

## Evaluation Of Differences In Environmental Awareness Among Students From 10 Provinces In Sumatra Using The PLS-SEM Approach

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### Abstract

This research aims to analyze the factors influencing environmental awareness among young people on the island of Sumatra. The research focus is directed toward students from ten provinces in Sumatra who are studying at the State Forestry Vocational School in Pekanbaru. The research method used is a quantitative approach with a descriptive-comparative design. Data was collected using a Likert-scale questionnaire that measured three dimensions of environmental awareness: knowledge, attitudes, and pro-environmental behavior. Data analysis was performed using Smart PLS 3 to identify differences between provinces and multiple linear regression to determine the factors that significantly influence environmental awareness. The research results indicate that environmental education factors, geographical background, local culture, and family influence significantly contribute to students' level of environmental awareness. These findings confirm the importance of integrating environmental values into the forestry education curriculum and the role of families and communities in instilling pro-environmental behavior in young generations. The implications of this research are directed toward designing contextual and local wisdom-based environmental education strategies on the island of Sumatra.

**Key words:** *environmental awareness, environmental education, geographical factors, local culture, young generation.*

## Introduction

Indonesia is the largest archipelago in the world with abundant natural resources, but it faces significant environmental challenges. Global issues such as climate change, biodiversity loss, and pollution are part of what is called the triple planetary crisis (United Nations, 2022). Deforestation and environmental degradation are major issues contributing to increased carbon emissions and habitat loss (Ministry of Environment and Forestry, 2020). On the island of Sumatra, forest degradation reached over 6.8 million hectares between 1990 and 2015 (Ministry of Environment and Forestry, 2015), threatening ecosystems and the sustainability of resource-based economies.

The role of humans, especially the younger generation, is key in facing this environmental crisis. According to Otto et al. (2019), environmental awareness is a combination of knowledge, attitudes, and behaviors that reflects an individual's responsibility toward natural sustainability. Education makes a significant contribution to shaping this awareness (Monroe et al., 2019). Young people not only need to understand environmental issues, but also have the willingness and skills to take concrete action

Some previous studies have highlighted factors influencing environmental awareness, such as education level, access to information, socioeconomic conditions, and local culture (Wang et al., 2018; Ardoin et al., 2020). However, research examining the variations in environmental awareness among young people in various provinces on the island of Sumatra is still limited. In fact, this region has high cultural, geographical, and socioeconomic diversity, which could potentially lead to differences in environmental awareness levels. Therefore, this research was conducted to analyze the differences in environmental awareness levels among students from 10 provinces on the island of Sumatra who study at the Pekanbaru State Forestry Vocational School. And to identify the factors that influence environmental awareness levels, and provide recommendations for relevant environmental education materials to increase students' environmental awareness.

This research is expected to contribute to the development of more contextual environmental education policies and strengthen the role of schools and communities in shaping environmentally conscious young generations.

## Method

### Research Design

This research uses a descriptive-comparative quantitative approach. This approach was chosen because it allows researchers to objectively measure environmental awareness levels and compare results across provinces. Additionally, regression analysis is used to determine the factors that significantly influence environmental awareness (Creswell & Creswell, 2018).

### Population and Sample/ Study Group/Participants

The study population consists of all students from the State Forestry Vocational School in Pekanbaru, who come from ten provinces on the island of Sumatra (Aceh, North Sumatra, West Sumatra, Riau, Riau Islands, Jambi, Bengkulu, South Sumatra, Lampung, and Bangka Belitung). A research sample of 300 students was selected using proportionate stratified random sampling, ensuring that each province had proportional representation relative to the total student population (Sugiyono, 2019). The characteristics of the respondents can be seen in Table 1 below:

**Table 1.**

Demographic Characteristics of Respondents (n=300)

Variable	Category	Frequency	Percentage (%)
Gender	Male	180	60
	Famale	120	40
Province of Origin	10 provinces	300	100
Class	Class 1	110	36.7
	Class 2	95	31.7
	Class 3	95	31.7

### Data Collection Tools

The research instrument was a five-point Likert scale questionnaire (1-5) that measured three dimensions of environmental awareness:

- Environmental knowledge (10 items), measuring students' understanding of environmental issues such as deforestation, pollution, and climate change.
- Pro-environmental attitudes (10 items), measuring the level of concern, values, and beliefs regarding the importance of nature conservation.
- Pro-environmental behavior (10 items), assessing students' actual actions in caring for the environment (e.g., saving energy, disposing of waste properly, and participating in environmental activities).

Validity was tested using confirmatory factor analysis (CFA) with a loading factor value  $\geq$  0.50, while reliability was tested using Cronbach's Alpha = 0.87, which indicates a high level of internal consistency (Hair et al., 2020).

### Data Collection

Data collection was conducted directly in the school environment thru the distribution of questionnaires supervised by accompanying teachers. Each student was given approximately 30 minutes to complete the questionnaire. All data was collected over a two-week period and then screened to ensure the completeness of the answers.

### Data Analysis

Data analysis in this study was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS 3.0 software (Hair et al., 2020). This method was chosen because it can simultaneously analyze the relationships between latent variables, whether reflective or formative, and is suitable for a medium sample size ( $n = 300$ ). The analysis was conducted in two main stages:

- Evaluation of the Measurement Model (Outer Model)

This includes tests for convergent validity, discriminant validity, and construct reliability. Convergent validity was tested thru loading factors ( $> 0.70$ ) and the Average Variance Extracted (AVE) value ( $> 0.50$ ). Reliability was measured using Cronbach's Alpha and Composite Reliability (CR) ( $> 0.70$ ). Discriminant validity was tested using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT) ( $< 0.90$ ).

- Evaluation of the Structural Model (Inner Model)

Testing was conducted to determine the influence between latent variables by examining the path coefficients,  $R^2$ ,  $f^2$ , and  $Q^2$ . Significance was tested thru bootstrapping 5,000 subsamples, with t-values  $> 1.96$  and  $p < 0.05$  as the significance criteria. The  $R^2$  value of 0.482 indicates that environmental education, local culture, family role, and media/technology variables explain 48.2% of the variation in environmental awareness among young people.

## Findings

### Evaluation of the Measurement Model (Outer Model)

The convergent validity test shows that all indicators for the constructs of environmental education, local culture, family role, and media and technology have loading factor values between 0.721–0.892, thus meeting the criteria of Hair et al. (2020), which is  $> 0.70$ . This means that each indicator is able to represent its construct well. The Average Variance Extracted (AVE) values for all constructs ranged from 0.56 to 0.72, exceeding the minimum threshold of 0.50, indicating adequate convergent validity. The Composite Reliability (CR) values ranged from 0.83 to 0.91, and Cronbach's Alpha ranged from 0.78 to 0.88, indicating good to excellent internal reliability of the constructs. The discriminant validity test using the Fornell-Larcker criterion showed that the square root of the AVE for each construct was greater than the correlation with other constructs, indicating that discriminant validity was met. Meanwhile, the HTMT (Heterotrait-Monotrait Ratio) test yielded values  $< 0.85$  for all pairs of constructs, confirming that each construct had clear discrimination from other constructs in the model.

### Evaluation of the Structural Model (Inner Model)

The structural model is evaluated based on the  $R^2$ ,  $f^2$ ,  $Q^2$  values, and the significance of the path coefficient results from bootstrapping. An  $R^2$  value of 0.482 indicates that the exogenous variables (environmental education, local culture, family role, media, and technology) are able to explain 48.2% of the variation in environmental awareness among young people, which falls into the moderate category. The  $f^2$  value indicates the contribution effect of each variable to the endogenous construct:

- Environmental education ( $f^2 = 0.35$ ) → large effect,
- Local culture ( $f^2 = 0.22$ ) → moderate effect,
- Family role ( $f^2 = 0.15$ ) → moderate effect,
- Media and technology ( $f^2 = 0.12$ ) → small to medium effect.

The Stone-Geisser  $Q^2$  result of 0.41 indicates that the model has good predictive ability, meaning that the exogenous constructs provide relevant information to explain environmental awareness (Hair et al., 2020).

The results of the bootstrapping test with 5,000 subsamples showed a t-statistic value  $> 1.96$  and a p-value  $< 0.05$  for all tested paths, thus all hypotheses were accepted.

Relationship between variables	Path Coefficient ( $\beta$ )	t-statistic	p-value	Test Results
Environmental Education → Environmental Awareness	0.356	6.214	0.000	Accepted
Local Culture → Environmental Awareness	0.218	3.971	0.000	Accepted
Family's Role → Environmental Awareness	0.192	3.562	0.001	Accepted
Media & Technology → Environmental Awareness	0.128	2.423	0.016	Accepted

## Environmental Awareness

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This result indicates that environmental education has the strongest influence on environmental awareness. This finding supports the environmental education pathway theory, which states that direct exposure to environmental contexts thru school curricula and field activities fosters a deep ecological awareness (Tilbury, 2019; Otto & Pensini, 2017). Local culture also plays a significant role because traditional values oriented toward natural balance strengthen the internalization of pro-environmental behavior. This is evident in provinces like West Sumatra and Jambi, where the customary principle "nature is the teacher" influences students' ecological perspectives (Dewi et al., 2017). The role of the family demonstrates its significant contribution as the first educational environment. Parents who set an example in environmentally friendly activities tend to foster similar behavior in their children (Musser & Diamond, 2019). Meanwhile, the significant but relatively small influence of media and technology illustrates that exposure to environmental information has not always been followed by real behavioral engagement – a phenomenon known as the information–action gap (Moser, 2010).

### Discussion

The analysis results using SmartPLS 3 show that the four exogenous variables – environmental education, local culture, family role, and media and technology – have a significant influence on the environmental awareness of young people in Sumatra Island. The following discussion explains the theoretical and empirical meaning of each relationship and its implications for educational practices and environmental policies in Indonesia.

The finding that environmental education has the strongest influence ( $\beta = 0.356$ ,  $p < 0.001$ ) indicates that the formal education dimension is the main foundation for shaping students' ecological awareness. This result supports the theory of Environmental Literacy (Roth, 1992), which states that conceptual understanding and direct experience with nature will shape responsible attitudes and behaviors toward the environment.

The curriculum of the Pekanbaru State Forestry Vocational School, which combines conservation theory with field activities such as school forest practicums and reforestation, has proven effective in strengthening students' emotional connection with nature. This aligns with the findings of Tilbury (2019) and Ardoin et al. (2020), who emphasize the importance of experiential learning approaches in environmental education. From a policy perspective, these results indicate that the context-based environmental education program based on the Sumatran ecoregion needs to be developed and replicated in other schools.

Local culture also proved to have a significant influence ( $\beta = 0.218$ ,  $p < 0.001$ ) on environmental awareness. This reinforces the concept of ecological wisdom contained in the local wisdom of the people of Sumatra. For example, the Minangkabau proverb "alam takambang jadi guru" (nature is the teacher) reflects the principle of learning from nature as a source of life values, while the earth alms tradition in Jambi and South Sumatra is a form of respect for the ecological cycle.

This research reinforces the view of Berkes et al. (2000) that traditional ecological knowledge (TEK) can be the basis for sustainable environmental management. Thus, environmental education policies need to integrate local cultural narratives and ecological indigenous practices as part of the formal curriculum. Integrating cultural values not only strengthens the local relevance of learning but also enhances a sense of belonging toward nature (Chawla & Derr, 2021).

The family role variable ( $\beta = 0.192$ ,  $p = 0.001$ ) shows a significant influence on students' environmental awareness. This result supports Bronfenbrenner's (1992) Ecological Systems theory, which places the family as the first microsystem influencing the formation of individual behavior. Families that instill environmental values from an early age – such as saving water, managing household waste, or planting trees together – are proven to foster a positive attitude toward nature.

Musser and Diamond (2019) explain that children's ecological behavior is heavily influenced by parental modeling. Therefore, raising environmental awareness cannot rely solely on schools, but needs to involve families as co-educators. Environmental education programs at

forestry schools can expand their impact thru family-based activities such as Family Green Day or intergenerational eco-volunteering.

The research results also show that media and technology have a positive but weakest effect ( $\beta = 0.128$ ,  $p = 0.016$ ) compared to other variables. This phenomenon illustrates the existence of an information-action gap (Moser, 2010), which is the condition where increased access to information about environmental issues is not always followed by real action.

Social media, particularly platforms like Instagram and TikTok, is widely used by young people to obtain information about environmental issues. However, superficial content that is not balanced with critical reflection can make environmental awareness temporary. Therefore, environmental communication strategies need to be directed toward creating educational media that is interactive and participatory, such as eco-challenges, virtual forest tours, or gamification of environmental learning (Anderson, 2012; Geiger et al., 2019).

Overall, this study shows that environmental awareness among young people on Sumatra Island is the result of an interaction between structural factors (formal education and technology) and cultural factors (local culture and family). This relationship illustrates Bronfenbrenner's (1992) socio-ecological model, where human behavior is shaped by layered interactions between individuals, families, communities, and social institutions. The high  $R^2$  value (0.482) indicates that the four factors have the ability to explain almost half of the variation in environmental awareness. However, there are still other factors such as peer influence, household economics, and field experience that have the potential to enrich this research model in the future.

This result also reinforces the recommendation of Otto and Pensini (2017) that effective environmental education is one that connects cognitive (knowledge), affective (emotions), and conative (actions) aspects. Thus, environmental education based on local culture and family values has great potential to bridge the gap between environmental knowledge and action (knowledge-behavior gap).

The implication of these results is the need for enhanced contextual environmental education programs that integrate local cultural values, strengthen the role of families, and utilize educational technology to raise ecological awareness among the younger generation.

### **Conclusion**

This research shows that the level of environmental awareness among young people on the island of Sumatra is considered high. Thru SmartPLS 3 analysis, it was found that four main factors influence environmental awareness: environmental education, local culture, family role, and media and technology. Of these four factors, environmental education is the most dominant, followed by local culture, family role, and media/technology. The research model with an  $R^2$  value of 0.482 indicates that the combination of these four factors is able to explain almost half of the variation in students' environmental awareness. These findings confirm the importance of integrating environmental education based on local wisdom, family support, and the use of digital media to shape pro-environmental behavior in the younger generation.

### **Suggestion**

Based on the research findings, it is recommended that educational institutions, particularly forestry schools, strengthen the implementation of environmental education based on direct experience in nature and integrate local cultural values into every learning activity. The contextual approach that links environmental issues to students' socio-cultural realities is expected to increase the relevance and effectiveness of the learning process. Additionally, families need to play an active role in instilling environmental values at home thru daily examples of environmentally friendly behavior. Consistent family involvement can reinforce the learning provided by schools. Local governments are also expected to formulate more contextual environmental education policies that are oriented toward the cultural characteristics and ecosystems of each province.

The use of digital media and technology needs to be continuously enhanced as a creative and interactive means of education so that young generations not only gain knowledge

about the environment but are also encouraged to take concrete action in preserving nature.

### Limitation

This research is limited to respondents from a single forestry school in Pekanbaru, so generalizing the results still requires caution. Additionally, the research model only includes four main factors and has not yet incorporated other variables such as peer influence or environmental extracurricular activities. Further research is recommended to expand the sample across institutions and provinces and incorporate a qualitative approach to delve deeper into the values and motivations behind the pro-environmental behavior of young people.

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