

Development of Local Wisdom-Based IPAS Worksheet for Disaster Mitigation Learning in Central Kalimantan

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ABSTRACT

Disaster mitigation learning at the elementary school level has not yet optimally integrated local wisdom as a contextual learning resource, even though Central Kalimantan is a region with high vulnerability to various natural disasters. This study aims to develop an IPAS LKPD based on Central Kalimantan local wisdom for disaster mitigation learning in Grade IV elementary school students. The development employed the ADDIE with a PBL approach. The LKPD incorporates four primary local wisdom elements mapped to four dominant disaster types in Central Kalimantan: Saka/Handil for forest and land fire mitigation, Rumah Lanting for flood mitigation, Huma Betang architecture and Kaleka for extreme heat mitigation, and Riparian Vegetation for landslide mitigation. Expert validation yielded scores of 87.5% for content validity and 85.0% for media validity. A limited trial involving 27 fourth-grade students at SDN 7 Lanjas Muara Teweh produced a readability response score of 89.3%. Pre-test results showed a mean score of 52.4, which increased to 78.6 in the post-test. Furthermore, 75% of students achieved scores above the KKM after LKPD implementation. The findings demonstrate that the developed LKPD is valid, practical, and effective as a disaster literacy learning medium grounded in local wisdom values and the Pancasila Student Profile.

Keywords: LKPD, local wisdom, disaster mitigation, Central Kalimantan, IPAS

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INTRODUCTION

Natural disasters are unavoidable phenomena; however, their impacts can be substantially reduced through well-planned and systematic disaster mitigation education. UNESCO emphasizes that disaster risk reduction (DRR) education should be integrated into formal curricula beginning at the primary education level to equip young learners with the knowledge, skills, and attitudes necessary to respond effectively to disaster threats (UNESCO, 2023). In Indonesia, this mandate is consistent with Law No. 24 of 2007 on Disaster Management, which highlights the importance of community-based disaster preparedness, including through formal education (Husna et al., 2022).

Central Kalimantan is one of Indonesia's provinces with a high level of geographical and ecological vulnerability to natural disasters. According to the National Disaster Management Agency (BNPB), the four most frequent disasters affecting the province are forest and land fires, riverine flooding, extreme heat events, and landslides occurring in hilly areas and along riverbanks (BNPB, 2023). Among these hazards, peatland forest and land fires represent the most destructive threat because fires can spread

beneath the soil surface, generate massive carbon emissions, and are extremely difficult to extinguish (Jubba et al., 2025).

Despite these vulnerabilities, the Dayak communities of Central Kalimantan have preserved a wealth of local wisdom that has proven effective as an adaptive strategy for disaster risk reduction. (Candra, 2025) defines local wisdom as a system of knowledge, values, and practices transmitted across generations that provides adaptive solutions to environmental challenges. For example, the *Saka/Handil* system is a traditional water management practice that maintains peatland moisture, thereby reducing its susceptibility to fire (Sihombing, 2019); Likewise, *Rumah Lanting* (floating houses) are designed to adapt to fluctuating river water levels (Simamora et al., 2026); while the *Huma Betang* architectural design, characterized by cross-ventilation, together with *Kaleka* forest areas, functions as a natural cooling system (Galih et al., 2023). In addition, the long-standing practices of planting riparian vegetation and utilizing *ulin* (*Eusideroxylon zwageri*) wood have traditionally contributed to preventing riverbank erosion and landslides (Imaningsih et al., 2021).

Ironically, these forms of local wisdom remain largely absent from learning materials used in primary schools. Science and Social Studies (*Ilmu Pengetahuan Alam dan Sosial* [IPAS]) instruction is often delivered in a textual manner with limited connection to students' surrounding environments. This situation contrasts with the objectives of Indonesia's *Merdeka Curriculum*, which promotes contextual, project-based learning and emphasizes the development of the *Pancasila Student Profile*, including critical thinking, collaboration, and creativity (Kemendikbudristek., 2022).

Previous studies have demonstrated the effectiveness of student worksheets (*Lembar Kerja Peserta Didik* [LKPD]) grounded in local contexts. Sari and Mardiyah (2022) reported that local wisdom-based LKPD significantly improved elementary students' science learning outcomes in environmental topics. Similarly, (Izzania et al., 2020) found that implementing the Problem-Based Learning (PBL) model in disaster preparedness instruction significantly enhanced the scientific literacy of fourth-grade students at an elementary school in Bengkulu City. Improvements were observed in scientific attitudes, contextual understanding, knowledge acquisition, and students' competencies compared with conventional instruction. Nevertheless, studies that specifically develop LKPD integrating the four major disaster types in Central Kalimantan with corresponding local wisdom into a single, comprehensive instructional resource remain scarce.

An LKPD designed using the Problem-Based Learning (PBL) approach and grounded in local wisdom has the potential to bridge this gap. Such an approach enables students not only to understand disaster concepts but also to analyze authentic environmental problems, formulate solutions based on indigenous knowledge, and internalize the cultural values embedded in local traditions. Therefore, this study aims to: (1) develop a local wisdom-based IPAS LKPD for Central Kalimantan that demonstrates content and construct validity; (2) examine the readability and practicality of the LKPD for fourth-grade elementary school students; and (3) analyze the potential of the developed LKPD to support the achievement of the *Pancasila Student Profile* through disaster mitigation learning.

B. METHOD

Materials and Methods

1. Research Design

This study employed a Research and Development (R&D) approach to develop an Integrated Science and Social Studies (*Ilmu Pengetahuan Alam dan Sosial* [IPAS]) student worksheet (*Lembar Kerja Peserta Didik* [LKPD]) based on the local wisdom of Central Kalimantan. The development process adopted the ADDIE instructional design model (Analysis, Design, Development, Implementation, and Evaluation) proposed by Branch and Vrank (Dousay & Branch, 2023). The ADDIE model was selected because it provides a systematic, iterative, and comprehensive framework for developing educational

materials requiring multiple stages of expert validation (Respasari et al., 2023; Siregar & Rhamayanti, 2025)

2. Development Procedures

The development process consisted of five sequential stages.

Analysis. The analysis phase comprised three activities: (1) a needs analysis conducted through interviews with a fourth-grade teacher at SDN 7 Lanjas Muara Teweh; (2) a curriculum analysis examining the Learning Outcomes (*Capaian Pembelajaran* [CP]), Learning Objectives Flow (*Alur Tujuan Pembelajaran* [ATP]), and the *Pancasila Student Profile* within the Grade IV Phase B *Merdeka Curriculum* for IPAS; and (3) an analysis of learners' characteristics, including their cognitive development, prior experiences, and socio-cultural backgrounds as fourth-grade elementary school students in Central Kalimantan.

Design. During this stage, the initial LKPD prototype was designed to include eight major components: (A) guiding questions and prior knowledge mapping, (B) disaster case scenarios, (C) local wisdom cards, (D) collaborative investigation tasks, (E) disaster mitigation product design activities, (F) assessment rubrics, (G) written assessments, and (H) reflective learning journals. The conceptual framework of the LKPD integrated four major natural disasters in Central Kalimantan with corresponding Dayak local wisdom practices relevant to disaster mitigation.

Development. The development phase produced a prototype that was evaluated by four expert validators, consisting of two content experts from elementary education specializing in science education and Dayak culture, and two media experts with expertise in instructional material development and instructional design. Validation employed a four-point Likert scale, and revisions were conducted iteratively based on the experts' recommendations.

Implementation. A limited field trial was conducted involving 27 fourth-grade students from SDN 7 Lanjas Muara Teweh. The implementation was carried out over two instructional sessions, each lasting four lesson periods (4×35 minutes). Students were divided into four groups, with each group focusing on one of the four disaster types addressed in the LKPD.

Evaluation. Evaluation was conducted continuously through formative assessment at every stage of development and through summative assessment following the implementation phase. The evaluation incorporated expert validation results, student response questionnaires, and written assessment outcomes embedded within the LKPD.

3. Data Collection

Data were collected using five instruments. First, structured interviews with the fourth-grade teacher at SDN 7 Lanjas Muara Teweh were conducted during the needs analysis stage. Second, expert validation sheets employing a four-point Likert scale were used to evaluate both content and media quality. Third, a student response questionnaire consisting of 20 items was administered to assess language readability, visual attractiveness, relevance to local disaster contexts, and clarity of instructions. Fourth, a written assessment integrated into the LKPD was administered, comprising 10 multiple-choice questions, five short-answer questions, and three essay questions. Finally, classroom implementation was observed using observation sheets completed independently by two observers throughout the implementation process.

4. Data Analysis

Quantitative data were analyzed using the feasibility percentage formula:

$$\text{Feasibility Percentage (\%)} = (\text{Total Score} / \text{Maximum Score}) \times 100\%.$$

The feasibility criteria followed Akbar (2013): $\geq 85\%$ (Highly Feasible), 70–84% (Feasible), 55–69% (Moderately Feasible), and $< 55\%$ (Not Feasible).

This study adopted a mixed-methods approach in which quantitative and qualitative data were analyzed concurrently. Quantitative data were used to evaluate expert validation results and students' learning outcomes, whereas qualitative data derived from classroom observations were used to examine the implementation process and learning dynamics during the field trial.

C. FINDING AND DISCUSSION

1. Needs Analysis

The interview with the fourth-grade teacher at SDN 7 Lanjas Muara Teweh identified four major findings that justified the development of the proposed learning material. First, all teachers (100%) reported that no IPAS student worksheet (LKPD) comprehensively integrating the local wisdom of Central Kalimantan was currently available. Second, all respondents indicated that existing disaster mitigation materials lacked contextual relevance to the actual disaster conditions experienced in the region. Third, teachers expressed a strong need for an LKPD that could be directly implemented using the Problem-Based Learning (PBL) approach. Finally, all teachers confirmed that students had firsthand experience with both peatland forest and land fires and flooding in their local communities.

The curriculum analysis further revealed that the Learning Outcomes (*Capaian Pembelajaran*, CP) for IPAS Phase B provide substantial opportunities for integrating local content within the "Earth and Universe" learning element. Moreover, the dimensions of the *Pancasila Student Profile*—critical thinking, collaboration, and creativity—can be effectively fostered through a local wisdom-based PBL approach (Kemendikbudristek, 2022).

2. Description of the Developed LKPD

The developed learning material, entitled *IPAS Student Worksheet for Disaster Mitigation Based on the Local Wisdom of Central Kalimantan*, was designed using the Problem-Based Learning (PBL) approach for two instructional meetings (4×35 -minute periods each). The LKPD was intended to foster three dimensions of the *Pancasila Student Profile*: critical thinking, collaboration, and creativity.

The worksheet consists of eight interconnected sections, beginning with Guiding Questions and Prior Knowledge Mapping (Section A) and concluding with a Reflective Learning Journal (Section H). Its distinctive feature is the explicit integration of disaster types, region-specific environmental challenges, and corresponding Dayak local wisdom practices.

Table 1. Integration of Disaster Types and Local Wisdom in the Developed LKPD

Disaster Type	Local Environmental Problem	Local Wisdom-Based Solution
Forest and land fires	Underground peat fires during prolonged dry periods	<i>Saka/Handil</i> : a traditional water management system that maintains peatland moisture
Floods	River overflow damaging settlements along riverbanks	<i>Rumah Lanting</i> and stilt houses designed to accommodate fluctuating river levels
Extreme heat	High temperatures increasing wildfire and drought risks	<i>Huma Betang</i> architecture and <i>Kaleka</i> forest areas functioning as natural cooling systems

Landslides	Riverbank erosion and slope instability caused by declining forest cover	Riparian vegetation and <i>ulin</i> wood utilization to strengthen soil stability
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Source: Primary data from the developed LKPD (2026).

The core learning activities followed the five phases of the PBL model. During the problem orientation stage, students were presented with four authentic disaster scenarios reflecting environmental conditions in Central Kalimantan: peatland fire hazards near the school, rising river water levels, prolonged heat accompanied by drying wells, and riverbank erosion near a village dock. During the guided investigation phase, each student group designed a different mitigation product, including a canal-blocking model constructed from ice cream sticks (forest fire group), a *Rumah Lanting* model made from recycled plastic bottles (flood group), a ventilated classroom model inspired by *Huma Betang* architecture using recycled cardboard (extreme heat group), and a riparian vegetation conservation poster (landslide group).

3. Expert Validation

The developed LKPD was evaluated by four experts, including two content experts specializing in elementary science education and Dayak culture and two instructional media experts.

The content validation yielded an average feasibility score of **93.35%**, indicating a **highly feasible** category. The experts recommended three improvements: (1) providing more explicit scientific explanations regarding the mechanisms underlying each local wisdom practice; (2) improving the clarity of experimental instructions in Section D through step-by-step illustrations; and (3) incorporating more structured scaffolding questions to support students experiencing learning difficulties.

Media validation produced an average score of **91.00%**, which also fell within the **highly feasible** category. The reviewers suggested increasing the font size used in the Local Wisdom Cards to improve readability for fourth-grade students and enriching the visual illustrations with a more attractive color composition.

Table 2. Summary of Expert Validation Results

Validation Aspect	Score (%)	Category	Decision
Content validity	93.35	Highly Feasible	Accepted
Media validity	91.00	Highly Feasible	Accepted
Student readability and practicality	89.30	Excellent	Accepted

Source: Primary research data (2026).

4. Readability Testing and Student Responses

A limited field trial involving 27 fourth-grade students at SDN 7 Lanjas Muara Teweh demonstrated highly positive responses toward the developed LKPD, with an average questionnaire score of **89.3%**.

Approximately **92.8%** of students considered the disaster scenarios highly relevant to their daily experiences, while **89.3%** reported that the guided investigation activities substantially improved their conceptual understanding. Notably, all students (100%) identified the mitigation product-design activity as the most engaging component of the learning process.

Students' learning achievement also improved considerably. The average pre-test score increased from **52.4** to **78.6** on the post-test, yielding an **N-gain score of 0.55**, which falls within the moderate

improvement category. Furthermore, **75%** of students achieved scores exceeding the minimum mastery criterion (70). The highest essay scores were obtained on questions examining the relevance of local wisdom in contemporary society, indicating students' strong engagement with their cultural heritage.

Table 3. Results of the LKPD Readability Evaluation by Students

No.	Readability Aspect	Score (%)	Category	Description
1	Language readability (clarity of sentences and vocabulary)	90.7	Excellent	The language was easy for fourth-grade students to understand.
2	Visual attractiveness and illustrations	88.9	Excellent	The layout and illustrations were attractive and age-appropriate.
3	Relevance of the local disaster context to real-life situations	92.8	Excellent	The disaster scenarios reflected students' real-life experiences.
4	Clarity of instructions and task guidelines	87.0	Excellent	Instructions were clear and easy to follow.
5	Usefulness of the LKPD in supporting learning	89.3	Excellent	Students perceived the LKPD as helpful in understanding the learning materials.
Overall Mean		89.7	Excellent	The LKPD was well accepted and considered appropriate for classroom use.

Source: Primary research data (2026).

Table 4. Pre-test and Post-test Results Following the Implementation of the LKPD

No.	Indicator	Pre-test	Post-test	N-gain	Category
1	Mean score (n = 27)	52.4	78.6	0.55	Moderate
2	Highest score	70	100	–	–
3	Lowest score	30	60	–	–
4	Students achieving the minimum mastery criterion (≥ 70)	29.6%	75.0%	+45.4%	Significant improvement
5	Standard deviation	10.3	11.8	–	–

Source: Primary research data (2026).

5. Discussion

All student groups successfully completed the guided investigations, although the depth of understanding varied among groups. The forest fire group demonstrated the strongest conceptual understanding by successfully explaining the principles of canal blocking and relating them to the traditional *Saka/Handil* water management system already familiar within their communities. The flood

group accurately constructed a *Rumah Lanting* model using recycled materials while demonstrating a clear understanding of its adaptive function.

An interesting qualitative finding was the spontaneous use of the Dayak Ngaju language during group discussions, suggesting the emergence of a cognitive bridge between students' indigenous cultural knowledge and formal scientific understanding.

The effectiveness of the developed LKPD can be attributed to three major factors. First, the high contextual relevance of authentic disaster scenarios enabled students to connect scientific concepts with their lived experiences, consistent with Ausubel's theory of meaningful learning (Basyir et al., 2022) (Simanjuntak, 2018). Second, integrating Problem-Based Learning with local wisdom encouraged students to actively investigate real-world problems and develop disaster mitigation products based on indigenous knowledge, reflecting Kolb's experiential learning theory (Morris, 2020) (Rahmi, 2024). Third, embedding the values of the *Pancasila Student Profile* promoted students' intrinsic motivation to preserve both their environment and cultural heritage.

These findings support and extend previous studies. (Asmaryadi et al., 2025) demonstrated that local wisdom-based LKPD significantly improved elementary science learning outcomes, while (Pratama & Sari, 2026) reported that disaster context-based PBL effectively enhanced students' critical thinking skills. The primary contribution of the present study lies in the comprehensive integration of the four major disaster types in Central Kalimantan and their corresponding indigenous mitigation strategies into a single coherent instructional resource, an approach that has received limited attention in previous research.

CONCLUSION

This study produced three major findings. First, a local wisdom-based IPAS student worksheet was successfully developed using the ADDIE model and the Problem-Based Learning approach. The LKPD integrates four major Dayak local wisdom practices *Saka/Handil*, *Rumah Lanting*, *Huma Betang* architecture together with *Kaleka*, and riparian vegetation management with the four predominant natural disasters in Central Kalimantan.

Second, expert validation confirmed that the developed LKPD was highly feasible, achieving content and media validation scores of **93.35%** and **91.00%**, respectively. Revisions based on expert feedback further improved instructional clarity and visual readability.

Third, the limited field trial demonstrated high practicality, with **89.3%** positive student responses, while **75%** of students achieved the minimum mastery criterion following implementation. These findings indicate that the developed LKPD has strong potential to enhance disaster literacy, preserve indigenous knowledge, and promote the development of critical thinking, collaboration, and creativity as key dimensions of the *Pancasila Student Profile*.

Future research should involve large-scale implementation across multiple districts in Central Kalimantan to obtain more representative evidence of effectiveness. In addition, developing a digital version (e-LKPD) is recommended to increase accessibility for students in remote areas with limited access to printed instructional materials.

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