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Analysis of the Implementation of Problem-Based Learning in Science Education at Elementary School 7 Panarung Palangka Raya

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ABSTRACT: This research aims to analyze the implementation of the Problem-Based Learning (PBL) approach in science education at SDN 7 Panarung Palangka Raya, focusing on teacher readiness, the development of students' critical thinking, collaboration, feedback mechanisms, as well as inhibiting and supporting factors. The approach used is qualitative with a case study design. Data were collected through observations, in-depth interviews, and documentation. The research subjects included one, two and three-grade teachers, as well as the school principal. Research shows that although teachers demonstrate enthusiasm for PBL, its implementation is still limited by conventional teaching habits and a lack of training. PBL has proven effective in promoting students' critical thinking skills, especially when associated with local issues such as peatland ecosystems and the culture of the Dayak community. Local values such as handep (mutual cooperation) and badamai (deliberation) strengthen student participation and collaboration in the learning process. However, the feedback mechanism is still unstructured and peer evaluation practices have not been widely implemented. The obstacles faced include limitations in local resources, a lack of ongoing training, and curriculum pressure. On the other hand, support from school principals and local community involvement are important enablers for the success of PBL. These findings emphasize the importance of integrating local wisdom and systemic support in the implementation of PBL in elementary schools.

KEYWORDS: Problem-Based Learning (PBL); Science Education; Learning Process; Student Engagement; Learning Outcomes; Instructional Strategy

I. INTRODUCTION

Problem-Based Learning (PBL) is an educational approach that has gained significant attention in primary education due to its potential to enhance various student competencies. PBL is characterized by its student-centered nature, where learners engage with real-world problems that prompt critical thinking, problem-solving, and active learning. This approach is increasingly integrated into elementary curricula across subjects such as English, mathematics, and science to enhance learning outcomes and student engagement. The following section explores the key characteristics of PBL in primary schools, drawing insights from recent research. PBL emphasizes student autonomy and choice, enabling learners to take ownership of their educational journey while engaging with authentic problems. This approach encourages students to develop higher-order thinking skills and achieve learning goals through active participation and exploration (Facilitating Problem-Based Learning in Primary English Curriculum: A Case Study from Macau, 2023).

The PBL model, as outlined by Arends (2012), is structured around five core syntaxes that facilitate effective learning experiences. These syntaxes guide educators in implementing PBL, ensuring that students engage deeply with content and develop essential critical-thinking skills. The key PBL components include: (1) Problem Identification, in which students are presented with real-world issues that require investigation, fostering analytical and problem-solving abilities; (2) Collaborative Learning, where teamwork is emphasized as students work in groups to explore solutions, enhancing social and communication skills (Mohamad Hsbollah & Hassan, 2022); (3) Self-Directed Learning, which encourages autonomy and motivation as learners take responsibility for their progress in both face-to-face and online environments; (4) Knowledge Integration, allowing students to apply interdisciplinary knowledge and connect concepts across subjects, as seen in technological and engineering education (Norström & Hallström, 2023); and (5) Reflection and Feedback, which involves continuous evaluation of the learning process and constructive feedback from peers and instructors, helping students refine their understanding and skills (Shin et al., 2022).

In mathematics, PBL has been shown to improve students' problem-solving abilities, mathematical communication, and reasoning skills. This model encourages learners to develop deep conceptual understanding and apply concepts in various contexts, thereby strengthening overall mathematical competence (Panjaitan, 2022). PBL also plays a crucial role in fostering critical-thinking skills, a key component of 21st-century competencies. By engaging students in problem-solving activities, PBL

cultivates lateral and systematic thinking needed to navigate complex challenges (Yulianti, 2021). Research further demonstrates that PBL significantly enhances students' critical-thinking abilities, as evidenced by improved performance across successive cycles of science learning activities (Yati, Mudjiran, & Fitria, 2020). Additionally, PBL promotes active learning by engaging cognitive, affective, and psychomotor domains, leading to improved learning outcomes as students become more motivated and involved in the learning process (Hidayat, Hamdu, & Riyanti, 2023).

This model has also been found to increase student motivation by shifting from conventional teaching methods to more innovative and interactive learning experiences. This shift results in greater student engagement and improved academic performance (Roni Hamdani et al., 2022). Aligned with modern educational curricula, PBL is effectively integrated into thematic learning approaches in which subjects are taught through interconnected themes. Such integration has been shown to improve learning outcomes in areas like Pancasila and Civic Education, as well as thematic units on diversity and energy conservation (Utama & Muhammadi, 2023). PBL is applied across various disciplines, and its effectiveness is often compared with other instructional strategies. Recent studies highlight the importance of teacher and student assessment in evaluating PBL's success, as well as the exploration of hybrid models that combine PBL with other teaching methods. Technology further supports this approach by enriching learning experiences and offering new avenues for implementing PBL in diverse educational settings (Ceker & Ozdamli, 2021).

Despite its many advantages, the implementation of PBL presents several challenges. Teachers require adequate training and resources to facilitate PBL effectively, and there may be resistance to shifting away from traditional instructional methods. Successful PBL also depends on carefully designed problems and accurate assessment of student progress. Nonetheless, growing research continues to support PBL's positive impact on primary education, making it a valuable approach for fostering essential skills among young learners. Implementing PBL in science education presents additional challenges despite its potential to enhance critical thinking and learning outcomes. Transitioning from traditional teaching to PBL requires careful planning and adaptation, which can be difficult for both educators and students. Many teachers lack sufficient training in PBL methodologies, hindering effective implementation. Some educators resist shifting from teacher-centered instruction to student-centered approaches, affecting the overall effectiveness of PBL (Sulastri, Supeno, & Sulistyowati, 2022). Moreover, students' diverse learning preferences make it challenging to engage all learners equally in a PBL environment, and some express greater preference for structured guidance over open-ended problem solving (Bijsmans & Versluis, 2020).

The effectiveness of PBL in science learning strongly depends on facilitator training. Studies indicate that trained facilitators achieve higher student engagement and better learning outcomes compared to untrained ones. The facilitator's role in managing group dynamics and providing constructive feedback is crucial, as inadequate facilitation can hinder the learning process and shape negative student perceptions of PBL (Almulhem & Almulhem, 2022). At the elementary-school level, PBL in science education offers opportunities to enhance students' problem-solving skills and stimulate interest in scientific inquiry. However, challenges remain, including teacher preparedness, resource limitations, and the need to adapt PBL to the cognitive stages of young learners. Therefore, it is essential to analyze the implementation of PBL in elementary science education to optimize its application and address potential constraints.

Indicators of PBL implementation include: (1) Teacher Readiness and Philosophy, which examines teachers' beliefs about PBL and their willingness to adjust teaching styles and relinquish control to foster student autonomy (Johnstone, 2022); (2) Critical-Thinking Development, assessing how effectively PBL promotes analytical and evaluative skills (Karlina & Wirdati, 2023); (3) Student Engagement and Collaboration, evaluating participation in inquiry and group discussion during PBL activities (Wicaksono & Setiawan, 2022); (4) Feedback Mechanisms, identifying how feedback is provided and how it influences the learning process through peer and teacher evaluation (Cahyono et al., 2022); and (5) Barriers and Enablers, which examine perceived challenges such as resource limitations and curricular constraints, as well as supporting factors that enable successful PBL implementation (Putra & Iswantir, 2021).

This study aims to explore the implementation of PBL at SDN 7 Panarung through in-depth interviews. By understanding various aspects such as student engagement, teacher roles, and the impact of PBL on students' skill development, this research seeks to provide valuable insights for educators and researchers in designing more effective PBL models suited to primary education needs. Using a qualitative approach, the study investigates the application of PBL in science learning at the school and identifies both challenges and innovations implemented by teachers in the process.

II. METHOD

This study employs a qualitative approach using a case study design, conducted at SDN 7 Panarung in Palangka Raya. The research involves students, classroom teachers, and the principal, who were selected purposively based on their key roles in the implementation of PBL at the school. Data collection techniques include direct observation of science learning activities that adopt the PBL approach, as well as semi-structured interviews with teachers and the principal to obtain in-depth perspectives on the implementation process. Document analysis is also utilized, encompassing lesson plans (RPP), instructional media, and

student worksheets (LKS). The collected data were analyzed using thematic analysis, which consists of data reduction, data presentation, and conclusion drawing. To ensure data validity, triangulation of techniques—observation, interviews, and document analysis—and triangulation of data sources involving teachers and the principal were applied.

III.RESULT AND DISCUSSION

A. Result

The findings of this study aim to analyze the implementation of Problem-Based Learning (PBL) in science education at SDN 7 Panarung Palangka Raya based on five key indicators. The results were obtained through in-depth interviews with the science teacher and principal, complemented by classroom observations. These findings also incorporate the local cultural context and Dayak values embedded within the community of Palangka Raya.

1. Teacher Readiness and Teaching Philosophy – Results

The findings indicate that most teachers at SDN 7 Panarung Palangka Raya demonstrate high enthusiasm toward the PBL approach. Teachers believe that PBL has strong potential to foster active student participation as well as critical and collaborative thinking skills. This enthusiasm is visible in their willingness to adopt new methods, even though conventional teaching practices still dominate daily instruction. Cultural background also plays a role in shaping teacher readiness. Several teachers from the Dayak community expressed that core local values—such as *handep* (collective cooperation)—align naturally with the principles of PBL, including group work, mutual support, and independent learning. However, despite philosophical alignment, challenges remain in translating these beliefs into consistent classroom practice. Many teachers continue to rely on teacher-centered instruction, one-way explanations, and textbooks as the primary source of information. A major limiting factor is the lack of professional development opportunities related to PBL. Teachers have not received structured training, and access to workshops is limited due to geographical constraints, lack of information, and minimal institutional support. Thus, teacher readiness remains at an early stage, requiring further capacity-building interventions.

2. Critical Thinking Development – Results

The implementation of PBL positively contributes to students' critical-thinking development, especially when contextualized using environmental and cultural elements familiar to students. Teachers observed significantly higher engagement when learning materials included local topics such as peat swamp forest ecosystems, orangutan conservation, and Dayak indigenous practices related to environmental balance. Students demonstrated increased motivation and awareness of environmental issues, accompanied by improved questioning, analysis, and causal reasoning. Nonetheless, the development of critical thinking varies across grade levels. Lower-grade students (Grades 1–3) still require substantial scaffolding to formulate questions, identify relevant information, and draw conclusions. Additionally, some teachers struggle to design open-ended and exploratory learning activities, limiting students' opportunities to engage deeply with problems.

3. Student Engagement and Collaboration – Results

The results show that PBL substantially enhances student engagement, particularly when lessons integrate local environmental and cultural issues such as pollution in the Kahayan River, protection of customary forests, and preservation of Dayak traditions. Group discussions fostered active participation, with students expressing ideas and collaborating to develop solutions. Local cultural values—including *badamai* (deliberation) and *handep*—naturally supported cooperative learning dynamics. However, challenges remain, particularly regarding passive students who lack confidence or prefer teacher-led instruction. Some groups exhibited dominance by higher-achieving students due to insufficiently structured grouping strategies. Teachers have not consistently assigned explicit roles, resulting in uneven participation among group members.

4. Feedback Mechanisms – Results

Observations and interviews revealed that feedback in PBL activities at SDN 7 Panarung is mostly informal, spontaneous, and verbal. Teachers typically provide immediate feedback during group discussions or presentations, but structured peer assessment and formal self-reflection practices are not yet implemented. Teachers reported time limitations and the absence of technical guidelines as primary constraints. Although cultural values such as *begurau menteng*—a Dayak practice of open mutual advice—hold promise for peer evaluation, these practices have not yet been operationalized within classroom activities.

5. Barriers and Enablers – Results

The implementation of PBL is influenced by both facilitating and inhibiting factors. On the positive side, teachers show strong interest in PBL, and local cultural values strongly align with PBL's collaborative spirit. Students also respond enthusiastically when learning issues are linked to local contexts. However, major barriers persist, including limited teacher training, insufficient supporting resources, time constraints, and heavy curricular demands. Teachers struggle to design contextual problems and manage exploratory learning due to a lack of structured guidance. These constraints highlight the need for comprehensive systemic support to strengthen PBL implementation.

B. Discussion

1. Teacher Readiness and Teaching Philosophy – Discussion

The findings suggest that teacher readiness at SDN 7 Panarung reflects a transitional stage, wherein enthusiasm exists but pedagogical capacity remains limited. Although teachers' cultural philosophies align well with PBL's collaborative values, effective implementation requires deeper professional knowledge. Previous studies emphasize the importance of teacher expertise in PBL, especially regarding flexible pedagogical reasoning and metacognitive guidance (Smith et al., 2022). Therefore, sustainable training and professional learning communities are essential to ensure continuous pedagogical transformation.

2. Critical Thinking Development – Discussion

The positive influence of PBL on critical-thinking development aligns with prior research showing that contextualized problem solving enhances student motivation and cognitive engagement (Widiastuti et al., 2023). However, uneven development across grade levels suggests a need for differentiation in instructional design. Younger students require explicit scaffolding and structured questioning strategies. Teachers must balance guidance with exploration, fostering independence without diminishing cognitive challenge. This is consistent with the aims of the Merdeka Curriculum, which emphasizes student-centered learning and the strengthening of Pancasila character values.

3. Student Engagement and Collaboration – Discussion

The high level of student engagement observed indicates that PBL effectively supports collaborative and culturally grounded learning. Local values, such as *badamai* and *handep*, enrich the collaborative experience and make learning more meaningful. This is consistent with research indicating that diverse group composition and structured collaboration improve problem-solving performance (Li et al., 2022). However, the presence of passive students highlights the need for improved group management strategies, including role rotation, explicit task distribution, and collaborative rubrics to ensure accountability.

4. Feedback Mechanisms – Discussion

Although teachers recognize the importance of feedback, its implementation remains limited. High-quality feedback is essential for reflective learning in PBL (Baluarte-Araya et al., 2021). The absence of structured peer assessment and self-reflection reduces opportunities for students to develop meta-cognitive awareness. Integrating local practices, such as *begurau menteng*, can create culturally resonant feedback mechanisms that promote constructive dialogue and strengthen community-based learning.

5. Barriers and Enablers – Discussion

The coexistence of strong cultural support and structural barriers reflects a complex dynamic in PBL implementation. While local values enhance collaboration and contextual learning, insufficient teacher training and resource limitations hinder full adoption. These findings align with studies identifying knowledge gaps and resource constraints as common barriers to PBL (Agulnik et al., 2022; Yang et al., 2022). To optimize PBL implementation, schools must adopt a systemic strategy that includes teacher capacity building, contextual resource development, flexible scheduling, and cross-disciplinary project integration. Such efforts align with Merdeka Curriculum principles that promote experiential, meaningful, and culturally grounded learning.

CONCLUSIONS

The findings of this study indicate that the implementation of Problem-Based Learning (PBL) in science education at SDN 7 Panarung Palangka Raya has demonstrated positive potential, although it continues to face various structural and pedagogical challenges. In terms of readiness, some teachers have understood the principles of PBL, yet its application remains constrained by conventional teaching habits and limited training opportunities. PBL has clearly contributed to the development of students' critical-thinking skills, particularly when connected to local environmental and cultural contexts such as peatland forest conservation and the traditions of the Dayak community. Student engagement and collaboration tend to increase when learning activities are contextual and culturally grounded, suggesting that values such as *handep* (collective cooperation) and *badamai* (deliberation) can serve as cultural foundations for PBL instruction. However, feedback mechanisms remain unstructured, and peer evaluation practices are not yet widely implemented. The main challenges include limited access to locally relevant learning resources, insufficient teacher training, and curricular constraints. On the other hand, principal support, community involvement, and an inclusive local culture serve as significant enabling factors in strengthening PBL implementation.

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