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Environmental Education Model Based on Local Wisdom of the Dayak Paramasan Tribe Indonesia

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ABSTRACT

The indigenous knowledge of the Dayak Paramasan in Indonesia holds the potential for environmental sustainability. This study aims to assess an environmental education framework grounded in the local wisdom of the Paramasan Dayak tribe. A survey was conducted among 300 individuals, including traditional leaders and members of indigenous communities residing in the Paramasan Subdistrict, Indonesia. Data collection occurred from May 2023 to July 2023 and was analyzed using Structural Equation Modelling (SEM). The findings indicate a significant association between indigenous values, local expertise, and community cohesion concerning environmental education. Local wisdom includes local skills, values, and community solidarity, which are crucial for environmental education. Local skills, like farming and hunting, have a significant impact on environmental protection. Passing down knowledge to younger generations needs improvement. Limited local resources create a gap between generations, but some believe traditional leaders can safeguard nature without formal education. Further exploration of implementing environmental education models within school settings will offer valuable insights for Indigenous communities and society, fostering environmentally conscious behaviors.

INTRODUCTION

The dimensions of local wisdom of the Dayak tribe include the preservation of cultural values and practices, sustainable management of the environment, and the use of traditional architecture and spaces for cultural activities. The Dayak tribes have a rich cultural heritage passed down from generation to generation, including traditional practices such as Dayak Binatur (Purba et al. 2021). They also have local wisdom in managing forest areas, such as the Bahuma Batahun system, which involves correctly burning forests at the right time to prevent disasters (Wahyu 2021). The Dayak Jangkang Bokidoh tribe has tangible and intangible architectural values, with traditional houses and spaces used for cultural activities like the "Gawai" ceremony (Fajarwati & Masruri 2019). The local wisdom of the Dayak tribe in Central Kalimantan has been diminishing, but it offers unique opportunities for researchers to explore their cultures, traditions, and biodiversity (Setyabudi et al. 2021).

Local wisdom plays a crucial role in environmental sustainability. It encompasses the values and practices passed down through generations and aimed at maintaining the natural environment. The implementation of local wisdom can be seen in various aspects, such as river preservation, entrepreneurship development, water resource conservation, and ecological guidelines. For example, the Kali Loji Festival in Pekalongan City, Indonesia, teaches the community to preserve the river and increases public awareness of river sustainability (Santoso et al. 2020). In Kulonprogo, Indonesia, sustainable entrepreneurship is developed to harmonize economic development with environmental preservation, and local wisdom is recognized as one of the domains for sustainable entrepreneurial development (Kartika et al. 2020). Similarly, in Lempur, the local wisdom of society is essential in conserving water resources and ensuring their proper conservation (Ferry 2019). Furthermore, the people of Kampung Naga in Tasikmalaya implement local wisdom to preserve the environment and sustain natural resources (Asteria et al. 2021). Lastly, integrating STEM education and character-based local wisdom in Indonesia enhances sustainability literacy and empowers local wisdom as an approach to invention (Akbar et al. 2020).

Environmental sustainability is paramount in ensuring our planet's and future generations' long-term well-being. It involves preserving the ecological system's structure and functions, assessing the ecosystem's state, and aligning

business operations with sustainable practices (Sulimin et al. 2021). Current diets and agricultural practices contribute to environmental problems such as climate change, biodiversity loss, and water shortages, emphasizing the need to change food systems and dietary choices (Rose et al. 2019). Shifting towards more sustainable dietary patterns and adopting new food analogs with lower environmental impacts can help reduce the global environmental impact of food production (Cottrell et al. 2021). However, ensuring that these new foods effectively drive the disadoption of existing high-impact alternatives is crucial to prevent exacerbating the environmental impact of human diets. Environmental sustainability is essential for maintaining a healthy planet and achieving a sustainable future.

Local wisdom refers to the ideas, values, and views that are wise, valuable, and inherent to a local community. It encompasses cultural, economic, communication, and ecological aspects and attitudes that are naturally created and passed down through customs or ancestral teachings (Limba et al. 2023). Local wisdom is the heritage of cultural values and norms that are strategically reformed and developed in the era of Information Technology (Ezir et al. 2023). It is a characteristic or culture that develops locally and is passed down from generation to generation, embodying cultural values (Sari et al. 2023). Local wisdom is seen as relevant to learning mathematics and can include various aspects of culture, such as philosophy, values, norms, ethics, rituals, beliefs, habits, and customs (Messy et al. 2023). Additionally, local wisdom serves as a means of social control and shared values that guide the lives of local people, preserving the environment and maintaining a balance between the needs of local life and ecological sustainability (Handayani & Suparno 2023).

Local wisdom positively correlates with environmental education (Duriani et al. 2019, Kurniasari et al. 2020, Mahendra 2021, Susanti et al. 2018). Local wisdom is believed to instill students' awareness and love for the environment (Hilman & Sunaedi 2018). The challenges of applying local wisdom in the educational environment include the impact of technological development, changes in the physical environment, contact with other communities and the culture of the community replacing local culture, and the perception that local wisdom is complicated and slow compared to modernity (Munawwarah & Astuti 2019). However, efforts to conserve local wisdom and integrate it into education can effectively function in promoting cultural education and advocating for social-cultural equality (Chaer et al. 2021). The massive use of technology poses a threat to local wisdom, but when combined with technology, local wisdom can increase people's understanding of its values and importance in education (Komariah & Asyahidda 2020). The need for instructional materials incorporating local wisdom is evident, as existing materials often fail to fulfill students' needs and implement character values (Yuniyati 2017). Integrating local wisdom values, such as tolerance and cooperation, into the national curriculum can contribute to maintaining national unity and diversity (Yamin & Wahyu 2018).

Spirituality and connectedness with nature are closely linked. Research has shown that spirituality can be part of well-being and influence well-being (Ryff 2021). Additionally, individuals with a strong sense of connectedness with nature, known as human-nature connectedness (HNC), tend to have higher levels of well-being and engage in pro-nature behaviors (Barragan-Jason et al. 2022). Indigenous worldviews also emphasize the importance of relationships with the environment for well-being (Keaulana et al. 2021). Furthermore, studies have found that connectedness to nature positively relates to sustainable behavior (Navarro et al. 2020). Parents' self-efficacy in engaging their children in nature-related activities, known as nature connectedness parental self-efficacy (NCPSE), is also associated with greater nature connectedness and well-being (Barnes et al. 2021). These findings suggest that spirituality, connectedness with nature, and well-being are interconnected and can positively affect individuals and their engagement with the natural world.

Local wisdom plays a significant role in the management of natural resources. It involves utilizing traditional knowledge and practices to support sustainable nature management and biodiversity conservation (Sonbait et al. 2021). Local wisdom is often embedded in communities' cultural and social systems, guiding their interactions with the environment and shaping their livelihoods (Intem et al. 2021). This includes accumulating, transferring, and inheriting knowledge from generation to generation, contributing to self-reliance, and preserving local identity(Setiawan et al. 2021). Local wisdom also informs the management of forest areas, with communities adhering to traditions, rules, and restrictions passed down through the years (Nurhayati et al. 2021). In fisheries resource conservation, local wisdom is valuable for tourism education and protecting fisheries resources(Rozaki et al. 2020). By incorporating local wisdom into natural resource management, communities can maximize the benefits of these resources while ensuring long-term sustainability.

The tradition of Gotong Royong, a form of cooperation and collaboration, is still actively practiced in Indonesian society in rural and urban areas (Simarmata et al. 2020). This tradition has been observed in various contexts, such as

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disaster response in Palu Valley, where ethnic and religious communities and non-governmental organizations played a significant role in the emergency response phase (Alamsyah et al. 2020). Cooperation has also been observed in the face of the COVID-19 pandemic, where communities have come together to provide mutual help and support, contributing to societal resilience (Bahagia et al. 2020). Gotong Royong is deeply rooted in Indonesian culture and has been recognized as crucial for community development and poverty reduction (Slikkerveer 2019). However, there is evidence of a decline in social trust and cooperation among different generations, indicating a change in societal values (Tomo et al. 2020). Overall, the tradition of Gotong Royong and collaboration continues to play a significant role in Indonesian society, fostering community resilience and unity.

Indigenous roles and Indigenous leadership are essential aspects in various contexts. The crucial role played by a solid local Aboriginal workforce in health care delivery emphasizes the importance of collaboration in developing effective prevention programs at a community level (Stroud et al. 2021). Indigenous research leadership can enhance research benefits to Indigenous communities (Kiatkoski Kim et al. 2021). The scholarly upbringing of Indigenous leaders from the Krikati (western Maranhão area, Central Brazil) people highlights the determination of native leaders to appropriate Western knowledge, contributing to the strengthening of their leaderships and the realization of projects in their territories (de Oliveira Silva et al. 2021). Indigenous leadership operates from the connected place of family and community, striving for better conditions and outcomes for all Indigenous peoples (Ryan & Evans 2020).

Environmental sustainability is an integral part of the Dayak tribal identity. The Dayak Ngaju community views the forest as sacred, communally owned, protected based on customary law rules, and passed down through generations(Ahmad 2020). The Central Borneo Dayak Tribe uses singers and jipen as ethical punishments to maintain environmental conditions and reduce ecological change (Azhari 2019). The Dayak Jalai community utilizes environmental history to reduce disaster risk and increase awareness of natural disasters (Wibowo et al. 2019). The indigenous peoples of Borneo have appropriate

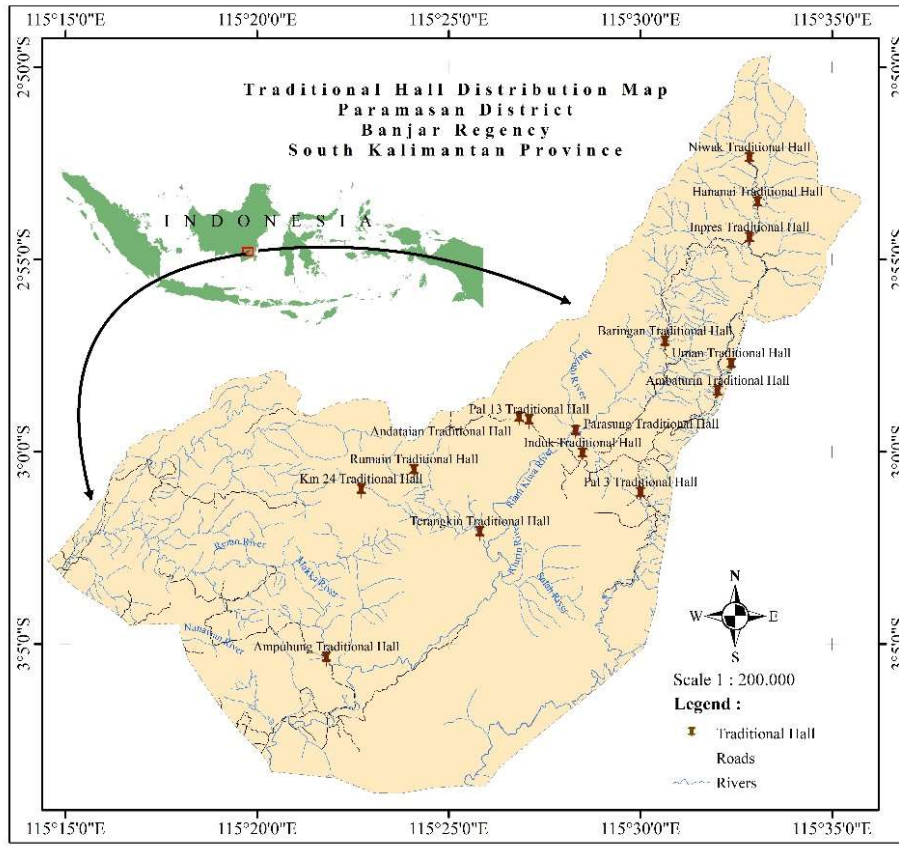

Fig. 1: Map of the research location.

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images of their close connection to nature to address economic, cultural, and ecological challenges (Duile 2017). Sustainable development is essential for businesses in global markets, and companies should respect and apply sustainability principles (Paurova & Chlebikova 2020).

MATERIALS AND METHODS

Research Location

This study was conducted in Paramasan, South Kalimantan, Indonesia. The map of the study site is shown in Fig. 1.

Data Collection

The data were collected using questionnaires distributed to a total of 300 respondents. They live as indigenous peoples in Angkipih Village, Paramasan Atas Village, and Paramasan Bawah Village, Indonesia. The data collection was carried out from Mei 2023 to July 2023. The variables used to analyze the environmental education model of the Dayak Paramasan tribe are local knowledge (LK), local values (LV), local skills (LS), local sources (LSo), Mechanism of local decision-making (MLDC), Local Society Solidarity (LSS) and Environmental Education (EE). We asked 35 questions on the questionnaire. The 35 items employed a Likert scale (1-5, strongly disagree-strongly agree).

Data Analysis

The data were analyzed using Structural Equation Modeling (SEM). Factors loading was used to assess discriminant validity, where only items with factors that outperformed 0.50 would remain in the model (Hair Jr et al. 2017). The hypotheses in this study are: Dimensions of Local Wisdom of the Paramasan Dayak Tribe (1-6) have a positive influence on Environmental Education (EE)

1. Local Knowledge (LC) has a positive influence on Environmental Education (EE)
2. Local Value (LV) has a positive influence on Environmental Education (EE)
3. Local Skill (LS) has a positive influence on Environmental Education (EE)
4. Local Source (LSo) has a positive influence on Environmental Education (EE)
5. Mechanism of local decision-making (MLDC) has a positive influence on Environmental Education (EE)
6. Local Society Solidarity (LSS) has a positive influence on Environmental Education (EE)

RESULTS AND DISCUSSION

Local Knowledge of The Dayak Paramasan

The local knowledge of indigenous people can be used in environmental education by integrating it into the curriculum and teaching practices. This can be achieved by incorporating indigenous practices, traditional ecological knowledge (TEK), and indigenous storytelling (Brondo et al. 2023, Matsekoleng & Mapotse 2023). By including indigenous knowledge, environmental education can provide a fresh perspective on environmental issues and offer solutions grounded in indigenous practices (Rosemary A. Kinch 2016). Integrating indigenous and local knowledge into sustainability and environmental education can promote epistemological justice and enhance students' identity and learning outcomes (Druker-Ibáñez & Cáceres-Jensen 2022). However, challenges are associated with incorporating Indigenous knowledge, such as the need for resources and support and the need for actors to navigate different frames of reference (Njoh et al. 2022). Despite these challenges, incorporating indigenous knowledge into environmental education can contribute to a more inclusive and holistic approach to sustainability.

The Dayak Paramasan people possess a profound knowledge of natural phenomena and signs that indicate shifts in seasonal cycles, including the transitions between dry and rainy seasons. They comprehensively understand the types and names of animals and plants in their village, including wild and domesticated species. However, only a limited number of these were mentioned in interviews due to their frequent encounters or protection within the area (Wardhani et al. 2023).

Local Value of the Dayak Paramasan

Indigenous peoples' values in environmental education emphasize interculturality, transversal, flexible approaches to education, and a connection to the natural world (Damas da Silveira & Aily Franco de Camargo 2015). They aim to promote environmental learning and reconnection with the natural world while also rebuilding and strengthening Indigenous identities, cultures, and ways of life (Nesterova 2020). Indigenous education models have long recognized the interconnectedness of humans and the environment and incorporate concepts of transformation, holism, caring, and responsibility (Mckeon 2012). Indigenous pedagogies and environmental education can complement each other in transformative endeavors, providing alternative pedagogies that value and harness the diversity of students' backgrounds and experiences (Biermann 2008). Indigenous peoples' knowledge about the environment and sustainability,

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Fig. 2: Ritual of Dayak Paramasan Indonesia.

particularly regarding the cultural role of ethnicity, is considered in designing educational materials for environmental education (Cebrián-de-la-Serna & Noguera-Valdemar 2010). The Paramasan community adheres to strict regulations during their traditional environmental protection rituals (Fig. 2), which include restrictions on logging, hunting, and other activities that harm nature (Wardhani et al. 2023).

Local Skill of the Dayak Paramasan

The local skill of the Dayak Paramasan indigenous people in environmental education is an essential aspect of their cultural heritage. They deeply understand their natural surroundings and have developed sustainable practices to conserve the environment (Tajibu 2020). The Dayak Paramasan people have traditional knowledge and practices that contribute to disaster risk reduction and environmental change management (Damas da Silveira & Aily Franco de Camargo 2015). They utilize their local indigenous knowledge in various ways, such as emergency evacuation and post-disaster relocation, food and livelihood security strategies, and weather forecasting from animals and celestial bodies (Surtikanti et al. 2017). The elders are crucial as local hazard forecasters and are dedicated to transmitting and preserving their local indigenous knowledge to the younger generation (Cuaton & Su 2020). This local skill is not only valuable for the Dayak Paramasan people but also has the potential to contribute to broader environmental education efforts (Gunawan & Dharman 2017).

The Paramasan Dayak community possesses a range of indigenous expertise in hunting, agriculture, and collecting resources from the forest, with hunting being primarily conducted for cultural rituals and employing a combination of traditional and contemporary tools while prioritizing minimal harm to terrestrial, aquatic, and avian fauna (Wardhani et al. 2023).

Local Source of the Dayak Paramasan

Indigenous peoples have been actively involved in environmental education, incorporating their knowledge systems and ways of knowing (Nesterova 2020). This involvement supports environmental learning, reconnecting with the natural world, and rebuilding and strengthening Indigenous identities, cultures, and ways of life (Damas da Silveira & Aily Franco de Camargo 2015). Indigenous schools in Brazil also emphasize the importance of environmental education and promote interculturality, transversal, and flexible approaches to education in their syllabuses (Cebrián-de-la-Serna & Noguera-Valdemar 2010). In the sub-region of Amazonia-Orinoquia in Venezuela, research was conducted to analyze indigenous peoples' knowledge about the environment and sustainability, particularly regarding the cultural role of ethnicity (Verma et al. 2016). The study also aimed to design and elaborate educational materials that address environmental education related to the cultural role that ethnic groups play in species preservation. These objectives were achieved through collaboration with indigenous communities and using various data collection techniques.

Local resources found in the forest, such as *Durio dulcis, Durio oxleyanus* Griff, *Nephelium ramboutanake* Lennh, and others, contribute to the biodiversity and ecological balance of the area. Similarly, local resources in the garden and water, including *Mystacoleucus padangensis* and *Barbonymus gonionotus* Bleeker, play a significant role in sustaining the local ecosystem (Wardhani et al. 2023).

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A Mechanism of Local Decision of The Dayak Paramasan

Indigenous peoples have been actively engaged in collaborative research projects and environmental education programs to address climate change and ecological degradation. These initiatives aim to incorporate Indigenous knowledge systems and ways of knowing, promote reconnection with the natural world, and strengthen Indigenous identities and cultures (Damas da Silveira & Aily Franco de Camargo 2015, Nesterova 2020). In the context of indigenous schools, environmental education should be rooted in interculturality, transversally, and flexible approaches that are linked to the natural world and the social dynamics of indigenous children and young natives (Cebrián-de-la-Serna & Noguera-Valdemar 2010). Research conducted in the Amazonia-Orinoquia sub-region involved indigenous communities as subjects and objects of analysis, focusing on analyzing their knowledge about the environment and sustainability. The study also aimed to design educational materials that address environmental education related to the cultural role of ethnic groups in species preservation (Magni 2017). Indigenous knowledge systems can contribute to sustainable practices, land and resource management, climate change adaptation, and disaster risk reduction strategies. Ensuring Indigenous peoples' full access to land and justice to realize their rights and foster an integrated knowledge system involving Indigenous groups in decision-making is essential.

All villages in the Paramasan Sub District possess customary institutions, although they need legal provisions on a national scale. The customary law in Paramasan District is being effectively implemented, adhering to government regulations. Local communities are granted the right to utilize their natural surroundings responsibly and abide by regional regulations, allowing them to cultivate their land (Wardhani et al. 2023).

Local Society Solidarity of The Dayak Paramasan

Local society solidarity in environmental education is crucial for achieving effective environmental outcomes and promoting community empowerment. Studies have shown that community environmental education, which includes public participation, environmental adult education, and environmental communication, can lead to collaborative efforts between organizations and local communities, resulting in improved local environments (Blair 2008). However, community participation in environmental management and activities is often limited and symbolic rather than effective or collaborative (Bilar & De Mendonça Pimentel 2020). It is essential to incorporate social participation and environmental education into protected areas to promote community empowerment and raise citizen participation (Malone 1996). Additionally, community participation significantly stimulates pro-environmental behaviors and place attachment, which is essential for achieving eco-environmental protection goals (Zhang et al. 2020). Factors such as lower income inequality, more businesses, and democratic political participation can contribute to higher levels of within-community cooperation for a shared green reputation (Rivera et al. 2017).

Cooperation in nature activities is well-executed due to mutual assistance and adherence to a predetermined schedule. Residents from different villages also contribute, particularly in land clearing, planting, and harvesting. When the work area is extensive and the workforce is inadequate, wage labor is employed for 8 hours with a wage of 120,000. Community cooperation is evident in various activities scheduled for each village or customary area, such as bridge repairs and road cleaning on Sundays for the Balai Matang Lahung indigenous community. The Balai 24 customary community conducts road and bridge construction every Wednesday (Wardhani et al. 2023).

Environmental education models based on local wisdom have been explored in several studies. These models aim to integrate local knowledge and practices into educational strategies to promote sustainable thinking and behaviors (Chaer et al. 2021). One study focused on developing an environmental education model beyond cognitive learning and addressing affective and psychomotor aspects (Dudung et al. 2019). Another study examined the relationships between community contexts and the application of local wisdom in school management of education, suggesting that the involvement of community members and experts is crucial for the successful implementation of local wisdom in schools (Lander 2017). Additionally, a study proposed a model of education suitable for underdeveloped areas, prioritizing local wisdom and improving the quality of education in lagging regions (Jahja 2016). These studies highlight the importance of incorporating local wisdom into environmental education models to enhance sustainability education and promote local knowledge and conservation practices.

Environmental education models based on local wisdom are seen from various aspects, including local knowledge, local values, local skills, local sources, mechanism of local decision-making mechanisms, and local societal solidarity. There are around 35 questions regarding the dimensions of local wisdom of the Paramasan Dayak tribe to obtain an environmental education model. The loading factor value is relatively high, with a value of > 0.5 and Cronbach's Alpha

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Table 1: Summary of measurement models.

Construct	Item	Loading Factor	Cronbach's Alpha
Local Knowledge (LC)	LC1	0.710	0.833
	LC2	0.755	
	LC3	0.657	
	LC4	0.796	
	LC5	0.806	
	LC6	0.699	
Local Value (LV)	LV1	0.617	0.848
	LV2	0.765	
	LV3	0.660	
	LV4	0.653	
	LV5	0.763	
	LV6	0.786	
	LV7	0.818	
Local Skill (LS)	LS1	0.721	0.872
	LS2	0.681	
	LS3	0.711	
	LS4	0.720	
	LS5	0.679	
	LS6	0.624	
	LS7	0.678	
	LS8	0.737	
	LS9	0.763	
Local Source (LSo)	LSo1	0.940	0.865
	LSo2	0.937	
Mechanism of Local Decision Making (MLDC)	MLDC1	0.892	0.745
	MLDC2	0.893	
Local Society Solidarity (LSS)	LSS1	0.882	0.761
	LSS2	0.914	
Environmental Education (EE)	EE1	0.665	0.887
	EE2	0.667	
	EE3	0.817	
	EE4	0.795	
	EE5	0.747	
	EE6	0.865	
	EE7	0.845	

Source: Questionnaire Results (2023)

> 0.7. In Table 1, a summary of the measurement model is presented.

The correlation between local knowledge, local value, local source, local society solidarity, and environmental education ranges from 0.6 to 0.7. The lowest correlation value is between the Mechanism of Local Decision Making in environmental education and other correlation values, namely 0.584. The highest correlation value is between local skills in environmental education compared to other correlation values, namely 0.741. It indicates that the relationship between local skill and environmental education is closer than the relationship between other local wisdom variables (Table 2).

The influence of local skills on environmental education is more significant than that of other local wisdom. This shows that farming, hunting, and forest product-gathering

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Table 2: Correlation between local wisdom on environmental education.

Variable	Environmental Education
Local Knowledge	0.671
Local Value	0.715
Local Skill	0.741
Local Source	0.694
Mechanism of Local Decision-Making	0.584
Local Society Solidarity	0.682

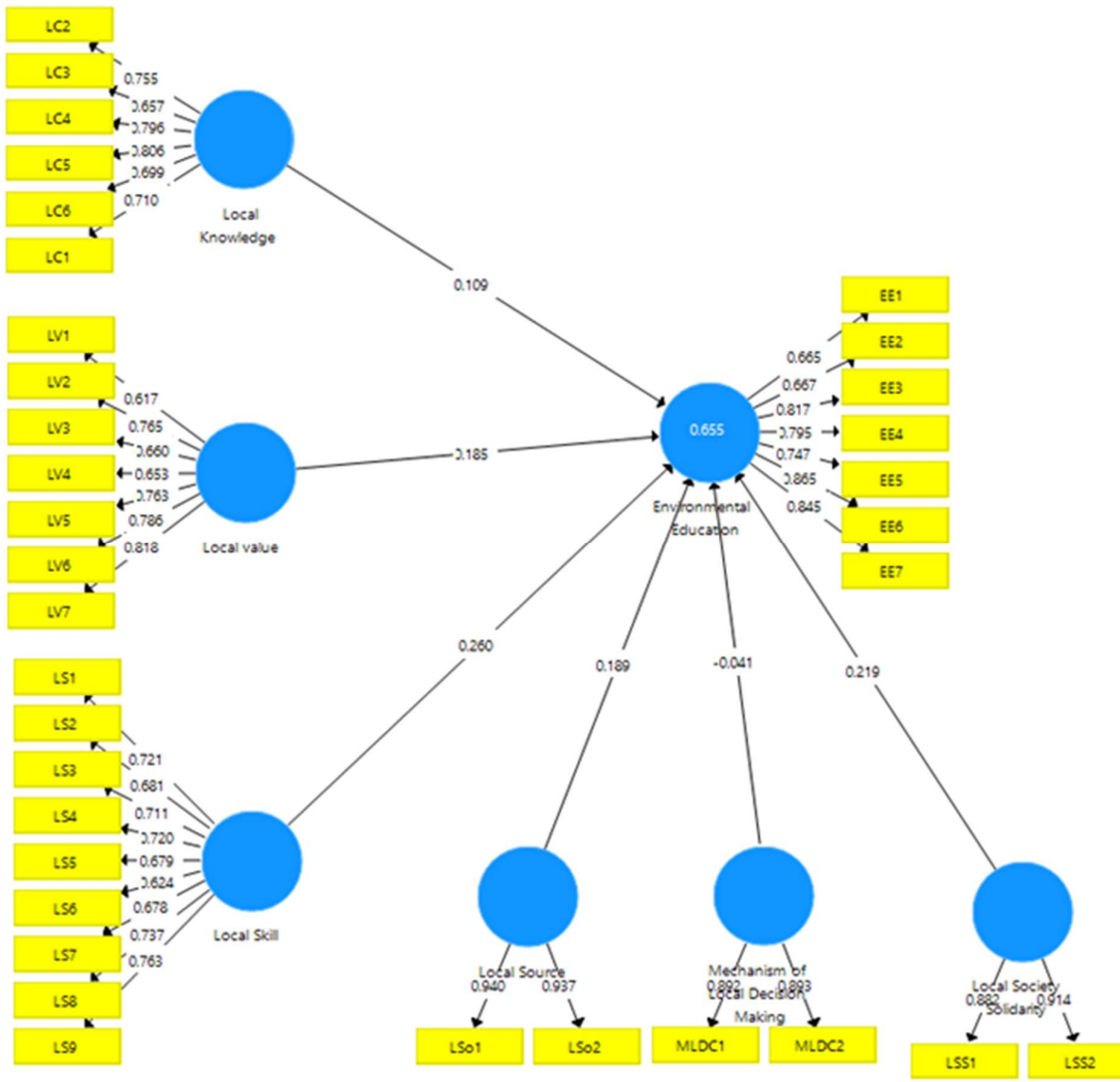
Source: data processing with SEM (2023)

skills significantly influence environmental education compared to different aspects.

The Environmental Education Model Based on the Local Wisdom of the Paramasan Dayak Tribe is shown in Fig. 3 and Table 3.

The p-value shows <0.05, causing the influence of the variable's local values, local skills, and local community solidarity with environmental education to be significant, while the variable's local knowledge, local resources, and regional decision-making mechanisms on environmental education are not significant.

Based on the data above, local skills have the highest significance value for environmental education, namely 0.260. The local skills of the Paramasan Dayak tribe include



(Source: data processing with SEM 2023).

Fig. 3: Environmental Education Model Based on Local Wisdom of the Paramasan Dayak Tribe.

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Table 3: Model summary.

Model Summary	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Conclusion
Local Knowledge -> Environmental Education	0.109	0.115	0.082	1.326	0.185	Not Significant
Local Value -> Environmental Education	0.185	0.185	0.074	2.502	0.013	Significant
Local Skill -> Environmental Education	0.260	0.265	0.092	2.825	0.005	Significant
Local Source -> Environmental Education	0.189	0.175	0.107	1.766	0.078	Not Significant
Mechanism of Local Decision Making -> Environmental Education	-0.041	-0.036	0.075	0.542	0.588	Not Significant
Local Society Solidarity -> Environmental Education	0.219	0.221	0.086	2.560	0.011	Significant

Source: Data Processing with SEM (2023)

animal hunting techniques (water, land, and air), farming techniques, techniques for gathering forest products, and ways to preserve natural products to be utilized by the next generation.

Local skills have the highest significance value for environmental education. Using local examples and skills in environmental education can provide a sensible and necessary approach to fostering a sense of informed stewardship in students (Dale & Carlisle, 2008). Locality in environmental education is essential, and local and contextual activities can contribute to a better understanding of ecological problems (Robottom 2004). Integrating environmental issues based on local wisdom into the elementary school curriculum can help create awareness and knowledge among students (Gündüz et al. 2019). The effectiveness of environmental education relies heavily on educators' knowledge, skills, and attitudes, emphasizing the importance of education and awareness among teachers (Sarbaini et al. 2022). Therefore, local skills are critical in environmental education because they contribute to a deeper understanding of environmental problems and enhance sustainable development

Local community solidarity also significantly influences environmental education, which can be seen at a value of 0.219. This value shows a more significant influence compared to the local value. The strong solidarity of the local Dayak Paramasan tribe can be seen from the existence of cooperation activities in various stages of farming, community activities, and various ritual or ceremonial activities carried out by indigenous communities.

Local community solidarity plays an essential role in environmental education (do Amaral et al. 2020, Gallay et al. 2021, Grúňová et al. 2017, Salazar et al. 2022, Schmitz et al. 2010). Collaborative educational models that link environmental sustainability with community engagement and social justice effectively promote sustainable communities. Environmental education programs for school children in local communities have been found to increase knowledge and support conservation activities. Engaging students in environmental projects in their urban communities fosters an appreciation for nature and promotes pro-environmental leadership and behavior. Regional/ municipal governments can facilitate school participation in environmental education programs, especially in communes where local authorities can promote voluntary initiatives. Environmental education programs that involve schools and communities in joint planning and implementation processes strengthen ties between schools and local communities and promote environmental awareness.

Local values provide a significant influence on environmental education worth 0.185. This value is among the lowest of the other two dimensions of local wisdom: local skills and community solidarity. The local values of the Paramasan Dayak tribe consist of carrying out traditional ritual/ceremonial processes to respect nature, obedience in avoiding various prohibitions or restrictions related to environmental management, application of local wisdom values that support the sustainable development of the village, and awareness of the importance of passing on local values to the next generation.

Local values provide a significant influence in the field of environmental education. Studies have shown that environmental education can effectively change students' environmental attitudes and behavior, which depends on their relationship with the natural world and their ecological worldview (Ma et al. 2021). Additionally, utilizing local examples in environmental education is a logical and indispensable approach, as it helps cultivate an enlightened sense of stewardship in students and builds social capital in society (Robottom 2004). In addition, research has confirmed that environmental education can result in the cultivation

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of ecological values and the formation of students' environmental experiences, both essential for promoting environmental sustainability and resolving environmental difficulties (Liu et al. 2018). Therefore, incorporating local values and experiences into environmental education can increase its efficacy and positively impact environmental outcomes.

Local knowledge, local resources, and regional decision-making mechanisms on environmental education may not be significant due to various factors. One possible reason is the lack of teaching materials and limitations on teachers' capabilities, which hinder the successful implementation of environmental education programs (Mendoza Jr et al. 2023). Additionally, neoliberal capitalism's constraints placed on conservation NGOs can limit the incorporation of local experiences, memories, and knowledge in environmental education programming (Brondo et al. 2023). Furthermore, the involvement of local stakeholders in adaptive ecosystem management choices can play a crucial role in influencing knowledge retention and pro-environmental behavior intentions (Krogman 2017). It is also essential to consider the influence of social capital and cognitive dimensions on individual environmental knowledge and behavior (Sechi et al. 2018). Lastly, capturing and sharing local ecological knowledge in a digital format can be challenging, especially in communities with limited technical skills or no formal education (Vitos 2018).

Discussion

The local wisdom of the indigenous Dayak Paramasan people in preserving the environment is based on their deep connection and respect for nature. They view the forest as more than just an economic asset, it is a part of their life and belief system (Suswandari et al. 2022). The Dayak Paramasan people practice sustainable behaviors, such as conserving land and resources and utilizing traditional rules and customs to guide their ecological behavior (Rachmat Effendi et al. 2020). They treat the forest with the same care and respect as they would, understanding that nature's well-being is interconnected with their well-being (Fahrianoor et al. 2016). This local wisdom is reflected in their livelihoods, social values, knowledge, and beliefs centered around maintaining a harmonious relationship with the environment (Rahmawati 2015). The Dayak Paramasan people's preservation efforts are crucial in the face of deforestation and forest degradation, as they recognize the importance of protecting and conserving plant diversity for their sustenance and future generations (Herianto et al. 2018).

A local wisdom-based environmental education model can potentially increase pro-environmental activity. This model integrates environmental education with existing subjects in schools, allowing for applying environmental knowledge in daily life (Lyesmaya et al. 2020), by incorporating local wisdom and culture into education policies, character education based on local knowledge can be implemented, leading to better cultural education and advocating for social-cultural equality (Lander 2017). Additionally, the proposed model for education for sustainability based on wisdom provides a theoretical framework that connects educators to existing education and developmental theories, supporting curricular design and assessment (Jahja 2016). When implemented effectively, education for sustainability can encourage the development of wisdom and promote sustainable thinking and behaviors among students (Chaer et al. 2021). Therefore, a local wisdom-based environmental education model can potentially foster pro-environmental attitudes and actions among individuals (Filipović 2018).

The Dayak Paramasan community has six dimensions of local knowledge in managing the environment that must be maintained. These dimensions include togetherness, obedience, consensus, fairness, and caring (Utomo et al. 2020). Norms play a role in utilizing natural resources, including prohibitions/taboos and suggestions (Chaiphar et al. 2013). Beliefs are also important, with practices such as providing *labuhan*/offerings and *Selamat*/*ritual* (Dirhamsyah et al. 2020). The community's knowledge management is divided into internal and external knowledge exchange (Wibowo et al. 2019). Additionally, the community participates in specific activities through group formation, such as saving money and handicraft production (Himawan et al. 2014). Therefore, the six dimensions of local knowledge the Dayak Paramasan community must maintain in managing the environment are values, norms, beliefs, internal knowledge exchange, external knowledge exchange, and active participation in environmental preservation.

Local wisdom plays a significant role in environmental education in Indonesia (Fatmawati 2021)(Hanafie Das et al. 2022). It is evidence of the behaviors and values of local people that are mutually agreed upon in a particular place (Parker & Prabawa-Sear 2020). However, there are shortcomings in environmental education in Indonesia, including underqualified teachers and outdated pedagogy (Parker 2018). The Indonesian government has recognized the need for environmental awareness in schools and has implemented the Adiwiyata program, but its influence has been low. To address these issues, education in Indonesia needs to undergo a cultural transformation and be expanded to reach various sectors. Overall, local wisdom can contribute to environmental education in Indonesia, but there is a need for improvement in the current educational system.

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Local science-based environmental education models play an essential role in safeguarding the environment into the future. These models provide guidelines for educators and managers to better understand and manage the learning environment in which environmental education programs occur (Buchan 2004). They also help promote innovative and engaging activities that underline the scientific aspect of environmental education, provoking interest in green sciences among students and increasing the number of students choosing science-related subjects (Lichtveld 2010). Environmental education is a lifelong interdisciplinary field of study that helps inculcate awareness, skills, attitudes, knowledge, and participatory potential in people to adjust their activities in a way that does not clash with the environment (Markaki 2014). Teacher training programs in environmental education and adequate funding for conservation research and resources are necessary for the future development of environmental education (Mushtaq et al. 2020).

CONCLUSIONS

Local wisdom encompasses various aspects, including local skills, local values, and local community solidarity, and these elements play a significant role in environmental education. Among these, local skills have the most substantial impact on environmental education. This is evident in the fact that farming, hunting, and forest product-gathering skills are more effective in environmental protection than other aspects of local wisdom. Local values also influence environmental education, although there is room for improvement, particularly in transmitting knowledge and traditions, especially during rituals, to younger generations. The limited availability of local knowledge, local decision-making processes, and local resources highlights a knowledge gap between older and younger generations. Some believe that as long as traditional leaders exist, there's no need for formal study, but they continue to safeguard nature based on the knowledge they possess.

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