LOCAL KNOWLEDGE-BASED CITIZENSHIP LEARNING MODEL TO INCREASE ECOLOGICAL AWARENESS IN THE INDONESIA-MALAYSIA BORDER AREA

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ABSTRACT

High gap between ecological knowledge and pro-environmental action remains a critical challenge for sustainability, particularly in ecologically sensitive border regions. This study addresses this gap by developing and testing a Civic Ecological Transformation (CET) learning model based on local knowledge to enhance students' ecological awareness in the Indonesia–Malaysia border region. Using a mixed-methods approach with a sequential exploratory design, the study began with a qualitative exploration (interviews, FGDs, observations) to identify local cultural values, followed by a quantitative phase (one-group pretest-posttest, PLS-SEM) to test the model's effectiveness. The findings reveal that the integration of local knowledge such as belalek, saprahan, and tepung tawar significantly improves ecological awareness. Path analysis confirms the effect of the CET learning model is fully mediated by this integration of local knowledge. The CET model effectively fosters ecological citizenship and supports the achievement of SDG 4, 13, and 15, contributing a pedagogical innovation for Civic Education rooted in environmental sustainability.

ABSTRAK

Kesenjangan yang tinggi antara pengetahuan ekologis dan tindakan pro-lingkungan tetap menjadi tantangan kritis bagi keberlanjutan, terutama di wilayah perbatasan yang sensitif secara ekologis. Penelitian ini menjawab kesenjangan tersebut dengan mengembangkan dan menguji model pembelajaran *Civic Ecological Transformation* (CET) berbasis pengetahuan lokal untuk meningkatkan kesadaran ekologis siswa di wilayah perbatasan Indonesia–Malaysia. Menggunakan pendekatan *mixed-methods* dengan desain *sequential exploratory*, penelitian diawali dengan eksplorasi kualitatif (wawancara, FGD, observasi) untuk mengidentifikasi nilai budaya lokal, dilanjutkan dengan tahap kuantitatif *(one-group pretest-posttest*, PLS-SEM) untuk menguji efektivitas model. Hasil penelitian menunjukkan bahwa integrasi pengetahuan lokal seperti belalek, saprahan, dan tepung tawar secara signifikan meningkatkan kesadaran ekologis. Analisis jalur mengonfirmasi bahwa pengaruh model pembelajaran CET sepenuhnya dimediasi oleh integrasi pengetahuan lokal ini. Model CET terbukti efektif menumbuhkan *ecological citizenship* dan mendukung pencapaian SDG 4, 13, dan 15, menyumbangkan inovasi pedagogis bagi Pendidikan Kewarganegaraan yang berakar pada keberlanjutan lingkungan.

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INTRODUCTION

Global efforts in realizing the Sustainable Development Goals (SDGs) emphasize the importance of a balance between economic, social, and environmental development as the main foundation of the earth's sustainability. The SDGs are not just an international agenda, but a collective commitment of humanity to maintain harmony between progress and sustainability through concrete actions in various sectors, including education. In this context, education plays a strategic role as a strategic means to instill sustainability values and build ecological awareness of the global community (Pan et al., 2024; Wang & Zheng, 2024). Sustainable development is therefore not only a policy or economic issue, but also a social learning process that fosters moral responsibility between generations.

One of the disciplines that has a strategic position in the transformation of sustainability values is Civic Education. Conceptually, Civic Education not only aims to form law-abiding and democratic citizens, but also ecological citizens who are responsible for social and environmental sustainability. Research by Cheah & Huang (2019) shows that citizenship education in Nordic schools has a significant effect on the formation of environmental citizenship. This is reinforced by Linhares & Reis (2023) emphasizing the importance of nature-based solutions in the education of prospective teachers to form reflective and participatory ecological citizenship actors. Thus, Civic Education has the potential to integrate civic literacy (Ridha et al., 2025) and ecological literacy (Husamah et al., 2025) to form an intelligent generation while caring for the environment.

However, the gap between knowledge and ecological action (attitude–behavior gap) is still a real challenge (Kollmuss & Agyeman, 2002). Many students know the importance of taking care of the environment, but have not yet applied it in their daily behavior. This also happens in Sambas Regency which is included in one of the Indonesia-Malaysia border areas and has natural resources and local culture such as; Stir-fry (tenun lunggi) (Januardi et al., 2025), belalek (Wiyono & Ramadhan, 2021), and tepung tawar (Pajriati & Rohmah, 2022; Septiani, 2025). The diversity of cultures and traditions draws on the biodiversity in Sambas Regency, but is currently facing ecological pressure from land conversion and the exploitation of natural resources, which threaten the preservation of biological resources in Sambas. Meanwhile, the community's low ecological awareness, in an effort to maintain tradition, exacerbates environmental degradation and ecosystem imbalances (Fatmawati et al., 2024; Januardi et al., 2022).

This attitude-behavior gap has particularly urgent implications in border regions such as Sambas Regency. As a frontline area bordering Malaysia, Sambas faces not only challenges of territorial sovereignty but also severe ecological pressures (Fatmawati et al., 2024). Recent data indicate an accelerating rate of deforestation and land degradation due to land conversion for large-scale plantations and unsustainable extractive practices. The erosion of traditional values in natural resource management exacerbates this situation. Local wisdom, such as belalek (community-based agriculture) (Wiyono & Ramadhan, 2021) and saprahan (communal sharing rituals) (Putri, 2019), which historically instilled a conservation ethos, are now being marginalized by modernity. Consequently, the younger generation in Sambas exists in a paradox: they cognitively understand global environmental issues (as per the national curriculum) but are practically disconnected from the local ecological practices inherited from their ancestors. Failure to bridge this gap not only threatens biodiversity (Januardi et al., 2022) but also erodes the socio-ecological resilience of the border community.

To address this complex problem, a multi-layered theoretical framework is required. As a grand theory, this study adopts the 'Attitude-Behavior Gap' model (Kollmuss & Agyeman, 2002), which identifies internal barriers and external barriers that prevent individuals from acting on their environmental knowledge. This model explains why pedagogical interventions focused solely on cognitive knowledge transfer often fail to produce behavioral change. Therefore, as a middle theory, we employ Experiential Learning Theory (Kolb, as cited in Morris, 2020) as the pedagogical mechanism to bridge this gap. Kolb argues that transformative learning occurs through a cycle of concrete experience and reflective observation, which internalizes values more powerfully than passive learning. In the context of applied theory, we integrate principles of Ethnopedagogy (Imaduddin & Eilks, 2024) and Education for Ecological Citizenship (Cheah & Huang, 2019). Ethnopedagogy provides the content (Sambas local wisdom) to create culturally relevant concrete experiences, while Ecological Citizenship provides the ultimate goal (forming ecologically responsible citizens), moving beyond mere passive awareness.

Several relevant studies have highlighted the role of education in fostering ecological awareness based on local values. As Imaduddin & Eilks (2025) emphasized, the use of local biodiversity can be a sustainable nature-based solution for water resource management. In another study (Imaduddin & Eilks, 2024), the importance of water literacy as part of education for sustainable development (ESD) was reviewed, where water literacy and environmental literacy are key to building people's ecological behavior. A similar view is put forward by Anwar & Elfaki (2021), who argue that the application of ecopedagogical approaches and local wisdom can transform ecological awareness into real social action within the educational community.

The state of the art in these studies shows a shift in focus from ecological knowledge alone to education grounded in local experiences and values. However, most studies are still oriented toward science education or general ecopedagogy, not yet specifically integrating the values of local wisdom into the formal learning structure of Civic Education. This is where the research gap that is raised is related to how to develop a Civic Education learning model based on local wisdom that is systematic, contextual, and measurable to increase the ecological awareness of students in border areas such as Sambas Regency

The novelty of this research lies in the development of a Civic Education learning model that combines local Sambas cultural values with an experiential learning approach (Morris, 2020). The model that has been developed is expected to be a bridge between ecological knowledge and action through direct experience, critical reflection, and the formation of sustainable ecological moral values. This integration also supports the achievement of the 13th SDG (Handling Climate Change) and the 15th SDG (Protection of Terrestrial Ecosystems), as well as strengthening the role of education as a driver of social transformation towards sustainability. Based on this description, this study seeks to answer three main questions, namely;

Q1 : What is the current level of ecological awareness of students in Sambas Regency?

Q2 : What values of local wisdom are relevant to be integrated in the learning of Civic Education to foster ecological awareness?

Q3 : How is the design of an effective learning model of Civic Education based on local wisdom to increase the ecological awareness of students in the Indonesia-Malaysia border area?

METHOD

This study uses a mixed methods approach with a sequential exploratory design as stated by Creswell (2014). This design begins with a qualitative exploration stage to explore the phenomenon in depth, then continues with a quantitative stage to test and verify the findings empirically. This approach was chosen because it was able to provide a comprehensive understanding of the development of the Civic Ecological Transformation (CET) learning model based on local wisdom in an effort to increase the ecological awareness of students in the Indonesia-Malaysia border area. The qualitative exploratory stage is intended to find cultural values relevant to the formation of ecological awareness, while the quantitative stage serves to test the effectiveness of the learning model that has been developed.

The place and time of the research were set in Sambas Regency, West Kalimantan, which is included in one of the Indonesia-Malaysia border areas. The study was conducted over six months, from January to June 2025, involving high schools in the region. The research subjects include Civic Education teachers, traditional leaders, community leaders, and high school students. The selection of informants at the qualitative stage was carried out by purposive sampling, considering the competence and involvement of informants in the context of local culture and civic education in schools.

The qualitative stage serves as a conceptual basis in designing a Civic Ecological Transformation (CET) learning model based on local wisdom. The primary focus is to identify and conceptualize the cultural values of the Sambas people that are relevant to ecological awareness. Data were collected through three main techniques: (1) in-depth interviews with key informants to explore cultural values and social practices that demonstrate the harmony of humans and nature; (2) Focus Group Discussion (FGD) involving lecturers and education experts, as well as community leaders to validate the findings of the interviews and build understanding on the integration of local values in learning; and (3) participatory observation and document review of the curriculum, lesson plans, as well as school and community activities.

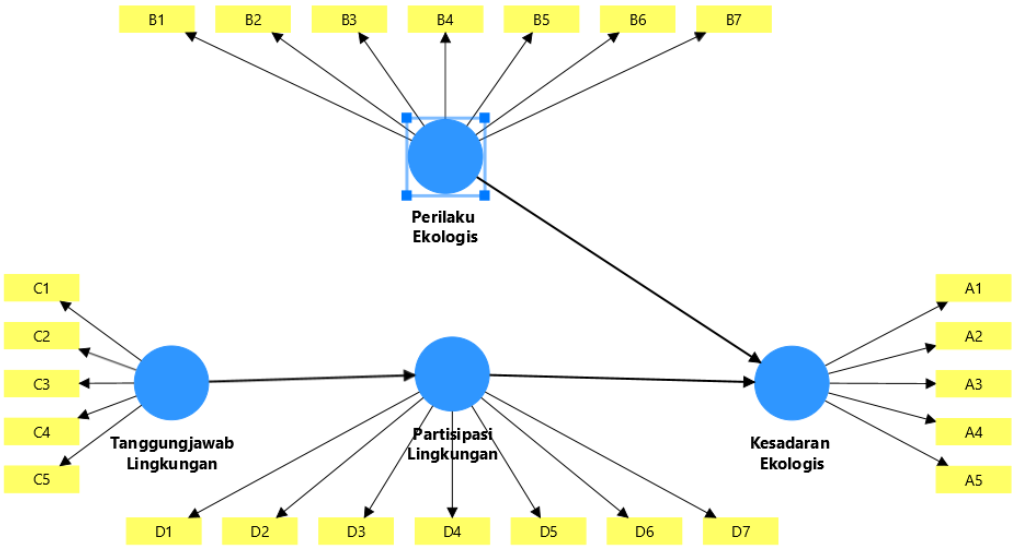
Qualitative data analysis uses an interactive model through three stages, namely: data reduction, data presentation, and conclusion drawn (Miles et al., 2013). Data reduction was carried out by selecting relevant information about local values and civic education learning. The data presentation was carried out in the form of a value category matrix and ecological awareness indicators. Conclusions are drawn iteratively and verified through triangulation of sources and methods to ensure the validity of findings. This process resulted in an initial design of the Civic Ecological Transformation (CET) model that contained learning objectives, principles, and steps.

The quantitative stage was carried out to test the validity, reliability, and effectiveness of the developed learning model. The research design uses a one–group pretest–posttest design (Sugiyono, 2017), where one group of students is given treatment in the form of CET learning based on local wisdom. Measurements were taken before and after treatment to assess changes in students' ecological awareness levels. The quantitative research was carried out at SMA Negeri 1 Galing, Sambas Regency, which was chosen purposively because it represented a multicultural social context, real environmental issues, and the preservation of local culture. The research population included all high school students in the Sambas border area, while the sample consisted of 100 students from various grade levels and two Civic Education teachers involved in the implementation of the learning model.

The research instruments include: (1) a Likert scale questionnaire to measure students' ecological knowledge, attitudes, and behaviors; (2) observation sheets to assess learning activities and student participation; (3) student reflection journals to evaluate learning experiences and attitude changes; and (4) post-intervention interviews to explore teachers' and students' views on the effectiveness of the model. The validity of the instrument's content was checked by three civic education and environmental education experts, while the reliability was tested using Cronbach's Alpha coefficient to ensure internal consistency between the statement items (Budiyono, 2011).

Quantitative data analysis was conducted in three complementary stages to answer the research questions comprehensively. First, to assess the model's overall effectiveness (addressing Q1 & Q3), a one group pretest-posttest design was used (Sugiyono, 2017). Pretest and posttest scores from the ecological awareness questionnaire were analyzed using a paired-samples t-test to determine if there was a statistically significant increase following the CET model intervention. Second, to test the mechanism of how the model worked, path analysis with a mediation variable was employed. As per the central hypothesis, this tested whether the influence of the CET Learning Model (Independent Variable) on Ecological Awareness (Dependent Variable) was mediated by the Integration of Local Wisdom (Mediation Variable), as detailed in Figure 1. Third, to deeply validate the theoretical structure of the 'ecological awareness' construct itself after the intervention, Partial Least Squares - Structural Equation Modeling (PLS-SEM) was used (Sarstedt et al., 2014). The PLS-SEM model (as conceptualized in Figure 1) tested the causal relationships between latent variables (i.e., Environmental Responsibility, Ecological Behavior, and Environmental Participation) to confirm the underlying theoretical framework of ecological awareness among the participants. This three-stage approach allowed us to not only confirm if the model worked (t-test) but also why it worked (mediation analysis) and what psychological structure it fostered (PLS-SEM). The proposed causal model can be seen in Figure 1.

Figure 1. PLS-SEM Analysis and Path Analysis



Source: Researcher, 2025

Pathway analysis makes it possible to measure the strength and significance of each causal pathway, providing a deeper understanding of the mechanisms behind the effectiveness of learning models (Sarwono, 2022). The causal model tested includes a direct

relationship between ecological participation in students' ecological awareness, as well as an indirect relationship through mediation variables in the form of the Environmental Responsibility → Ecological Behavior → Ecological Awareness mediation pathway, which is interpreted as responsibility for the environment affects ecological awareness indirectly through ecological behavior as an intermediate variable.

The validity of the structural model was tested through measurements of convergent and discriminant validity, composite reliability, and significance test using bootstrapping. In addition, external validity is strengthened through member checking, which is confirming the results of the analysis to key informants to ensure the conformity of interpretation with the reality of the field. The ethical aspects of research are maintained through voluntary participation consent, explanation of the purpose of the research, and guarantee of confidentiality of participants' identities.

The design of this method is expected to not only produce empirical findings, but also be transformative. The qualitative stage provides an in-depth understanding of the local values that form the conceptual basis of the CET model, while the quantitative stage provides empirical evidence of the effectiveness of the model's application in increasing students' ecological awareness. This approach is in line with the experiential learning principles put forward by Kolb in (in Morris, 2020) and strengthening pedagogical content knowledge (Bahari, 2020; Hidayah et al., 2023; Imaduddin et al., 2024) so that this research contributes to the development of civic education learning innovations that are rooted in local culture and support sustainable development goals in Indonesia.

RESULTS AND DISCUSSION

This section presents the results of research obtained from qualitative and quantitative analysis of the development and application of the Civic Ecological Transformation (CET) model in the learning of Civic Education based on local wisdom in the Indonesia-Malaysia border area. The results of the study were presented integratively to answer research questions about how the CET model is able to increase ecological awareness and form students' ecological citizenship. The presentation of the results was focused on relevant empirical findings, followed by theoretical analysis and discussion that related the research data to the concept of Education for Sustainable Development (ESD), experiential learning, and the values of local wisdom of the Sambas community. Each subsection of the discussion is structured based on the focus of the main findings in order to provide a comprehensive overview of the theoretical and practical contributions of the developed learning model. The explanation is as follows, this section presents the primary empirical findings (qualitative and quantitative) structured to answer the three research questions posed in the introduction directly.

1. The Initial Level of Ecological Awareness and the Attitude-Behavior Gap

Research question one (Q1) sought to identify the current level of ecological awareness among students in Sambas. The analysis of pretest data (N=100) revealed a complex picture. Cognitively, students demonstrated a relatively high level of knowledge about global environmental issues, with a mean score of 78.5 on the knowledge subscale. However, this contrasted sharply with findings from qualitative interviews and the pretest data on the behavior subscale, where the mean score was only 42.3.

This confirms the "attitude-behavior gap" (Kollmuss & Agyeman, 2002) cited in the introduction. Interviews with Civics teachers confirmed this gap; as one teacher noted, "*students know that littering is wrong, but you will still find them throwing food wrappers in the school*

drain." Qualitative findings also identified that although students live in an environment rich with local wisdom, 85% of students in the pretest could not explain the ecological meaning behind traditions like belalek or tepung tawar. This baseline finding is crucial: it empirically justifies the need for a learning model that does not just teach about ecology, but embeds ecological values through contextual experience.

2. Identification and Integration of Relevant Local Wisdom Values

Research question two (Q2) focused on identifying relevant local wisdom values. The qualitative exploratory phase (FGDs and interviews with traditional leaders and community elders) identified three central Sambas cultural practices rich in ecological values: (1) Belalek, a tradition of mutual cooperation in agriculture (Wiyono & Ramadhan, 2021) that reflects principles of sustainability, communal resource management, and social equity; (2) Saprahan, a communal dining ritual (Putri, 2019) that teaches values of equality, anti-waste (taking only what is needed), and gratitude towards nature's provisions; and (3) Tepung Tawar, a ritual using natural elements (water, rice, leaves) as symbols of purification and harmony between humans, nature, and the divine (Pajriati & Rohmah, 2022). Meanwhile, informants stressed that these were not mere rituals but "embodied pedagogies" designed to transmit conservation ethics. These findings formed the basis for the CET model's syntax, where these values were not taught as folklore, but were integrated into experiential, project-based learning, such as simulating belalek principles for managing a school garden.

3. Effectiveness and Theoretical Contribution of the CET Model

Research question three (Q3) evaluated the effectiveness of the CET model design. Effectiveness was first measured via the pretest-posttest comparison. The paired-samples t-test showed a statistically significant increase in students' overall ecological awareness scores (Mean pretest = 51.4; Mean posttest = 82.7; *t-test* = 14.2, p-value < 0.01). This increase was observed across all three dimensions: cognitive, affective, and behavioral, indicating the model was successful in bridging the gap identified in Q1.

More importantly, we tested the mechanism behind this success. We hypothesized that the CET model (the pedagogical approach) would only succeed if the local wisdom values (the contextual content) were successfully integrated. The path analysis for mediation (presented in Table 1).

Table 1. Results of the Analysis of the Local Wisdom-Based Learning Model on Students' Ecological Awareness

Path (Relationship Between Variables)	Path Coefficients	Path (Relationship Between Variables)	Path Coefficients
Learning Model → Integration of Local Wisdom	0.68	< 0.01	Significant
Integration of Local Wisdom → Ecological Awareness	0.55	< 0.01	Significant
Learning Model → Ecological Awareness (Direct Track)	0.12	0.18	Insignificant

Source: Research Data, 2025

The findings in Table 1 show that the direct path from the Learning Model to Ecological Awareness became insignificant (P-Value = 0.18) once the mediation variable (Integration

of Local Wisdom) was included. The indirect path through local wisdom integration was highly significant. This is a key finding of this research: it was not the model alone that mattered, but its ability to authentically integrate local wisdom. The CET model's success was fully mediated by the successful integration of the values from belalek, saprahan, and tepung tawar into the students' learning experience.

4. Theoretical Implications and Novelty

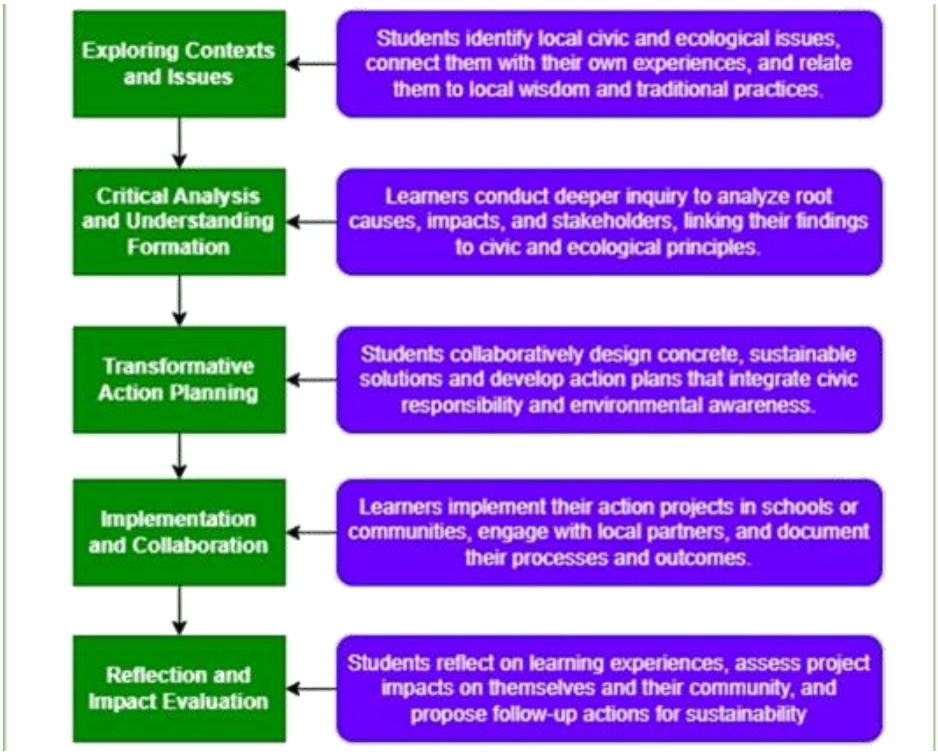
This study contributes significantly to the theoretical discourse on the 'attitude-behavior gap' (Kollmuss & Agyeman, 2002). Our findings, particularly the pretest data (Q1), demonstrate that the failure to act pro-environmentally is not an individual moral failing, but a pedagogical one. The CET model succeeded because it redesigned Civics Education from cognitive transmission to a transformative experience, aligning with Kolb's theory (Morris, 2020). Instead of just knowing about SDG 13 and 15, students experienced these principles through the Belalek simulation.

This is a key difference from many previous studies. While much research focuses on general ecopedagogy (Anwar & Elfaki, 2021) or water literacy (Imaduddin & Eilks, 2025) within the realm of science education, our research grounds this intervention firmly within Civic Education. This aligns with the work of Mulyani et al. (2024) who call for a transformation of Civic Education to address global issues. Our study shows how that transformation can be achieved: by using local wisdom as the pedagogical bridge. By integrating ethnopedagogical content (Imaduddin et al., 2024), the CET model makes abstract global goals (SDGs) tangible and culturally resonant.

The Civic Ecological Transformation (CET) model features an interdisciplinary character that connects Civics Education, Environmental Science, and History or Social Sciences. In terms of Civic Education, the learning that has been carried out fosters ecological citizenship, where students not only understand their rights and obligations to the Indonesian state, but also to the environment. From the environmental science side, students directly observe the relationship between human activities and ecosystem balance, while from the historical side, learning raises local cultural values that show the harmony of humans and nature.

This learning syntax flow consists of five mutually continuous phases, namely: (1) Exploration of context and issues, where students recognize the problems of citizenship and the environment around them and relate them to local wisdom; (2) Critical analysis and understanding formation, as students examine the issues found to understand the root of the problem and relate it to the concepts of citizenship and ecology; (3) Transformative action planning, in which students design concrete solutions and action projects based on collaboration and local values; (4) Implementation and collaboration, when students carry out action projects in the school or community environment with the partnership of various parties; and (5) Reflection and impact evaluation, where students assess results, reflect on experiences, and develop a follow-up for the sustainability of the action.

Figure 2. Civic Ecological Transformation (CET) Learning Model



Source: Research Data, 2025

The Civic Ecological Transformation (CET) model developed is consistent with UNESCO's mandate through Education for Sustainable Development (Catana & Brilha, 2020; Shulla et al., 2020), which emphasizes the integration of social, cultural, economic, and environmental dimensions in learning. Meanwhile, the results of the study show that students are able to relate local traditional values such as the conservation of customary forests with modern sustainability principles, forming a reflective and contextual ecological understanding. These findings are in line with Imaduddin et al. (2024) the finding that the integration of ethnopedagogical values in science learning strengthens the connection between scientific knowledge and local cultural practices.

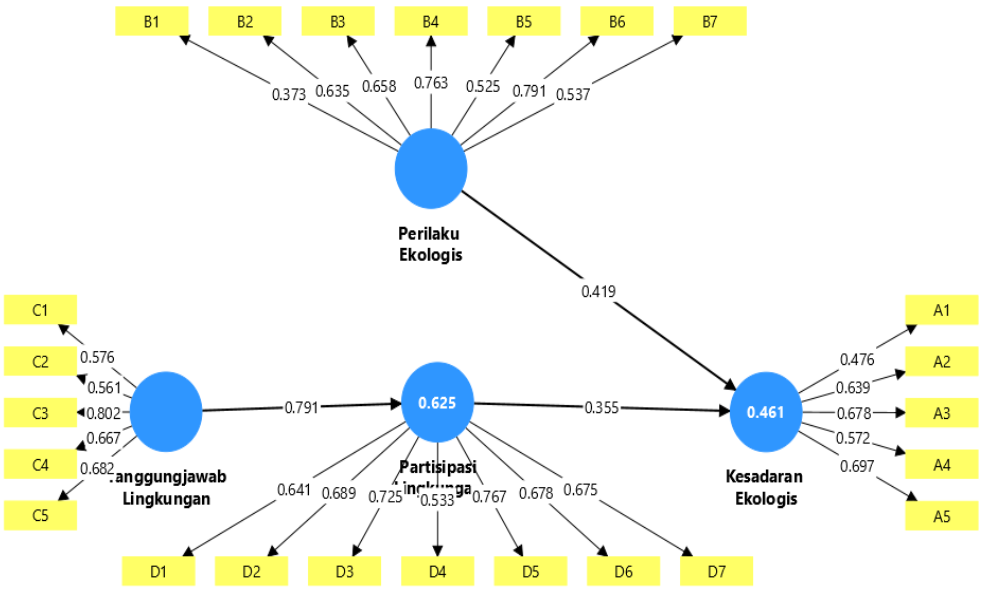
In line with this opinion, research Mulyani et al. (2024), shows that Global Citizenship Education has an important role in equipping students with the values and competencies to face global issues such as climate change, social inequality, and environmental sustainability. Meanwhile, Indriyani & Naidu (2025) emphasized the importance of integrating local wisdom values through the participatory project model (Participatory Project-Based Learning), which has proven effective in transforming local cultural values such as the Cianjur Cultural Pillar in Pancasila and citizenship learning.

Meanwhile, in the context of ecological character education, (Bhughe, 2022; Hendri & Nurlaili, 2023), it highlights the central role of civic education teachers as facilitators of the formation of discipline and character of students, which has direct implications for habituating the values of social responsibility and concern for others and the environment. Meanwhile, Ginting et al. (2025) show that the integration of local arts and culture in education is able to strengthen the character of harmony and tolerance between the young generation in a multicultural society. These findings strengthen the conceptual basis of CET as a transdisciplinary learning model that combines civic values, local knowledge, and

ecological awareness to form reflective and responsible citizens, and contribute to the achievement of the Sustainable Development Goals (SDGs), especially SDG 4 (Quality Education), SDG 13 (Climate Action), and SDG 15 (Life on Land). Through this approach, students not only understand environmental and social issues, but also take an active role in climate change mitigation actions, natural resource conservation, and strengthening the value of mutual cooperation as part of Indonesia's ecological citizenship identity.

The results of the study show that the Civic Ecological Transformation (CET) model is able to significantly increase students' ecological awareness and social involvement in the Indonesia-Malaysia border area. This model combines the principles of Experiential Learning (Morris, 2020) and Education for Sustainable Development (Collins-Figueroa, 2012; Yoshizumi, 2009), in the framework of learning based on local wisdom, especially in the Indonesia-Malaysia border area in Sambas district. Thus, it is hoped that through an experience-based approach and critical reflection, Civic Education learning can transform from a mere knowledge transfer to a transformative process that shapes the ecological character and social responsibility of students. Meanwhile, based on theresults of interviews and FGDs, these values have great potential to become the foundation of contextual and effective learning. As well as the results of the respondent questionnaire given to 100 respondents can be seen in the following picture.

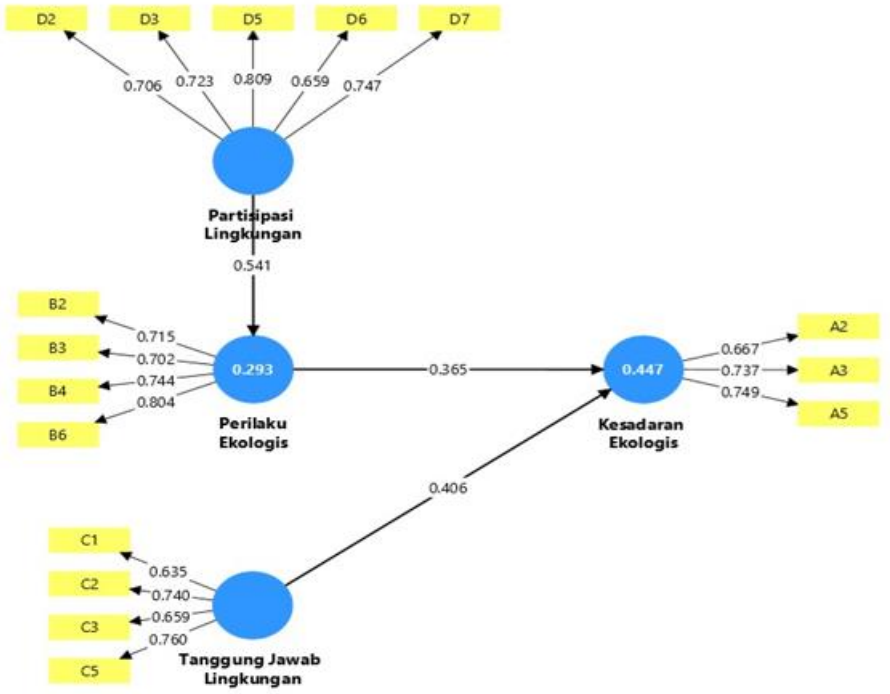
Figure 3. Respondent Survey Results



Source: Research Data, 2025

The findings of this study were analyzed using two complementary quantitative models. Partial Least Squares-Structural Equation Modeling (PLS-SEM) and Path Analysis. The PLS-SEM analysis confirms that the measurement model has met the requirements for validity and reliability, with the outer loading value of all indicators above 0.6. The structural model shows a significant direct influence between latent variables, while the results can be seen in the figure below.

Figure 4. PLS-SEM Analysis and Path Analysis



Source: Research Data, 2025

The PLS-SEM analysis (Figure 3) provides further insight into the outcome of the CET intervention. This model, using the post-intervention data, shows that 'Environmental Responsibility' (β =0.406) and 'Environmental Participation' (β =0.541) are the strongest predictors of 'Ecological Awareness'. This suggests the CET model was successful in instilling an affective sense of responsibility which, in turn, drives behavioral action (participation).

This finding enriches the work of Indriyani & Naidu (2025), who also used a participatory project model to revitalize local values in Cianjur Cultural Pillars. Our study suggests that in the Sambas context, this participation is most effective when preceded by fostering affective responsibility. This also echoes the findings of Bhughe (2022) and Hendri & Nurlaili (2023), who highlight the central role of Civics teachers as facilitators of character and discipline in this case, 'ecological discipline'. The CET model provides a formal structure for teachers to fulfill this role.

These findings reinforce the theory of experiential learning that concrete experiences are the basis for meaningful learning and internalization of values that Morris (2020) puts forward. Local values such as belalek (sustainable traditional agriculture in sambas) (Widianti et al., 2023; Wiyono & Ramadhan, 2021) and saprahan (Putri, 2019), serve as an authentic context for students to understand ecological responsibility. These results are in line with research Jumali et al. (2025) and Nurhadianto et al., (2024) that shows that ecopedagogy based on local wisdom is able to transform ecological awareness into real social action in the educational community, as well as Imaduddin et al. (2024) that affirms the importance of biodiversity literacy in community-based education.

The CET learning model is formulated to guide students from the introduction of issues to the real actions of ecological citizenship. The proposed stages or syntax in the development of the CET model have a positive influence on the improvement of ecological

awareness, as can be seen from the increase in the average score of ecological awareness post-intervention. Meanwhile, based on students' reflections and interview results, it is shown that direct involvement in environmental projects to strengthen the cognitive, affective, and behavioral dimensions of ecological awareness. This confirms the findings that ecological awareness is a major psychological factor that drives pro-environmental behavior, but it needs to be facilitated through reflection and critical thinking as suggested (Shutaleva, 2023).

The results of this study also confirm that integrating local values serves as a bridge to close the attitude-behavior gap described by Kollmuss & Agyeman (2002). When students learn through a cultural context close to their lives, the internalization of values becomes more powerful and sustainable. Thus, the influence of the Civic Ecological Transformation (CET) model on ecological awareness is indirect but profound, through the process of internalizing cultural values into real ecological actions.

Theoretically, this research expands the scope of Education for Sustainability by integrating local knowledge, awareness, and ecological citizenship in a single cross-disciplinary learning design. These findings reinforce the idea, as proposed by Hidayah et al. (2023), that pedagogical content knowledge can be strengthened through context-based local activities to build ecological responsibility. Practically, the CET model can be adapted in other schools, especially in areas that have a wealth of local wisdom, in order to grow a young generation that is critical, socially ethical, and committed to environmental sustainability.

The results of this study show that the development of the Civic Ecological Transformation (CET) model can be an effective pedagogical solution in increasing students' ecological awareness while strengthening ecological citizenship in the Indonesia-Malaysia border area. Through the integration of experiential learning approaches and Education for Sustainable Development (ESD) principles, this model transforms Civic Education learning from a mere cognitive activity to a contextual process of forming sustainable values, attitudes, and behaviors.

Theoretically, these results reinforce the view that pro-environment behavior is not only determined by knowledge, but also by the interaction between attitudes, values, and social contexts. In the context of Sambas Regency, local wisdom such as belalek and saprahan function as a social context that encourages ecological participation, thereby reducing the gap between attitudes and behaviors, as explained by Kollmuss & Agyeman (2002). Thus, learning based on local wisdom has been proven to function as a cultural bridge that connects the cognitive and affective dimensions of students to sustainable real actions. In line with Fayyaz et al.'s (2023) opinion, it is emphasized that environmental awareness and conservation behavior must be instilled through sustainability-oriented school practices, such as conservation projects and community-based learning. This approach is relevant to the CET implementation phase, which prioritizes collaborative action in the school environment and society to internalize sustainability values in student behavior.

Furthermore, the development of deep ecological awareness can be facilitated through the embodied pedagogy approach described by Pearce (2024). In his study of embodied ecological awareness, Pearce showed that the experience of the body directly interacting with natural elements such as water, soil, and wind can change the way individuals understand human–nature relationships holistically, as well as address anthropocentric views in education. This principle can also be adapted in the context of

CET learning through environmental observation activities and simulation of local ecosystem-based roles, which foster reflective and empathetic awareness of nature.

These findings also expand the Education for Sustainability study by showing that the integration of local values and social participation can strengthen students' reflective awareness of environmental issues. In line with two studies by Imaduddin (2024; 2024), the learning process that grounds learning in local culture is shown to encourage the development of ecological literacy and greater social responsibility. With an interdisciplinary approach involving aspects of Civics Education, Social Sciences, and Environmental Sciences, the CET model shows that sustainability can be internalized through value education and social practices, not just through knowledge materials.

From the methodological side, the results of the path analysis test using PLS-SEM showed that the influence of the learning model on ecological awareness was fully mediated by the local wisdom integration variable ($\beta = 0.55$; $p < 0.01$). This means that the success of this model does not depend on the learning approach itself, but on the extent to which local values are successfully integrated into the learning process. This proves that culture-based education is not only a contextualization tool but a determining factor in the transformation of students' ecological awareness.

Furthermore, practically, the Civic Ecological Transformation (CET) learning model makes a significant contribution to building students' critical, reflective, and collaborative thinking skills. The learning process centered on real experience and social action strengthens students' agency as change agents. These results are in line with UNESCO's recommendations (Catana & Brilha, 2020; UNESCO, 2020), which emphasize that continuous learning must foster critical awareness and capacity for transformational action at the community level.

Conceptually, this research offers a new contribution to the civic education literature, namely by introducing the conceptual model of Civic Ecological Transformation (CET), which combines three main pillars: (1) civic literacy, (2) local ecological knowledge, and (3) reflective ecological citizenship. The combination of the three forms a learning framework that is able to integrate cultural values, local identity, and global responsibility in one pedagogical unity. Thus, this research not only bridges the gap between civic education and environmental education but also expands the scope of the concept of citizenship towards an ecological citizenship paradigm rooted in the local cultural context.

The primary novelty of this research lies in the development and validation of the Civic Ecological Transformation (CET) model itself. This model is unique for three reasons:

1. Cross-Disciplinary Integration: It formally bridges Civic Education with Education for Sustainable Development (ESD), realms that are often siloed in curriculum design.
2. Empirically-Proven Mechanism: We empirically proved (via Table 1) that local wisdom integration is the full mediation mechanism. This moves beyond prior studies that use local wisdom merely as a 'context' or 'example'; we demonstrate it is the active agent of the observed change in awareness.
3. Borderland Contextualization: The model is specifically designed for the Indonesia-Malaysia border context, where 'citizenship' has a dual meaning, loyalty to the state (nationalism) and responsibility for the land (ecological). The CET model integrates both, offering a blueprint for forming a locally-rooted ecological citizenship (Cheah & Huang, 2019).

CONCLUSION

This study concludes that there is a significant gap between ecological knowledge and behavior among students in Sambas Regency, where a high level of cognitive knowledge is not matched by real pro-environmental attitudes and actions. The integration of local wisdom values such as belalek, saprahan, and tepung tawar into Civic Education, through the developed Civic Ecological Transformation (CET) learning model, was proven effective in bridging this gap and significantly increasing ecological awareness. Path analysis confirmed that the model's success is fully mediated by this integration of cultural values, which function as the essential pedagogical bridge between cognitive knowledge and sustainable action. These cultural values not only contextualize learning but also strengthen the moral and social dimensions in shaping an ecological citizenship identity rooted in local culture and aligned with Education for Sustainable Development (ESD) principles.

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The author does not have a potential conflict of interest.

REFERENCES

Anwar, N., & Elfaki, K. E. (2021). Examining the Relationship Between Energy Consumption, Economic Growth and Environmental Degradation in Indonesia: Do Capital and Trade Openness Matter? *International Journal of Renewable Energy Development*, *10*(4), 769–778. https://doi.org/10.14710/ijred.2021.37822

Bahari. (2020). Pedagogical Knowledge: Analisis Kemampuan Pedagogik Guru IPS dalam Merancang Pembelajaran. *Indonesian Journal of Social Science Education (IJSSE)*, *2*(1), 33–39. https://doi.org/10.29300/ijsse.v2i1.2726

Bhughe, K. I. (2022). Peran Guru Pendidikan Pancasila dan Kewarganegaraan dalam Pembentukan Karakter Peserta Didik di Sekolah Dasar. *Jurnal Kewarganegaraan*, *19*(2), 113–125. https://doi.org/10.24114/JK.V19I2.36954

Budiyono. (2011). *Statistika untuk Penelitian*. UNS Press.

Catana, M. M., & Brilha, J. B. (2020). The Role of UNESCO Global Geoparks in Promoting Geosciences Education for Sustainability. *Geoheritage*, *12*(1). https://doi.org/10.1007/s12371-020-00440-z

Cheah, S. L., & Huang, L. (2019). Environmental Citizenship in a Nordic Civic and Citizenship Education Context. *Nordic Journal of Comparative and International Education (NJCIE)*, *3*(1), 88–104. https://doi.org/10.7577/njcie.3268

Collins-Figueroa, M. (2012). Biodiversity and Education for Sustainable Development in Teacher Education Programmes of Four Jamaican Educational Institutions. *Journal of*

Education for Sustainable Development, *6*(2), 253–267. https://doi.org/10.1177/0973408212475257

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.

Fatmawati, Sulisdiani, I., Marini, M., & Syarmiati, S. (2024). Kepedulian Sosial Masyarakat Perbatasan Dalam Mempertahankan Ketahanan Ekonomi (Kasus Di Temajuk, Paloh, Sambas Kalimantan Barat). *SOSIO EDUKASI Jurnal Studi Masyarakat Dan Pendidikan*, *7*(2), 152–166. https://doi.org/10.29408/sosedu.v7i2.25509

Fayyaz, S., Lashari, A. A., Nandwani, S., & Chang, M. A. (2023). Assessing Environmental Awareness and Conservation Behavior in Schools for Sustainable Development. *Pakistan Journal of Humanities and Social Sciences*, *11*(4). https://doi.org/10.52131/pjhss.2023.1104.0676

Ginting, J. S., Sumarno, E., Sitopu, S., & Lubis, A. R. (2025). Merajut Harmoni: Peran Seni dan Budaya dalam Membentuk Sikap Hidup Generasi Muda. *Jurnal Kewarganegaraan*, *22*(1), 103–112. https://doi.org/10.24114/jk.v22i1.64600

Hendri, & Nurlaili, L. (2023). Eksistensi Peran Guru Pendidikan Kewarganegaraan dalam Membangun Disiplin Belajar Peserta Didik di SMA Mancengan Darussalam, Modung, Bangkalan. *Jurnal Kewarganegaraan*, *20*(1), 77–85. https://doi.org/10.24114/JK.V20I1.44064

Hidayah, F. F., Imaduddin, M., Yuliyanto, E., Gunawan, G., Djunaidi, M. C., & Qomariyah, S. (2023). Strengthening Pedagogical Content Knowledge in Designing Laboratory Activity Based on Small-Scale Chemistry Practicum Approach. *European Journal of Educational Research*, *12*(4), 1631–1644. https://doi.org/10.12973/eu-jer.12.4.1631

Husamah, H., Rahardjanto, A., Permana, T. I., & Lestari, N. (2025). The Relationship Between Environmental Literacy, Ecological Literacy, And Science For Sustainability: A Systematic Literature Review. *Research and Development in Education (RaDEn)*, *5*(1), 351–364. https://doi.org/10.22219/raden.v5i1.399

Imaduddin, M., & Eilks, I. (2024). A Scoping Review and Bibliometric Analysis of Educational Research on Water Literacy and Water Education. *Sustainable Chemistry and Pharmacy*, *42*, 101833. https://doi.org/10.1016/j.scp.2024.101833

Imaduddin, M., & Eilks, I. (2025). Harnessing Indonesia's Biodiversity for Sustainable Water Treatment: A Review of Local Plant-based Solutions. *Environmental Science and Pollution Research*, *32*(20), 12167–12190. https://doi.org/10.1007/s11356-025-36485-2

Imaduddin, M., Nikmah, A., Pasiningsih, Salic-Hairullah, M., & Guarin, R. M. (2024). A Bibliometric Analysis of the Scientific Production and Thematic Trends of Ethnopedagogy in STEM Education. *Pakistan Journal of Life and Social Sciences (PJLSS)*, *22*(1), 2668–2690. https://doi.org/10.57239/PJLSS-2024-22.1.00199

Indriyani, D., & Naidu, N. B. B. M. (2025). Revitalisasi Nilai Lokal: Model Proyek Partisipatif Berbasis Budaya Cianjur dalam Pembelajaran Pancasila. *Jurnal Kewarganegaraan*, *22*(2), 137–159. https://doi.org/10.24114/jk.v22i2.64750

Januardi, A., Moad, Reza, M., Endang Kusumajaya, U., Nur, S., Nawawi, N., & Dwiyana, E. (2025). Tenun Lunggi dan Resiliensi Perempuan Sambas: Strategi Life-Long Learning dalam Menjaga Warisan Budaya. *Jurnal Pendidikan Kewarganegaraan*, *9*(1), 320–326. https://doi.org/10.31571/jpkn.v9i1.9027

Januardi, A., Superman, & Firmansyah, H. (2022). Tradisi Masyarakat Sambas: Identifikasi Nilai-Nilai Kearifan Lokal dan Eksistensinya. *Jurnal Pendidikan Sosiologi Dan Humaniora*,

13(1), 185–192. https://doi.org/10.26418/j-psh.v13i1.52469

Jumali, W., Yuliananingsih, & Moad. (2025). Analisis Menjaga Lingkungan Sekolah pada Program Bina Pribadi Islam pada Siswa Kelas VIII Ikhwan di SMPIT Al-Fityan Kubu Raya. *Character and Civic: Jurnal Pendidikan Kewarganegaraan Dan Karakter*, *4*(3), 142–331. https://jurnal.fipps.upgripnk.ac.id/index.php/PPKn/article/view/375

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Linhares, E., & Reis, P. (2023). Education for Environmental Citizenship and Activism Through the Development of Nature-Based Solutions With Pre-Service Teachers. *JSSE-Journal of Social Science Education*, *22*(4), 1–23. https://doi.org/10.11576/jsse-6498

Miles, M. B., Huberman, M., & Saldana, J. (2013). *Qualitative Data Analysis: A Methods Sourcebook* (4th ed., Issue 1985). SAGE Publications.

Morris, T. H. (2020). Experiential Learning – a Systematic Review and Revision of Kolb's Model. *Interactive Learning Environments*, *28*(8), 1064–1077. https://doi.org/10.1080/10494820.2019.1570279

Mulyani, H., Komalasari, K., Permatasari, M., Bribin, M. L., & Suriaman, S. (2024). Transformasi Pendidikan Kewarganegaraan Global di Era Abad 21: Analisis Implementasi dan Tantangan. *Jurnal Kewarganegaraan*, *21*(1), 88–101. https://doi.org/10.24114/jk.v21i1.55115

Nurhadianto, N., Suhaida, D., Azwar, I., & Moad, M. (2024). Penguatan Profil Pelajar Pancasila Dalam Menangkal Bahaya Narkoba Di Kabupaten Sambas. *GERVASI: Jurnal Pengabdian Kepada Masyarakat*, *8*(1), 243–257. https://doi.org/10.31571/gervasi.v8i1.7846

Pajriati, N., & Rohmah, R. A. (2022). Nilai-Nilai Tradisi pada Upacara Tepuk Tepung Tawar Perkawinan Adat Melayu di Desa Rambah Hilir Timur. *Bakoba: Journal of Social Science Education*, *2*(1), 127–134. https://journal.upp.ac.id/index.php/bakoba/article/view/1216

Pan, H., Liu, G., Muller, J.-P., Sun, Z., Yao, Y., Chang, Y., Xiong, Z., & Zhang, Y. (2024). Comprehensive Assessment of Sustainable Development of Terrestrial Ecosystem Based on SDG 15—A Case Study of Guilin City. *Remote Sensing*, *17*(63), 1–23. https://doi.org/10.3390/rs17010063

Pearce, M. (2024). Embodied Ecological Awareness and the Pedagogy of Jacques Lecoq. *Theatre, Dance and Performance Training*, *15*(3), 375–394. https://doi.org/10.1080/19443927.2024.2376601

Putri, A. E. (2019). Analisis Kebutuhan Bahan Ajar Berbasis Literasi Digital Nilai-Nilai Kearifan Lokal pada Tradisi Saprahan di Pontianak. *Yupa: Historical Studies Journal*, *3*(1), 1–7. https://doi.org/10.30872/yupa.v3i1.132

Ridha, M. K., Arpannudin, I., Ma'rifatun, R., & Haryanto, Y. (2025). Mapping Civic Literacy Research: An Integrated Systematic Review and Bibliometric Analysis. *Jurnal Penelitian Pendidikan*, *42*(2), 404–411. https://doi.org/10.15294/jpp.v42i2.34772

Sarstedt, M., Ringle, C. M., Smith, D., Reams, R., & Hair, J. F. (2014). Partial Least Squares Structural Equation Modeling (PLS-SEM): A Useful Tool for Family Business Researchers. *Journal of Family Business Strategy*, *5*(1), 105–115. https://doi.org/10.1016/j.jfbs.2014.01.002

Sarwono, J. (2022). Analisis Jalur: Untuk Riset Skripsi. *Elexmedia Komputindo Kompas Gramedia*

Jakarta, *16*(2), 39–55.

Septiani, F. (2025). Integrasi Kajian Etnopedagodi dalam Pendidikan Biologi Melalui Kearifan Lokal Suku Melayu Pada Tradisi Tepung Tawar. *Edukasia Jurnal Pendidikan*, *1*(3), 83–87. https://e-journalbattuta.ac.id/index.php/bje/article/view/60

Shulla, K., Filho, W. L., Lardjane, S., Sommer, J. H., & Borgemeister, C. (2020). Sustainable Development Education in the Context of the 2030 Agenda for Sustainable Development. *International Journal of Sustainable Development & World Ecology*, *27*(5), 458–468. https://doi.org/10.1080/13504509.2020.1721378

Shutaleva, A. (2023). Ecological Culture and Critical Thinking: Building of a Sustainable Future. *Sustainability*, *15*(18). https://doi.org/10.3390/su151813492

Sugiyono. (2017). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

UNESCO. (2020). *A Toolkit on Youth and Young Professionals in Science, Engineering, Technology, and Innovation for Disaster Risk Reduction*. UNESCO Office Jakarta.

Wang, X., & Zheng, J. (2024). The Evolution of Sustainable Economic Development: Trends, Trade-Offs and Trajectories for Balanced Economic Activities. *Sustainable Economies*, *2*(1), 1–12. https://doi.org/10.62617/se.v2i1.12

Widianti, W., Kharisma, N. A., Fariza, A., Ginting, R., & Yunita, K. (2023). Memaknai Tradisi Belale' Dalam Perspektif Akuntansi Hutang Piutang: Sebuah Kajian Etnografi. *KEUNIS*, *11*(2), 138–145. https://doi.org/10.32497/keunis.v11i2.4431

Wiyono, H., & Ramadhan, I. (2021). Pergeseran Tradisi Belalek Dalam Budaya Bertani Masyarakat Melayu Sambas. *Jurnal Studi Agama Dan Masyarakat*, *17*(1), 1–9. https://doi.org/10.23971/jsam.v17i1.2880

Yoshizumi, M. (2009). Towards Sustainable Community Development : Education for Sustainable Development Initiatives in Nishinomiya, Japan. *SANSAI: An Environmental Journal for the Global Community*, *4*, 45–65. https://doi.org/http://hdl.handle.net/2433/110019