



DEVELOPMENT OF AN EDUCATIONAL MODULE FOR INTRODUCING THE BRUBUH TRADITION TO THE YOUNGER GENERATION

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ABSTRAK

Kearifan lokal merupakan bentuk pengetahuan ekologis yang berkembang melalui interaksi panjang antara masyarakat dan lingkungannya, namun keberadaannya semakin terancam oleh modernisasi dan minimnya integrasi dalam pendidikan formal. Salah satu kearifan lokal masyarakat Jawa adalah tradisi Brubuh, yaitu praktik penebangan kayu yang diatur berdasarkan sistem kalender musiman Pranata Mangsa. Penelitian ini bertujuan untuk mengembangkan modul edukasi berbasis tradisi Brubuh dan Pranata Mangsa serta menganalisis kelayakan dan kepraktisannya sebagai sumber belajar integratif bagi generasi muda. Penelitian menggunakan pendekatan Research and Development (R&D) dengan adaptasi model Borg dan Gall. Tahapan penelitian meliputi studi pendahuluan melalui kajian literatur, wawancara, dan observasi lapangan; penyusunan draf modul; validasi oleh ahli materi, ahli desain pembelajaran, dan praktisi budaya; serta uji coba terbatas kepada peserta didik. Hasil penelitian menunjukkan bahwa tradisi Brubuh mengandung rasionalitas ekologis dan material yang selaras dengan konsep ilmiah modern, khususnya terkait pengaruh kadar air terhadap sifat fisik dan mekanik kayu. Modul yang dikembangkan dinilai layak dan praktis, dengan respons peserta didik mencapai tingkat ketercapaian sebesar 89% pada kategori sangat baik. Integrasi kearifan lokal ke dalam modul pembelajaran terbukti mampu meningkatkan pemahaman konsep, kesadaran ekologis, serta apresiasi terhadap warisan budaya. Penelitian ini berkontribusi pada pengembangan bahan ajar kontekstual berbasis etnosains dan membuka peluang penerapan modul serupa pada kearifan lokal lain sebagai upaya pendidikan berkelanjutan dan pelestarian budaya.

Kata Kunci: *Brubuh, Konservasi Kayu, Budaya Jawa, Modul Edukasi*

ABSTRACT

Local wisdom represents a form of ecological knowledge that has developed through long-term interactions between communities and their natural environments. However, its existence is increasingly threatened by modernization and the limited integration of indigenous knowledge into formal education. One such form of Javanese local wisdom is the *Brubuh* tradition, a traditional wood-cutting practice regulated by the seasonal calendar system known as *Pranata Mangsa*. This study aims to develop an educational module based on the *Brubuh* tradition and the *Pranata Mangsa* system and to analyze its feasibility and practicality as an integrative learning resource for younger generations. The research employed a Research and Development (R&D) approach adapted from the Borg and Gall model. The research stages included a preliminary study through literature review, interviews, and field observations; module drafting; expert validation involving subject matter experts, instructional design experts, and local cultural practitioners; and limited field testing with students. The findings indicate that the *Brubuh* tradition embodies strong ecological and material rationality that aligns with modern scientific principles, particularly regarding the influence of moisture content on the physical



and mechanical properties of wood. The developed module was evaluated as valid and practical, with student responses reaching an achievement level of 89%, categorized as very good. The integration of local wisdom into the educational module effectively enhanced students' conceptual understanding, ecological awareness, and appreciation of cultural heritage. This study contributes to the development of contextual learning materials grounded in ethnoscience and offers prospects for applying similar modules based on other forms of local wisdom to support sustainable education and cultural preservation.

Keywords: *Brubuh, Wood Conservation, Javanese Culture, Educational Module*

PENDAHULUAN

Local wisdom is a vital component of community life, encompassing knowledge, values, and practices developed through long-term interactions with the natural environment. In Javanese culture, it functions not only as a cultural and spiritual guide but also as a framework for sustainable natural resource management. One significant example is the Brubuh tradition, a traditional wood-cutting practice regulated by seasonal calculations based on the Pranata Mangsa calendar. This tradition reflects adaptive local ecological knowledge that supports sustainable forest resource use (Sobirin). Such perspectives align with studies highlighting the crucial role of local ecological knowledge in resource conservation, forest regeneration, and biodiversity sustainability (Aung et al., 2023; Urzedo et al., 2022).

Beyond its technical aspects, the Brubuh tradition demonstrates a sophisticated understanding of natural cycles and wood material properties. Tree felling is conducted during specific seasons associated with lower wood moisture content, a key factor influencing wood's physical and mechanical properties. High moisture content has been shown to reduce structural strength, stiffness, dimensional stability, and impact bending resistance (Hering et al., 2021; Kherais et al., 2024; Vand & Tippner, 2024). These scientific findings confirm that the timing of tree felling in the Brubuh tradition is ecologically and materially rational, aligning closely with principles of modern materials science.

The technical understanding embedded in the Brubuh tradition is closely connected to the Pranata Mangsa system, a season-based Javanese calendar dividing the year into twelve periods defined by specific climatic and environmental indicators. For centuries, this system has guided Javanese agrarian communities in agriculture, forest management, and natural resource use. In addition to crop cultivation, Pranata Mangsa has been applied by fishermen to guide fishing activities and predict marine resource availability (Karjanto, 2022). As a form of traditional Javanese science, it incorporates environmental management concepts that support ecological balance and offer valuable potential for biology education (Anazifa). Studies show that integrating such local wisdom into biology learning enhances students' understanding of ecosystems, biodiversity, and conservation by making learning more contextual and meaningful (Zebua & Malik, 2025). Based on long-term environmental observations, Pranata Mangsa demonstrates relatively high predictive accuracy and can be regarded as an ethnoscientific system that supports human adaptation to environmental variability while balancing economic and ecological interests (Dora et al., 2025).

Despite its ecological significance, the application of Pranata Mangsa-based traditions such as Brubuh has gradually declined due to modernization, which has reshaped production systems, knowledge transmission, and agrarian orientations. Agricultural modernization has been shown to marginalize local wisdom practices that previously supported sustainable resource management (Hunowu et al., 2021), while limited documentation and intergenerational transfer further threaten their continuity. In educational contexts, local



wisdom such as *Brubuh* remains underutilized as an integrated learning resource linking cultural knowledge with scientific concepts, even though studies consistently show that its integration strengthens conceptual understanding, fosters ecological awareness, and bridges local knowledge with modern science (Setiawan et al., 2021).

Integrating local wisdom into educational modules provides a strategic means of addressing this gap by enabling contextual learning grounded in culturally relevant experiences. Such approaches help students understand scientific concepts while fostering ecological awareness and cultural identity. In environmental education, learning designs based on local wisdom enhance scientific literacy by linking scientific concepts with students' cultural practices, increasing learning motivation and awareness of environmental conservation and local values (Yamin et al., 2024). Furthermore, educational modules rooted in local wisdom serve not only as instructional media but also as instruments for preserving intangible cultural heritage (Salelatu & Rohaeti, 2023).

Accordingly, this study aims to develop and analyze an educational module based on the *Brubuh* tradition and the *Pranata Mangsa* system as an integrative learning resource connecting local ecological wisdom with scientific concepts of wood properties and environmental sustainability. Previous studies show that similar modules improve environmental literacy, critical thinking skills, and socio-cultural awareness by strengthening the connection between scientific concepts and local cultural practices, thereby supporting more contextual and sustainable learning (Firmansyah & Maulana, 2025; Marlina et al., 2025).

METODE PENELITIAN

This study employed a Research and Development (R&D) approach to develop a learning module based on local wisdom, specifically the *Brubuh* tradition and the *Pranata Mangsa* system, and to evaluate the feasibility of the module as a learning resource. The development model used in this study was an adaptation of the Borg and Gall model, modified to suit the research context. The study was conducted in Kapanewon Gamping, Sleman Regency, involving community elders and cultural practitioners as initial data sources, education experts as validators, and students as subjects for the module trial.

The initial stage of the research began with a preliminary study consisting of a literature review, interviews, and field observations to explore community understanding of the *Brubuh* tradition and its potential integration into learning activities. Data at this stage were collected using interview guidelines and observation sheets developed by the researcher. Based on the findings of the preliminary study, an initial draft of the learning module was developed by integrating the historical, philosophical, and practical aspects of the *Brubuh* tradition into learning activities linked to scientific concepts related to wood properties and environmental sustainability. The module draft was subsequently validated by subject matter experts, instructional design experts, and local cultural practitioners using validation instruments that assessed content feasibility, conceptual accuracy, alignment with learners' characteristics, and the quality of module presentation. Feedback from the experts served as the basis for revising the module.

The revised module was then subjected to a limited trial involving students to assess the clarity of the material, module readability, student engagement, and learners' responses to the learning activities. Data during the trial phase were collected using student response questionnaires and observation sheets on learning implementation. The trial results were analyzed to identify the strengths and weaknesses of the module, which were subsequently used as the basis for final evaluation and revision to ensure that the developed module achieved an

appropriate level of validity and practicality in accordance with learners' needs and instructional objectives.

HASIL DAN PEMBAHASAN

Results

This study explored the *Brubuh* tradition through in-depth interviews with informants who still possess knowledge and experience in traditional wood-cutting practices. The interviews focused on the selection of tree species, the determination of appropriate cutting periods, the stages of *Brubuh* implementation, and informants' perspectives on the sustainability of the tradition. The results indicate that although the practice of *Brubuh* has gradually been abandoned by modern wood craftsmen, knowledge of this tradition persists among certain community members, particularly in relation to the construction of traditional houses and the use of wood for specific purposes.

The findings further show that Javanese communities in the Special Region of Yogyakarta recognize the selection of wood types based on their functional uses as well as the timing of tree felling determined by the *Pranata Mangsa* system. Teak (*Tectona grandis*) and sonokeling (*Dalbergia latifolia*) are commonly felled during *Mangsa Kasanga*, coconut (*Cocos nucifera*) and sugar palm (*Arenga pinnata*) during *Mangsa Kasadasa*, while wood used for household utensils and traditional musical instruments is felled up to *Mangsa Dhesta*. Informants stated that felling trees during these seasons is believed to produce wood that is denser, more durable, less prone to warping, and more resistant to insect attacks and decay, as summarized in Table 1.

Table 1. Felling Seasons of Commonly Used Tree Species in Yogyakarta

Function	Common Tree Species	Felling Season	Reason/Belief
Pillars and house framework	Teak (<i>Tectona grandis</i>), Indian rosewood (<i>Dalbergia latifolia</i>)	Kasanga (9th Mangsa)	When moisture content is low, the wood fibers are denser, making the timber more durable and resistant to decay
Roof beams and rafters	Coconut (<i>Cocos nucifera</i>), Sugar palm (<i>Arenga pinnata</i>)	Kasadasa (10th Mangsa)	The straight fibers are more stable, and the wood is less likely to warp
Doors, windows, carvings, and furniture	Teak, Mahogany (<i>Swietenia mahagoni</i>)	Kasanga–Kasadasa	Easier carving and drying process without cracking
Household tools (mortar, pestle, wooden pot)	Mahogany, Spanish cherry (<i>Manilkara kauki</i>), Jackfruit (<i>Artocarpus heterophyllus</i>)	Kasanga–Dhesta (9th–11th Mangsa)	Denser wood, less prone to cracking even under frequent impact



The limited trial phase was carried out in several educational institutions involving a small group of students as participants. During this stage, the prototype of the Brubuh digital educational module was implemented in a real classroom setting to observe its practicality, clarity, and student engagement. The learning sessions integrated discussions, visual analyses, and reflection activities related to traditional ecological knowledge. Data were collected through questionnaires, interviews, and classroom observations to assess students' comprehension, interest, and responses to the learning material. This procedure was carried out in several senior high schools in the Special Region of Yogyakarta.

Table 3 Sample of Assessment Instrument

Statement	Yes	No
I know that the <i>Brubuh</i> tradition is related to tree cutting performed at a specific time.	<input type="checkbox"/>	<input type="checkbox"/>
I can explain why choosing the right time for <i>Brubuh</i> is important to maintain wood quality.	<input type="checkbox"/>	<input type="checkbox"/>
I can identify the types of wood commonly used in the <i>Brubuh</i> tradition.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that the <i>Brubuh</i> process also involves rituals or offerings as a form of respect to nature.	<input type="checkbox"/>	<input type="checkbox"/>
I realize the importance of preserving the <i>Brubuh</i> tradition as part of Javanese cultural heritage.	<input type="checkbox"/>	<input type="checkbox"/>

The results showed that most students found the topic of Brubuh both unique and relevant to their daily lives, particularly in understanding the relationship between culture and environmental sustainability with average assessment score of 89. Teachers also appreciated the contextual approach that connected local wisdom with modern learning objectives. However, several suggestions were made, including the need for clearer visual representations of the felling process, additional glossaries for Javanese terminology, and simplified explanations of the Pranata Mangsa system. This feedback became the basis for further revision to enhance the instructional quality and accessibility of the module before it proceeded to the final evaluation stage.

The evaluation stage focused on analyzing the effectiveness, practicality, and quality of the revised Brubuh educational module. This process involved reviewing the results from expert validation and the limited trial to identify areas requiring improvement. Both qualitative and quantitative feedback were considered — including students' comprehension levels, engagement, and teachers' assessments of lesson delivery.

The evaluation revealed that the integration of local wisdom through the Brubuh tradition effectively increased students' cultural awareness and understanding of environmental ethics. Additionally, the module's structured layout and contextual learning activities were found to support active participation and critical thinking. However, minor adjustments were made to language clarity, layout design, and the sequencing of activities to ensure smoother implementation across different educational levels. Following these refinements, the module was finalized as a culturally grounded educational resource suitable for promoting the preservation of Javanese environmental traditions in modern learning contexts.

Discussion

The findings indicate that the Brubuh tradition constitutes a form of local ecological knowledge integrated with the Pranata Mangsa system. Tree felling during Mangsa Kasanga to



Dhesta coincides with environmental conditions of lower moisture and sap content, resulting in more durable and decay-resistant wood. This aligns with studies by Sobirin and Dora et al., which highlight the significant influence of moisture content on wood strength, stability, and durability. Likewise, Kherais et al. (2024) demonstrate that moisture content affects key mechanical properties, including the modulus of elasticity and rupture, with higher moisture levels reducing wood performance under mechanical loading. These results empirically confirm that appropriate moisture levels are essential for achieving optimal mechanical performance in structural wood applications.

The offering rituals accompanying the Brubuh practice reflect a Javanese cosmological worldview that situates humans as part of the natural ecosystem and embodies an environmental ethic of respect, prudence, and balance in resource use. This supports the views of Anazifa and Karjanto that local wisdom functions as a socio-cultural mechanism for environmental sustainability through inherited values and norms. Similar findings by Khumairoh et al. (2025) show that local wisdom practices within the Betawi community of Setu Babakan serve not only as cultural symbols but also as expressions of environmental ethics and strategies for sustainable conservation, indicating that ritual-based values can foster strong ecological awareness in contemporary society.

The integration of the Brubuh tradition into an educational module was shown to enhance students' cultural awareness and understanding of the relationship between culture and the environment. Positive student responses, with an achievement level of 89%, indicate that contextual learning grounded in local wisdom creates meaningful and relevant learning experiences, in line with constructivist approaches that emphasize learners' socio-cultural contexts (Husnayayin et al., 2024). Previous studies similarly show that local wisdom-based learning strengthens cultural awareness and the preservation of cultural values while enabling students to connect academic content with real-life practices and environmental contexts (Partawan et al., 2025).

The module development process, which involved expert validation, limited field trials, and iterative revisions, demonstrates the systematic application of the Research and Development (R&D) model. This approach allows instructional products to be refined based on empirical and theoretical feedback, resulting in learning modules with strong validity, practicality, and effectiveness. These results are consistent with studies on the development of integrated thematic learning modules using R&D models such as ADDIE, which report high levels of validity, practicality, and effectiveness, indicating that the developed instructional materials are highly feasible for classroom use (Utami & Marfilinda, 2024). This finding reinforces the conclusions of UntoroSeto and UntoroSeto (2023) and Kabatiah et al. (2024), which highlight the effectiveness of R&D approaches in producing innovative, context-based learning materials.

Overall, the findings of this study demonstrate that the Brubuh tradition holds significant potential for integration into modern education as a means of cultural preservation and environmental ethics education. Integrating local traditions into learning enables students to understand environmental concepts not only cognitively but also through living, contextual cultural values. The developed Brubuh learning module functions not only as a learning resource but also as a medium for transmitting the ecological and cultural values of Javanese society to younger generations in a sustainable manner. This finding is in line with Nurhayati, Sari, and Kurniawan (2022), who assert that local wisdom-based learning effectively enhances environmental awareness, ecological attitudes, and students' connectedness to their socio-



cultural environments. Thus, the Brubuh module contributes not only to academic achievement but also to the development of students' character and environmental responsibility.

KESIMPULAN

This study confirms that the Brubuh tradition is not merely a cultural practice but a structured and rational form of local ecological knowledge rooted in the Javanese community's understanding of natural cycles, wood material properties, and environmental sustainability. The timing of tree felling based on the Pranata Mangsa system demonstrates strong ecological and material foundations consistent with modern scientific findings, particularly regarding the influence of moisture content on wood quality and durability. As such, Brubuh represents a meaningful integration of traditional wisdom and material science relevant to sustainable natural resource management.

The development of an educational module based on the Brubuh tradition shows that local wisdom can be effectively transformed into a meaningful and contextual learning resource. The module functions not only as a medium for knowledge transfer but also as a means of internalizing environmental ethics, cultural awareness, and ecological responsibility among students. Positive responses from students and teachers indicate that integrating local culture into learning successfully bridges scientific concepts with learners' socio-cultural experiences, making learning more relevant and reflective.

Methodologically, the application of the Research and Development (R&D) model enables a systematic and reflective module development process with continuous evaluation, while the involvement of cultural practitioners, education experts, and students strengthens both academic validity and cultural sensitivity. Looking ahead, the Brubuh module has strong potential for broader application across disciplines, digital learning formats, and project-based learning, as well as for future research on its long-term impact on students' environmental literacy, ecological attitudes, and sustainable behaviors. Integrating local wisdom such as Brubuh into formal education thus contributes not only to the preservation of intangible cultural heritage but also to transformative strategies for addressing future environmental sustainability challenges.

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