and subsequently organized into a code tree aligned with the latent constructs of the study: Local Knowledge (LK), Local Values (LV), Local Skills (LS), Local Resources (LR), Mechanism of local decision-making (MD), and Local Society Solidarity (LD).

Code Tree (Summary)

1) Local Knowledge (LK): traditional knowledge, intergenerational transmission, and herbal practices.
2) Local Values (LV): customary beliefs, community rules, and sustainability norms.
3) Local Skills (LS): herbal preparation techniques, agroforestry practices, and post-harvest processing skills.
4) Local Resources (LR): forest products, medicinal plants, and cultivated lands.
5) Mechanism of local decision (MD): collective deliberation in adat councils, regulation of natural resource use (tree felling, honey collection, fishing restrictions), and integration of adat law with state regulations.
6) Local Society Solidarity (LD): collective rituals and ceremonies, mutual assistance in land clearing and harvesting, etc.

RESULTS

Local Knowledge of The Dayak Deah

Local knowledge refers to a set of location-based understandings exclusively utilized by a specific community that may vary from region to region (Jessen et al. 2022). Based on interviews with the Dayak Deah customary leader and customary healer, or *Balian*, it was revealed that the Dayak Deah community uses this knowledge to predict the seasons and sustainably manage the environment. The dry season is indicated by the red blossoms of ampalam (*Mangifera foetid*a), kuini (*Mangifera odorata*), and binjai (*Mangifera caesia*). In contrast, the rainy season is marked by the white flowers of the meranti (*Shorea leprosula*) and durian (*Durio kutejensis*) trees. Other indicators include the growth of moss (*Bryophyta* sp.), wildlife behavior, and changes in the colors of the sun and moon.

In natural resource management, the community understands ecological patterns and adjusts its activities

according to natural cycles (Adade Williams et al. 2020). The dry season is considered the optimal time for hunting because animals gather near water sources. The rainy season is more suitable for farming because the soil becomes fertile.

The dry season is considered the optimal time for hunting because animals gather near water sources. The rainy season is more suitable for farming because the soil becomes fertile (Az-Zahra et al. 2021). The ability to select appropriate plants for treating specific illnesses is an essential aspect of local knowledge that communities must have. Among the Dayak Deah people, medicinal plants are preferred over chemical-based medicines. For example, Pasak Bumi (*Eurycoma longifolia*) is used to treat back pain and enhance stamina. This practice reflects the balance between resource utilization and environmental conservation. Table 1 presents a selection of medicinal plants used by the Dayak Deah community.

Table 1 presents the medicinal plants used by the Dayak Deah community to treat various diseases. The table highlights traditional remedies, including *Lagerstroemia speciosa* for diabetes and gastric issues, *Annona muricata* L. for hypertension, and *Baccaurea lanceolata* for cholesterol. Other treatments include *Eleutherine bulbosa* for cancer and *Bambusa vulgaris* for hepatitis, and *Psidium guajava* for diarrhea, respectively. The preparation methods vary and include boiling, soaking, and direct application. This demonstrates the community's reliance on natural resources for healthcare, emphasizing its profound ecological knowledge and sustainable medicinal practices.

Indigenous communities have preserved the knowledge of medicinal plants for millions of years. The practices of the Dayak Deah community are similar to those of the Tacana and Leco communities in the Amazon rainforest, who extensively use leaves, roots, bark, flowers, seeds, and oils to treat various illnesses (Wartmann & Purves 2018). In research of a similar scope, the local knowledge of the Dayak Paramasan Indigenous community also emphasizes the use of community knowledge to understand animals and plants (Wardhani et al. 2023). With a deep understanding of the ecosystem, the Dayak Deah community maintains an environmental balance through ancestral customary practices. This highlights the importance of local wisdom in the sustainable management of natural resources.

Local Values of the Dayak Deah Community

The implementation of local values in the lives of the Dayak Deah community is reflected in their land management, agricultural practices, and social interactions, which are based on customary laws and traditional wisdom. The land is divided into several zones: production forests, plantations, settlements, customary forests, and mining areas. Customary forests are strictly protected as they are considered sacred, reflecting the community's deep respect for nature and ancestral beliefs (Hakim 2023, Shiferaw et al. 2023).

The values of solidarity and cooperation serve as fundamental principles in daily life, as reflected in customary laws that regulate community behavior (Hanim & Noorman 2018). Social interactions prioritize ethical and consensus-based decision-making. This principle preserves social harmony while supporting environmental sustainability, ensuring that resource utilization is conducted wisely and without excess (Jaiswal et al. 2022).

Table 1: Traditional Knowledge of the Dayak Deah Community on Medicinal Plants.

Plant	Disease	Treatment Method
Bungur Leaf *Lagerstroemia speciosa*	Diabetes	The leaves are soaked in cold water and consumed three times a day. The top leaf is pounded to treat wounds.
Soursop leaf *Annona muricata* L.	Hypertension	Seven-strand leaves boiled with seven glasses of water until three glasses remain, and then consumed three times a day.
Fruit Limpasu *Baccaurea lanceolata*	Cholesterol	The fruit is peeled, soaked in cold water, and one glass 3 times daily.
Dayak Onion *Eleutherine bulbosa*	Cancer	The bulbs and seven leaf strands were boiled until 1 liter was obtained. Drink 3 times daily.
Bungur root *Lagerstroemia speciosa*	Indigestion	Soaking roots in cold water and drinking it before and after eating is also recommended.
Yellow Bamboo Root *Bambusa vulgaris*	Hepatitis and Jaundice	The roots were boiled in 1 liter of water. One glass three times a day, with palm sugar.
Guava Shoot *Psidium guajava* L.	Diarrhea	Soaked in hot water, and drink
Black sticky rice *Oryza sativa* var. *glutinosa*	Hemorrhoid	Cooked rice was eaten without a side dish.
Kapuk Leaves *Ceiba pentandra*	Fever	The plant is crushed, mixed with water, and used for compresses.
Galangal *Alpinia galanga* L.	Ringworm	The stem was rubbed on the affected area of the ringworm.

The local wisdom of the Dayak Deah community shapes a sustainable socio-ecological system, ensuring a balance between human needs and environmental conservation. This demonstrates that traditional values strengthen cultural identity and serve as a foundation for preserving ecosystem sustainability for future generations.

Based on the Interview with the Dayak Deah customary leader, the Dayak Deah Indigenous community upholds a profound philosophy: "Alam dengan manusia, manusia dengan Tuhan, Tuhan dengan Alam" (Nature with humans, humans with God, God with Nature). This philosophy reflects the interconnectedness between nature and humans, who depend on nature for survival and must protect it. Likewise, the relationship between humans and God signifies that nature represents divine existence, as humans maintain their spiritual connection with God. It is believed that any harm inflicted on nature brings misfortune (tulah), a form of divine punishment.

The relationship between humans and nature is further represented in the proverb: "Tanah adalah daging, air adalah darah, batu adalah tulang, akar adalah urat-urat kita" (The land is flesh, water is blood, stone is bone, and roots are our veins). Dayak Deah Balian explained this value, suggesting that this expression signifies the deep connection between human existence and the natural world, emphasizing that harming nature is equivalent to harming oneself. Additionally, the philosophy "Ibu adalah bumi dan langit, ayah kita yang kuasa" (Mother is the earth and sky, father is the Almighty) reinforces the belief that nature is a nurturing entity. Simultaneously, the Creator holds supreme power over all beings.

The Dayak Deah people believe that living beings are formed from various natural elements that shape their bodies and are endowed with spirits before they arrive on Earth. This belief is reflected in a deeply held phrase: "Mother is the Earth, Father is the Forest, Water is the Blood." This expression signifies the intrinsic connection between humans and nature, with Earth as the source of life, forests as protectors, and water as a vital element for survival. Consequently, harming nature is perceived as harming oneself, one's family, and future generations.

The concept of local values prohibiting environmental destruction is also reflected in the Dayak Kenyah community in East Kalimantan through the Tana Ulen system, which serves as a traditional mechanism for preserving the natural environment. This practice designates specific forest areas as protected zones, ensuring the sustainable management of natural resources while maintaining an ecological balance (Njau et al. 2019).

Table 2: Customary Law of the Dayak Deah Community in managing the environment.

Category of Customary Rule	Content of the Rule
Environmental Customary Rules	1. Every citizen of the Dayak Deah Community has the same right to a good and healthy living environment. 2. The Deah community has the right to file a court lawsuit and report environmental problems to law enforcement that are detrimental to the community's well-being. 3. Every Deah indigenous citizen must maintain and prevent environmental pollution and damage. 4. The Dayak indigenous community has the same and broadest opportunities to play a role in environmental management.
Regulations on Customary Forests	1. The Dayak Deah customary law community can collect forest products to meet their daily needs and carry out forest management activities according to the applicable customary law provisions. 2. The community is obliged to participate in maintaining and protecting customary forest areas from disturbances and destruction. 3. Indigenous communities have the right to file lawsuits in court and report forest damage that is detrimental to community life to law enforcement.
Customary rules for forest and land use	4. Forest clearing is not permitted in protected forest areas or in customary forests. 5. Land use in areas prone to landslides or upstream areas must involve planting perennial plants.

Table 3: Values in the Dayak Deah indigenous community.

Local Values	Description
Religiosity	Nature is often considered a manifestation of divine powers. Humans must naturally guard their balance by respecting God and their ancestors.
Care Environment	Nature and humans are one unit, and life must be in harmony. Excessive exploitation is considered a violation of the balance of the ecosystem.
Cooperation	The management environment is established collectively based on the principles of cooperation and collaboration. The community works similarly to preserve forests, resources, and the power of nature.
Justice	Customs rules arrange the wise utilization of land and natural resources. Under the law and customs, the offender is sanctioned.
Wisdom	The utilization of source power is naturally achieved by considering sustainability and the generation of well-being.

Table 4: Rules and methods of the Dayak Deah community in opening the field.

Skills	Description
Ngalala	The stage begins with carrying out the Ngumo matter. This is an activity area inspection to determine the location of farming.
Nyiro	The activity marks the area to be worked on for farming, make a sign in the form of a circle made from rattan or a wooden cross.
Mowah	Activity: Cleaning grass and slashing small wood. Mowah, done in a way, works together in a way.
Nowokng	Activity to cut down the large tree (allowed)
Nutu Jowa	Activity: Cut tree branches that have been cut down and work together.
Nyelai Jowa	Activity to dry branches and twigs that are already cut until they are ready to burn
Nutukng	The activity involved burning fields, which was carried out in cooperation with the family, neighbors, and less-fortunate communities. More than one land needed more than 40 people at each point to brave the fire so that it did not creep into another land.
Mondruk	Activity gathering branches and twigs that have already been burned.
Metopah	Cleaning after the activities. This is done to clean the remains of leaves that are not twigs that have been burned. Mothers usually do this through cooperation.
Ngasok	Rice harvesting is carried out by cooperation.
Ngerikut	Community activity includes cleaning small grasses and weeds after the rice is 2 months old. Mothers usually do this kind of work.
Ngimpuu Umo	Activity of guarding the fields from rice pests after age 5-7 months.
Ngani	Activity: harvesting ripe rice.
Mesiwah Pare	Thanksgiving Activities result in a harvest. Mesiwah is a thanksgiving to the creator of the harvest's results. The rice may not be eaten until the rice field is completed.

Additionally, the prohibition against environmental destruction is reflected in the customary laws of the Dayak Deah community, as shown in Table 2. These regulations emphasize the community's commitment to environmental sustainability and the preservation of natural resources.

Based on Table 2, it can be observed that the values that develop within an indigenous community manifest as written laws that must be followed strictly. The customary law of the Dayak Deah reflects noble values in environmental conservation and ecosystem balance through the community's collective obligations, rights, and responsibilities. This data-based management system was practiced long before the emergence of modern conservation concepts (Knoepfel & Nahrath 2005, Eddy 2021). The principle of ecocentrism serves as the fundamental basis, wherein humans are regarded as integral parts of a larger ecosystem.

The reciprocal understanding between humans and nature, as observed in the field, encourages forest protection, promotes the wise management of natural resources, and helps prevent destructive practices such as illegal logging and indiscriminate waste disposal (Kopnina et al. 2018, Rülke et al. 2020). The values upheld by the Dayak Deah indigenous community are listed in Table 3.

Based on Table 3, it can be concluded that the local wisdom values of the Dayak Deah community reflect a harmonious relationship between humans and nature, where religiosity, cooperation, justice, and wise resource utilization are the fundamental principles. These principles maintain ecosystem balance and ensure environmental sustainability for future generations, making them a culturally based conservation model that remains relevant.

Local Skills of the Dayak Deah Community

Local skills in indigenous knowledge refer to abilities or expertise developed within a community based on traditions, experiences, and cultural values that have been passed down through generations. These skills are typically inherited over time and are deeply rooted in local cultural and ecological contexts (Jessen et al. 2022). In managing the environment, the Dayak Deah community possesses specialized skills and regulations documented in customary law upheld by the entire indigenous Dayak society, as follows:

The most distinctive skill of the Dayak Deah community is their unique land cultivation techniques, which differ from those of other indigenous groups in the region. Community behavioral patterns implement land management regulations among the Dayak Deah, as reflected in their customary ceremonies and rituals. The Dayak Deah community's land management skills are based on specific rules, as shown in Table 4.

Based on Table 4, it can be explained that the local skills of the Dayak Deah community in opening fields reflect their wisdom in maintaining ecological balance. They begin with *Ngalala*, a process of selecting suitable land, followed by

Fig. 2: Clothes and accessories from Deluang tree bark, typical of dayak deah.

Nyiro, which marks an area without disrupting the ecosystem. *Mowah* and *Nowokng* demonstrate selective woodcutting and tree-felling skills, while *Nutukng* is carried out under strict supervision to prevent the fire from spreading to other areas of the forest. In agriculture, they master techniques such as *Ngasok* (seed planting using the menugal method), *Ngerikut* (weeding), and *Ngimpuu Umo* (protecting fields from pests). After harvesting, the *Mesiwah Pare* tradition, as an expression of gratitude, highlights the harmonious relationship between villagers and nature. These skills demonstrate that the Dayak Deah farming system differs from conventional slash-and-burn practices, as it is rooted in ecological knowledge passed down through generations, ensuring environmental sustainability and a balanced environment.

Based on interviews with the Customary Chief, Customary Council, and Balian Adat (spiritual leader) of the Dayak Deah, before opening land, the community first performs the *Bamimpi* ritual to seek permission from their ancestors to do so. The farming location is determined through prayers to the earth, sky, and tree spirits, followed by a three-day waiting period for guidance through dreams. If the signs are deemed favorable, the land is used with a small Thanksgiving ceremony and offerings to honor the land-guardian spirits to ensure protection from disturbances.

This practice aligns with the shifting cultivation system adopted by the Dayak Meratus, in which slash-and-burn techniques are regulated by the customary law. This prevents environmental degradation and ensures sustainable forest management practices.

The Dayak Deah community's practices align with those of the Dayak Meratus and Lokasado communities, although they use different terminologies and methods for the same. Despite these variations, they share the same objectives and adhere to similar customary regulations regarding land management and environmental conservation (Alviawati 2023).

One of the distinctive skills of the Dayak Deah community is their ability to process the trunk and bark of the *Artocarpus odoratissimus* tree, commonly known as the Deluang tree, into clothing and accessories for traditional ceremonies. Based on the interviews, the Deluang tree is abundant in the customary and community-managed forests in the area. As a result, the skill of making bark cloth garments has developed in response to the local environmental conditions in which trees thrive.

Fig. 2 illustrates the design of the clothing and accessories made from the Deluang wood bark. Making garments from Deluang wood requires only simple tools, such as a wooden mallet, *Mandau* (traditional Dayak machete), and Belayang axe. However, to ensure sustainability, only trees with diameters greater than 10 cm are permitted for bark harvesting, as regulated by customary law.

Bark processing is carried out carefully, starting with the precise separation of the bark from the trunk. The mixture was then evenly beaten with a wooden mallet to flatten and soften the texture. This pounding process takes 2–3 h to produce a single sheet of fabric that is ready for sewing. The fabric was dried under sunlight for approximately 2 h, depending on the weather conditions. The final stage involves cutting the fabric according to the patterns, adding traditional motifs, and finishing the edges to achieve a neat appearance.

The Dayak Deah community's local skills reflect an ecologically based approach to sustainability. Their shifting cultivation system is regulated by customary law, ensuring environmental balance and differentiating it from destructive

deforestation. The use of Deluang bark for clothing also demonstrates a deep ecological understanding, as the bark is harvested selectively to preserve the trees. This skill is not merely a tradition but a resource management model that harmonizes with nature and reinforces cultural identity within the sustainable development framework.

Local Resources of the Dayak Deah Community

The Dayak Deah community, which traditionally depends on nature, upholds its customs and possesses local knowledge. For them, local resources, primarily derived from forests, are managed wisely to ensure their sustainability as a source of livelihood (Carson et al. 2018, Balick & Cox 2020). As previously explained in the section on local knowledge, the Dayak Deah community continues to rely on traditional medicine.

The Upau District, the center of the Dayak Deah community, is renowned for producing pasak bumi (*Eurycoma longifolia*) and various other herbal plants. In 2023, the biopharmaceutical plant production in Upau District included 70 kg of ginger, 69 kg of galangal, 69 kg of aromatic ginger, 79 kg of turmeric, and 59 kg of Java turmeric per square meter. The annual production of ginger, 336 kg of galangal, 321 kg of aromatic ginger, and 393 kg of turmeric reached 324, 336, 321, 393, and 285 quintals, respectively (BPS 2024).

The practices of the Deah community align with the traditions of other Indigenous Indonesian communities. This is reflected in research conducted in Karo village, North Sumatra, where local knowledge similarly supports sustainable practices, as in the Deah community (Silalahi et al. 2015). Furthermore, with a livelihood pattern closely connected to nature, indigenous communities such as the Tengger and Ammatoa Kajang have managed to sustain themselves using over 30 species of medicinal plants (Jadid 2020, Zubaidah et al. 2020). However, the findings of this study are not limited to literature reviews; they are grounded in direct field observations and in-depth interviews with members of the Dayak Deah community. This suggests that the preservation of traditional medicinal practices is closely tied to the role of indigenous customs, as exemplified by the Dayak Deah Indigenous Community of South Kalimantan.

In addition to cultivating medicinal plants, the Dayak Deah community relies on fruit plantations, growing durians, rambutan, Siam oranges, bananas, papayas, salak, langsat, jackfruit, and cempedak. The development of agroforestry gardens led to the Upau District being recognized in 2022 as a leading producer of local fruits in the Tabalong Regency. This recognition aligns with the strategic initiative of the Tabalong Regency Government to position the region as a food buffer for the new capital city (IKN). In addition to fruits, the community cultivates various agricultural commodities, including large chili peppers, curly peppers, bird's eye chili, tomatoes, and eggplants.

These practices demonstrate that local wisdom and customary traditions play crucial roles in agricultural management and the utilization of medicinal plants in various indigenous communities in Indonesia. The Dayak Deah community exemplifies how sustainability can be achieved through effective forest management, sustainable agriculture, and the utilization of medicinal plants based on local knowledge. Preserving these traditions ensures food security and access to healthcare and contributes to environmental conservation and sustainable local economies.

In this context, constructs such as "local resources" (LR) and "local skills" (LS) are conceptually formative, as they represent diverse inputs that collectively shape community sustainability. These indicators do not merely reflect an underlying latent variable; instead, they form the constructs themselves. However, when modeled as reflective constructs, a strong theoretical justification is required, such as considering them as manifestations of the broader latent dimension of indigenous sustainability practices (Edwards & Bagozzi 2000).

Local Decision-Making Mechanism

Similar to other indigenous communities in Indonesia, the Dayak Deah community in Upau District possesses strong local wisdom regarding natural resource management and the application of customary law. In the Upau District, traditional institutions play a crucial role in balancing environmental utilization and cultural preservation. The structure of these institutions, comprising the head of adat, adat leaders, adat elders, and balian, ensures that customary laws are enforced fairly and in accordance with local values.

Similar to the Paramasan District, customary law in the Upau District aligns with government regulations (Wardhani et al. 2023). Based on interviews, the Dayak Deah community emphasized that they have the right to utilize the natural environment wisely, following established regulations and involving customary institutions in decision-making, such as land-use changes. For example, when using biopharmaceutical plants such as pasak bumi, turmeric, and temulawak, the community must ensure the sustainability of these resources by engaging with customary institutions for resource management planning.

The Dayak Deah community's annual rituals are an integral part of customary law. These rituals preserve tradition, serve as a mechanism for strengthening community solidarity, and remind people of the importance of

maintaining harmony with nature. If a community member violates customary regulations, a customary fine is imposed. Within the Dayak Deah community, these fines can be either a "tajau" or a "real." The determination of the fine is not made individually but rather through consensus deliberations that consider the severity or mildness of the violation. One unit of tajau is valued at IDR 10,000,000 (ten million rupiah), whereas one unit of real is valued at IDR 6,000 (six thousand rupiah).

One of the customary regulations governing natural resource management concerns the felling of fruit-bearing and honey-nesting trees. In such cases, the customary fine is determined in real or tajau, depending on tree size. Compensation is given to the tree owner or the head of the adat if the tree has no private owner.

Additionally, harvesting wants (honey) from a hive that does not belong to the harvester without the owner's permission results in a customary fine of five confirmed and social sanctions imposed by the adat community. Regarding fishing practices, the community strictly prohibits the use of chemicals or electric shock devices within the Dayak Deah customary territory. Violators are subject to customary fines and are reported to law enforcement authorities. The acceptable amount is determined through deliberation, considering the extent of the environmental damage caused by illegal practices.

Local Society Solidarity

The strong sense of local solidarity within the Dayak Deah indigenous community is evident, particularly in traditions such as land clearing and harvest celebrations. These practices go beyond mutual assistance and reflect deeply rooted values related to social relations and the sustainability of ecosystems. During land clearing, all extended family and local community members work together in shifts to clear the land. Clearing a single plot of land requires approximately 40 people who volunteer their labor without monetary compensation, following a rotational system based on local trust and mutual respect.

The rotational system in the Dayak Deah community follows unique regulations, where each plot of land can only be cultivated twice before being left to rest, allowing the soil to recover its fertility. This cycle enables the community to relocate to a new site and return to its original location once it has regenerated. This practice embodies ecological awareness that has been passed down through generations. Additionally, it illustrates the high level of social capital in the Dayak Deah Community. Field observations and interviews confirmed that this practice reflects ecological awareness and demonstrates a high level of social capital within the Dayak Deah community. Trust and cooperation are fundamental elements of social capital that strengthen social networks and the resilience of traditional communities (Roslinda 2018, Hatu & Darsono 2019).

Solidarity within the Dayak Deah community can be categorized as mechanical solidarity, where social bonds are based on shared values and norms. This form of solidarity strengthens collective cohesion, which is the foundation of various aspects of social life, including agrarian practices, religious rituals, and environmental conservation (Mortazavi et al. 2024).

In addition to the agrarian aspect, the solidarity of the Dayak Deah local community is reflected in various traditional ceremonies that strengthen their social bonds and cultural identities. These include *Tawas Jaa*, *Mesiwah Pare*, *Buntang Mamali*, and other rituals. The descriptions presented in Table 5 are based on the results of field interviews with community members

Table 5: Traditional rituals and social solidarity values.

Traditional Ceremony	Purpose	Form of Solidarity	Environmental Impact
Tawas Jaa	Protection from misfortune	Conducted collectively through cooperation	Guard the balance between nature and identity.
Mesiwah Pare	Gratitude for the rice harvest	Joint celebration with a shared distribution of the harvest	Encourages sustainable agricultural practices
Buntang Mamali	Tradition Death	Community participation without monetary reward	Preserves sacred land and burial sites
Baaruh	Celebrating agricultural results.	Collective celebration and shared harvest distribution	Promotes sustainable farming and biodiversity conservation
Manopeng	The treatment was traditional with herbal plants.	Community members gather and prepare remedies together	Supports the conservation of medicinal plant species
Mambatur	Honoring, worshipping, and expressing gratitude to God and ancestors	Conducted through traditional rituals involving customary leaders and community consensus	Reinforces spiritual connection with nature, supports regulated natural resource use

who explained the meaning and implementation of these rituals**.**

Based on Table 5, the various traditional ceremonies of the Dayak Deah community reflect strong social solidarity while contributing to cultural and environmental preservation. *Tawas Jaa*, a ritual for warding off misfortune, is conducted collectively through cooperation, reinforcing cultural identity and spiritual connections with nature. *Mesiwah Pare*, a rice harvest thanksgiving ceremony, involves the distribution of crops and traditional feasts, fostering communal bonds and preserving conventional farming techniques. *Buntang Mamali*, a customary funeral ritual, emphasizes selfless cooperation, strengthening the values of mutual assistance and traditional solidarity. The Harvest Festival, a celebration of agricultural yields, fosters social connections by sharing food and crops while

Table 6: Summary of model measurement.

Construct	Item	Loading Factor	Cronbach's Alpha	Composite Reliability	AVE
Environment Education (EE)	EE1	0.772	0.738	0.882	0.586
	EE2	0.684			
	EE3	0.780			
	EE4	0.811			
	EE5	0.779			
	EE6	0.774			
	EE7	0.753			
Local Society Solidarity (LD)	LD 1	0.890	0.882	0.885	0.793
	LD 2	0.891			
Local Knowledge (LK)	LK 1	0.732	0.868	0.900	0.600
	LK 2	0.833			
	LK 3	0.785			
	LK 4	0.722			
	LK 5	0.802			
	LK 6	0.769			
Local Resources (LR)	LR 1	0.867	0.723	0.878	0.782
	LR 2	0.901			
Local Skill (LS)	LS 1	0.756	0.901	0.919	0.559
	LS 2	0.703			
	LS 3	0.776			
	LS 4	0.803			
	LS 5	0.750			
	LS 6	0.745			
	LS 7	0.714			
	LS 8	0.706			
	LS 9	0.770			
Local Value (LV)	LV 1	0.782	0.739	0.881	0.552
	LV 2	0.751			
	LV 3	0.747			
	LV 4	0.766			
	LV 5	0.702			
	LV 6	0.708			
Mechanism of local decision-making (MD)	MD 1	0.881	0.838	0.884	0.792
	MD 2	0.899			

promoting sustainable farming practices. Meanwhile, Traditional Collective Healing demonstrates solidarity in utilizing herbal medicine, safeguarding community health, and preserving indigenous knowledge of medicinal plants. These findings are not only supported by the literature but also confirmed through direct field observations and in-depth interviews with community members, who emphasized that such rituals continue to function as mechanisms for strengthening solidarity and sustaining the balance between humans and nature. Collectively, these traditions serve as a medium for social interaction and a sustainable strategy for conserving cultures and ecosystems.

The evaluation of the measurement model involved an assessment of factor loadings, internal consistency reliability (Cronbach's Alpha and Composite Reliability), and convergent validity using Average Variance Extracted (AVE). A summary of these results is presented in Table 6.

The factor loadings across indicators were generally strong, with most values exceeding the recommended threshold of 0.70 (Hair et al. 2019). Within the construct of Environmental Education (EE), six of the seven items achieved loadings above this benchmark, ranging from 0.753 to 0.811. Although one indicator (EE2 = 0.684) fell slightly short, it was retained because of its theoretical relevance and proximity to the cutoff point. In such cases, retaining the item is considered appropriate, particularly when its inclusion enhances conceptual coverage without undermining reliability or the AVE.

Reliability tests further supported the adequacy of these dimensions. Cronbach's alpha values ranged from 0.723 for Local Resources to 0.901 for Local Skill, all of which surpassed the conventional threshold of 0.70. This indicates that the constructs possess acceptable to high internal consistency. The composite Reliability (CR) values were also robust, ranging between 0.878 and 0.919. Notably, CR values were consistently higher than their corresponding Cronbach's alpha values, suggesting that the constructs were well captured by their observed measures. Convergent validity was also established. The AVE values for the constructs ranged from 0.552 (Local Value) to 0.793 (Local Solidarity), exceeding the minimum recommended level of 0.50. These results show that each construct explains more than half of the variance in its respective indicators, thereby satisfying the criterion for convergent validity.

Table 7: Discriminant Validity Assessment using HTMT criterion.

Item Relationship	HTMT
Environmental Education (EE) ↔ Local Knowledge (LK)	0.493
Environmental Education (EE) ↔ Local Resources (LR)	0.575
Environmental Education (EE) ↔ Local Skill (LS)	0.419
Environmental Education (EE) ↔ Local Solidarity (LD)	0.338
Environmental Education (EE) ↔ Local Value (LV)	0.444
Mechanism of local decision-making (MD) ↔ Environmental Education (EE)	0.371
Mechanism of local decision-making (MD) ↔ Local Knowledge (LK)	0.527
Mechanism of local decision-making (MD) ↔ Local Resources (LR)	0.329
Mechanism of local decision-making (MD) ↔ Local Skill (LS)	0.357
Mechanism of local decision-making (MD) ↔ Local Solidarity (LD)	0.153
Mechanism of local decision-making (MD) ↔ Local Value (LV)	0.263
Local Knowledge (LK) ↔ Local Resources (LR)	0.379
Local Knowledge (LK) ↔ Local Skill (LS)	0.306
Local Knowledge (LK) ↔ Local Solidarity (LD)	0.207
Local Knowledge (LK) ↔ Local Value (LV)	0.369
Local Resources (LR) ↔ Local Skill (LS)	0.483
Local Resources (LR) ↔ Local Solidarity (LD)	0.381
Local Resources (LR) ↔ Local Value (LV)	0.461
Local Skill (LS) ↔ Local Solidarity (LD)	0.447
Local Skill (LS) ↔ Local Value (LV)	0.369
Local Solidarity (LD) ↔ Local Value (LV)	0.219

Among the constructs, Local Solidarity (LD) and Mechanism of Local Decision-Making (MD) emerged with the strongest psychometric properties, showing very high factor loadings (0.881–0.899), strong Cronbach's alpha values (0.882 and 0.838), and excellent AVE scores (0.793 and 0.792, respectively). Local Skill (LS), despite comprising nine indicators, also demonstrated high reliability (CR = 0.919) and satisfactory convergent validity (AVE = 0.559). This suggests that a broader set of indicators successfully captured the construct consistently and coherently. Overall, the measurement model fulfilled the recommended benchmarks for reliability and validity in PLS-SEM (Henseler 2017, Hair et al. 2019, Hair Jr et al. 2021). These findings confirm that the model is grounded in solid psychometric principles, providing a reliable basis for subsequent structural analysis.

The coefficient of determination (R^2) for Environmental Education (EE) was 0.377, indicating that approximately 37.7% of the variance in EE is explained collectively by the six predictors: Local Knowledge (LK), Local Resources (LR), Local Skills (LS), Local Values (LV), Local Solidarity (LD), and Mechanism of Local Decision-Making (MD). This value reflects the substantial contribution of local wisdom dimensions to environmental education outcomes in the Dayak Deah community, while also suggesting that other unobserved factors may influence EE in the community.

As shown in Table 7, discriminant validity was evaluated using the Heterotrait-Monotrait Ratio of Correlations (HTMT). This approach is widely recommended because it is considered more reliable than the traditional Fornell-Larcker test. A value below 0.85 is generally considered evidence that the constructs are distinct from one another.

The HTMT values in Table 7 range from 0.153 to 0.575. The lowest value appears between the Mechanism of Local Decision-Making and Local Solidarity at 0.153, while the highest value is between Environmental Education and Local Resources at 0.575. These results show that the constructs are related in practice but do not overlap in terms of measurement.

Some stronger associations were found, such as between Environmental Education and Local Resources (0.575) and between Local Skills and Local Solidarity (0.447). These reflect the natural connections in community life, where education often relies on local resources and solidarity often

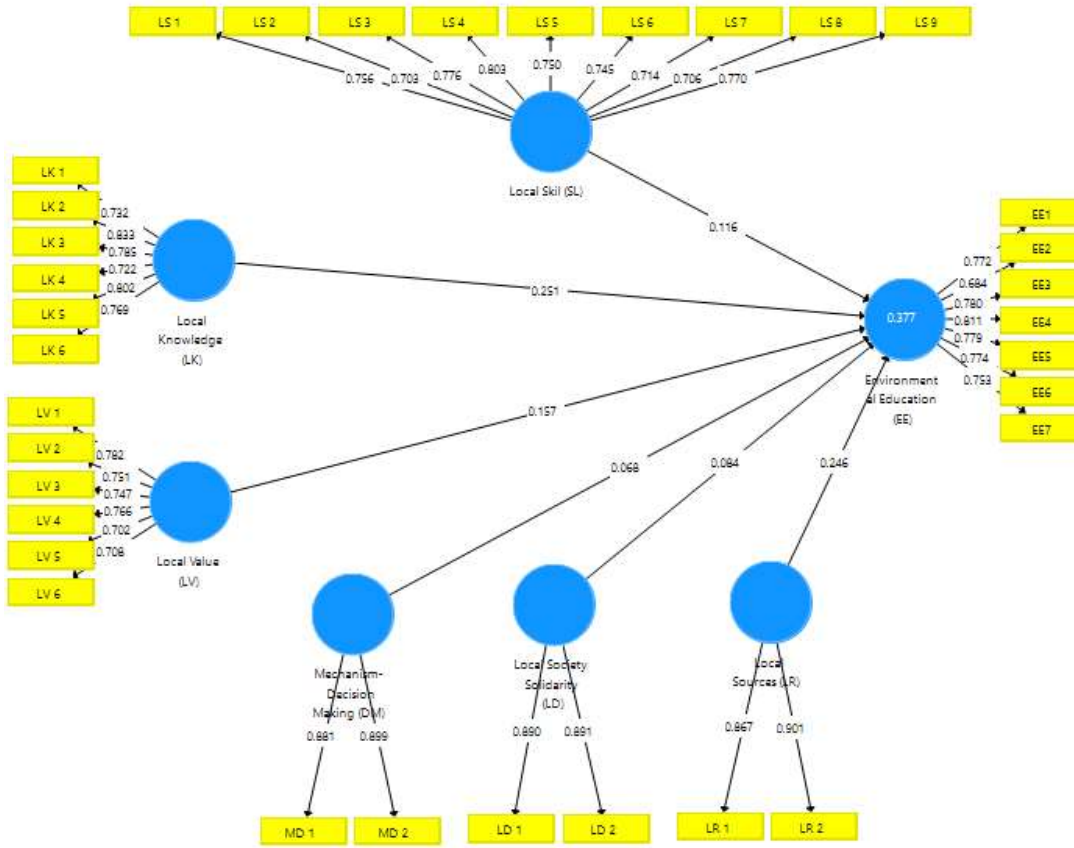

Fig. 3: Environment education model of the Dayak Deah Tribe.

Table 8: Model summary.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Conclusion
Mechanism of local decision-making (MD) -> Environmental Education (EE)	0.068	0.068	0.048	1.431	0.153	Not Significant
Local Knowledge (LK) -> Environmental Education (EE)	0.251	0.257	0.052	4.805	0.000	Significant
Local Resources (LR) -> Environmental Education (EE)	0.246	0.242	0.052	4.709	0.000	Significant
Local Skill (LS) -> Environmental Education (EE)	0.116	0.118	0.049	2.350	0.019	Significant
Local Society Solidarity (LD) -> Environmental Education (EE)	0.084	0.083	0.050	1.682	0.093	Not Significant
Local Value (LV) -> Environmental Education (EE)	0.157	0.159	0.050	3.156	0.002	Significant

depends on shared skills. However, the values remained well below the threshold of 0.85, supporting discriminant validity. Overall, the analysis confirmed that the constructs were sufficiently different. Environmental Education and the six dimensions of local wisdom capture different but connected aspects of the model (Fig. 3). This provides a solid foundation for structural model analysis.

The Influence of the Mechanism of Local Decision-Making on Environmental Education

Based on the data presented in Table 8, the influence of local decision-making mechanisms (MD) on environmental education (EE) was not statistically significant, with a path coefficient of β=0.068 and a p-value of 0.153. Although this finding indicates that the data do not support a direct relationship, it does not diminish the potential value of local governance. Instead, it suggests a more nuanced dynamic: the role of community-based decisions in fostering environmental education may not be straightforward or linear. These mechanisms may exert an indirect effect, perhaps by fostering a sense of collective ownership and responsibility that facilitates engagement in environmental learning. This opens the door for future research to explore these more complex mediated pathways to fully understand how grassroots governance contributes to environmental knowledge and behavior change.

The Influence of Local Knowledge on Environmental Education

Based on the data presented in Table 8, the analysis shows a coefficient value of β = 0.251 with a p-value of 0.000. This indicates that local knowledge plays the most significant role in shaping environmental awareness and behavior within the community. This suggests that the way people understand their natural surroundings, such as forests, ecosystems, and local environmental cycles, forms a strong foundation for conveying ecological values through education.

Local or traditional knowledge is a crucial component of ecological practice. When integrated into community-based environmental education, it is a powerful tool for promoting sustainable practices. In conclusion, the community's local knowledge reflects their deep ecological relationship with nature and makes a meaningful contribution to strengthening environmentally conscious behavior (Berkes et al. 2000, Zainal et al. 2024).

The Influence of Local Resources on Environmental Education

Based on the results shown in Table 8, local resources also had a significant influence on environmental education, with a path coefficient of β = 0.246 and a p-value of 0.000. This indicates that the availability and sustainable use of natural resources, such as water, soil, plants, and forest products, when managed wisely by the community, provide direct and meaningful experiences for sustainable environmental practices.

Such practices contribute to fostering a harmonious reciprocal relationship between humans and nature, while nurturing the community's ecological awareness. This dynamic is reflected in the Dayak Deah community, where the use of local resources plays a vital role in traditional medicine and the utilization of non-timber forest products.

The Influence of Local Skills on Environmental Education

Based on the findings presented in Table 8, local skills within the Dayak Deah community also show a significant contribution to environmental education, with a path coefficient of β = 0.116 and a p-value of 0.019. This indicates that indigenous skills play a significant role in

shaping ecological education. The community's ability to understand natural cycles, engage in sustainable agriculture, hunt, fish, and process forest products and medicinal plants is not merely a matter of daily survival but is a vital aspect of their cultural heritage. However, it has become an integral part of a deeply rooted and lived learning process.

These skills are passed down through generations via direct practice, providing real and contextually relevant learning experiences for community members. In an educational context, experiential learning makes a significant contribution to community environmental awareness and understanding. This reflects the collective memory that shapes ecological behavior. This finding reinforces the idea that education does not always have to occur in formal spaces; it can also emerge from the lived experiences of everyday life, embodying a more authentic form of environmental education (Ardoin & Heimlich 2021).

The Influence of Local Values on Environmental Education

As shown in Table 8, local values significantly influenced environmental education, with a path coefficient of $\beta = 0.157$ and a p-value of 0.002. This finding highlights the significance of the value system upheld by the Dayak Deah community, including the principles of cooperation (gotong royong), respect for nature, and customary prohibitions against the overexploitation of natural resources. These values are not merely social norms; instead, they reflect the community's collective awareness of the need for a balance between humans and the environment.

Within the context of environmental education, such values serve as a form of local environmental ethics that implicitly guide the Dayak Deah community to live harmoniously with their surroundings. This finding supports the notion that effective ecological education does not always require external inputs. Instead, it can emerge organically from within, through the norms and local wisdom that have long shaped human-nature relationships in the region. These values function as a moral foundation, providing social legitimacy for sustainable practices (Zidny et al. 2020).

The Influence of Local Solidarity on Environmental Education

Table 8 also reveals that the dimension of local community solidarity does not show a statistically significant influence on environmental education, with a path coefficient of $\beta = 0.084$ and a p-value of 0.093. However, this does not mean that solidarity should be ignored. In contrast, this result serves as a valuable note indicating that social solidarity, while not yet fully explored or optimized in this context, still shows a positive trend. The p-value approaching the 0.05 threshold suggests that social cohesion may still be relevant in environmental education.

The data suggest that in the Dayak Deah community, solidarity tends to manifest in everyday activities, such as assisting during harvests, participating in cultural ceremonies, and supporting communal needs rather than in initiatives directly related to environmental preservation. Nevertheless, the strong spirit of cooperation and mutual aid (gotong royong) that exists in the community could serve as a robust foundation for supporting environmental education, provided it is harnessed using approaches that align with the community's cultural context (Jana et al. 2024).

DISCUSSION

The research findings indicate that local knowledge, resources, skills, and values significantly influence environmental education in the Dayak Deah community. These results reinforce the argument that environmental preservation is not merely a technical endeavor but is also shaped by dynamic sociocultural practices passed down across generations in Indigenous society. The involvement of indigenous communities plays a substantial role in sustainable environmental management. In this context, both local knowledge and skills may be viewed as traditional methods through which communities sustainably regulate the relationship between humans and nature (Levis 2024).

Specifically, this study highlights that the Dayak Deah community's local knowledge significantly influences environmental education. This is primarily attributed to the community's deep understanding of their ecological landscape, including knowledge of rainfall patterns, planting seasons, endemic plant species, and natural signs used to determine agricultural cycles and the timing of rituals. In the context of environmental education, such knowledge serves as a source of information and a pedagogical resource that fosters respect for the natural world. Traditional knowledge is not merely about understanding facts, but more importantly, about guiding ethical behavior and actions based on that understanding (Berkes et al. 2000, Barnhardt & Oscar Kawagley 2005, Sumarwati et al. 2020, Zidny et al. 2020).

This local knowledge can also be understood within the framework of critical environmental pedagogy, which emphasizes the importance of cultivating ecological awareness through local narratives and the lived experiences of Indigenous communities. Despite their potential to enrich environmental learning with culturally grounded and context-specific insights, these elements are often underrepresented or insufficiently integrated into formal education and teaching practices (Ajaps & Forh Mbah 2022).

Furthermore, the local knowledge possessed by the Dayak Deah community is strongly supported by their traditional skills, including the preparation of medicinal plants, shifting cultivation practices that avoid ecological degradation, and sustainable hunting, fishing, and forest resource processing methods. These skills have been developed through long-term ecological adaptation and are not merely technical routines but reflect the principles of energy efficiency and sustainability. Research findings confirm that these local skills significantly influence environmental education, as they embody direct experiential practices that bridge knowledge with concrete action (Yolida et al. 2023).

Furthermore, the research findings indicate that local resources significantly influence environmental education in schools. This aligns with the understanding that local resources are not merely defined by their physical availability but also by their ecological context, which is interpreted and integrated culturally by the Dayak Deah Indigenous community into their social lives. These resources are embedded with cultural meanings and values that shape environmental awareness and practices, making them essential components of community-based ecological learning (Sechi et al. 2018, Niigaaniin & MacNeill 2022). It emphasizes that natural resources within Indigenous communities are understood holistically as integral elements of a life system rich in cultural, spiritual, and collective identity. Rather than being viewed solely as material assets, these resources are deeply embedded in traditional knowledge systems and social structures, serving as both the symbolic and functional foundations of sustainable living (Muradian & Gómez-Baggethun 2021).

In the belief system of the Dayak Deah Indigenous community, the forest is regarded not merely as a resource for sustenance but also as a sacred space that serves as the dwelling place of ancestral spirits. Similarly, water is not viewed simply as a physical necessity but as a spiritually potent element that embodies the profound connection between humans and nature. This is reflected in the traditional *Tawas Jaa* ceremony, where water is ritually used as a medium to protect the village from disasters and illnesses.

What makes this perspective particularly compelling is the community's view of human-nature relations as inherently interdependent and inseparable from one another. This worldview aligns with the concept of *relational ontology* in political ecology, which emphasizes that nature and society are not distinct spheres but are entangled in a network of reciprocal relationships grounded in cultural, spiritual, and ecological meanings (Meurer & Eitel 2021).

Equally important, the research findings indicate that local values within the Dayak Deah community significantly influence environmental education in the community. These values are not merely norms handed down through generations; instead, they reflect a deeply rooted belief system, ethical framework, and worldview that shape how the community understands and interacts with the natural environment. These cultural values have been shown to meaningfully influence environmental behavior within the community, serving as an internal compass that guides sustainable interactions with the natural environment (Nguyen 2015).

In the context of local values, it is also noted that they possess pedagogical potential that can be transformed into contextual learning in the classroom. These values can serve as a meaningful medium to encourage learners to act ethically and think critically and reflectively about the relationship between humans and nature. This approach to education fosters ecological awareness rooted in local wisdom, making learning more relevant and impactful in the community context (Zidny et al. 2020).

These local values, derived from the historical experiences of Indigenous communities, contribute to the formation of collective ecological memory. This memory serves not only as a cultural repository but also as a mechanism of social regulation, guiding community members to refrain from engaging in environmentally destructive behaviors. Through shared norms and ethical practices passed down across generations, these values embed a sense of ecological responsibility that supports sustainable living and environmental stewardship (Chunhabunyatip et al. 2018). Thus, these values are indirectly connected to social solidarity and decision-making mechanisms within the community. Shared ecological memory and ethical frameworks foster collective awareness, enabling community members to act in unison when addressing environmental issues. The integration of cultural values into communal governance reflects how traditional knowledge and social cohesion contribute to sustainable environmental practice.

Furthermore, local values not only shape ways of thinking but also influence ways of living, as reflected in the community's collective attitudes and responsibilities toward the environment (Horlings 2015, Kenter 2015, Martin 2024). Within the Dayak Deah community, these values serve as foundational pillars for sustainable living, rooted in ecological ethics that emerge from deeply held cultural beliefs. The Dayak Deah community perceives nature not merely as a resource to be exploited but as a sacred entity that embodies life. This deep-rooted philosophy shapes their environmental ethics, aligning with Traditional Ecological Knowledge (TEK), which integrates spiritual beliefs with practical conservation strategies. Indigenous communities

often maintain a spiritual connection with forests, considering them to be living entities deserving of respect and protection (Usop & Rajiani 2021, Mutolib et al. 2024).

For the Dayak Deah community, the forest is not merely land covered with trees but a source of life that must be preserved through rituals, taboos, and community-based management systems (Sharma 2021). This belief system fosters a deep sense of environmental responsibility, ensuring that natural resources are used sustainably in future generations (Siddiqui et al. 2024). This perspective aligns with anthropological and ecological theories that emphasize the role of Indigenous knowledge in conservation. Furthermore, the traditional understanding of the Dayak Deah indigenous community in land management includes shifting cultivation, selective logging, and sustainable harvesting of non-timber forest products (Joshi et al. 2004).

One of their main strategies is shifting cultivation, where land is cultivated for a limited period before being left to regenerate, unlike modern agricultural systems, which often lead to soil degradation (Yang et al. 2020). This method allows for natural regeneration, preserves biodiversity, and maintains soil fertility. Moreover, the community has customary laws regulating forest resource use. For instance, certain areas are designated as hutan larangan (sacred forests), where logging and hunting are strictly prohibited. This local governance system reflects contemporary conservation models, such as Community-Based Forest Management (CBFM), which recognizes the rights of Indigenous communities in environmental stewardship (Aryandini & Parvez 2023).

The Dayak Deah community's environmental governance is deeply rooted in customary law. Violations of these traditional regulations, such as illegal logging or overexploitation, are subject to sanctions determined by tribal elders using a consensus-based approach to decision-making. The concept of denda adat (customary fines) serves as a deterrent to ecological destruction.

For instance, individuals who cut down fruit-bearing trees or beehive trees without permission are fined in real or tajau (traditional currency or ceramic jars), with the penalty amount depending on the tree size and extent of the damage caused. Moreover, fishing practices involving chemicals or electric currents are strictly prohibited, and offenders face customary and state penalties. These regulations not only safeguard natural resources but also reinforce the collective responsibility for sustainability (Chan 2016).

Compared to modern environmental policies, customary governance systems often achieve higher compliance rates because they are integrated with cultural values and community-based enforcement. While statutory laws tend to rely on repressive penalties, customary laws emphasize restoration, compensation, and social accountability (Rahayu et al. 2024).

These traditions cultivate deep ecological awareness by integrating spiritual beliefs into environmental practice. These rituals serve as informal educational tools, ensuring that conservation principles are passed down through generations without external enforcement (Rahayu et al. 2024).

Although their traditions remain strong, the Dayak Deah community faces significant challenges in preserving this environmental wisdom. Deforestation due to commercial logging, agricultural expansion, and government policies that often disregard Indigenous rights threatens the sustainability of their lives. Additionally, younger generations are increasingly drawn to modern lifestyles, leading to a decline in the transmission of traditional knowledge (Wardhani et al. 2024).

Some community members have begun to integrate Indigenous wisdom with modern conservation strategies as a form of adaptation. One example is the development of ecotourism and sustainable agroforestry projects that provide alternative livelihoods while reinforcing environmental awareness.

Government policies must recognize and support Indigenous conservation models by integrating customary law into formal environmental regulations. A participatory approach that includes Indigenous voices in policy-making can ensure that traditional knowledge remains relevant to modern conservation efforts.

CONCLUSIONS

This study highlights the crucial role of indigenous ecological knowledge in the environmental management practices of the Dayak Deah Community. Their deep spiritual and cultural connection to nature fosters sustainable land-use practices, including community-based forest governance, selective logging, and the harvesting of non-timber forest products. Traditional rituals and customary laws play a central role in resource conservation, ensuring environmental sustainability, and fostering social cohesion in the region.

Despite the resilience of these traditions, external pressures such as deforestation, agricultural expansion, and shifts in cultural values among younger generations pose significant challenges. Integrating local wisdom into formal education and conservation policies is crucial for sustaining indigenous environmental knowledge. Initiatives such as ecotourism and sustainable agroforestry provide viable models for balancing economic development and ecological preservation.

The findings of this study contribute to the broader discourse on community-based conservation and the integration of Indigenous knowledge into modern environmental governance. Future research should explore strategies for strengthening the transmission of traditional ecological knowledge to younger generations and assess the long-term impact of policy interventions on Indigenous environmental management systems. Strengthening collaboration between Indigenous communities, policymakers, and researchers is critical to ensuring a sustainable and culturally inclusive conservation approach.

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