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Enhancing Learning Processes and Outcomes in IPAS (Science, Environment, and Social Studies) through Problem-Based Learning for Elementary School Students

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Abstract

This study was motivated by the problem of low student engagement and limited achievement levels in Science, Environment, and Social Studies (IPAS) learning. To address this issue, the research aims to enhance learning processes and outcomes by implementing Problem-Based Learning (PBL) in a fourth-grade elementary classroom. He used a Classroom Action Research (CAR) design with the Kemmis and Taggart model in two cycles, consisting of involving planning, action, observation, and reflection. Data were collected through observations, tests, and questionnaires with 10 fourth-grade students at SDN 86/II Timbolasi. Data were analysed using qualitative descriptive techniques for observations and questionnaires. Researchers also conducted quantitative data analysis using descriptive statistics. The study revealed notable improvements from Cycle I to Cycle II, demonstrating the effectiveness of implementing Problem-Based Learning in enhancing teaching quality and student outcomes. Teacher performance increased significantly from 55% in Cycle I to 90% in Cycle II. Likewise, student engagement rose markedly, from 70% in Cycle I to 90% in Cycle II, with the latter categorised as "very good." These changes were then evaluated and reflected in the second cycle initiative planning, leading to instructional strategy refinement. The research was conducted with a small sample size in a single rural school, which may limit the generalizability of the findings. However, the results provide valuable guidance for integrating PBL with interactive media to improve student-centred learning. This study offers empirical evidence of PBL's effectiveness in interdisciplinary elementary education within rural contexts, highlighting the role of facilitative

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teaching strategies and multimedia integration in fostering critical thinking, collaboration, and deeper understanding among young learners.

Penelitian ini dilatarbelakangi oleh permasalahan rendahnya keterlibatan siswa dan terbatasnya tingkat pencapaian dalam pembelajaran IPA. Untuk mengatasi permasalahan tersebut, penelitian ini bertujuan untuk meningkatkan proses dan hasil belajar dengan menerapkan Pembelajaran Berbasis Masalah (PBL) di kelas IV SD. Desain yang digunakan adalah Penelitian Tindakan Kelas (PTK) dengan model Kemmis dan Taggart yang dilaksanakan dalam dua siklus, yaitu meliputi perencanaan, tindakan, observasi, dan refleksi. Pengumpulan data dilakukan melalui observasi, tes, dan angket terhadap 10 siswa kelas IV SDN 86/II Timbolasi. Analisis data dilakukan dengan teknik deskriptif kualitatif untuk observasi dan angket terbuka. Peneliti juga melakukan analisis data kuantitatif dengan statistik deskriptif. Penelitian ini menunjukkan adanya peningkatan yang nyata dari Siklus I ke Siklus II, yang menunjukkan efektivitas penerapan Pembelajaran Berbasis Masalah dalam meningkatkan mutu pengajaran dan hasil belajar siswa. Kinerja guru meningkat secara signifikan dari 55% pada Siklus I menjadi 90% pada Siklus II. Demikian pula, keterlibatan siswa meningkat tajam, dari 70% pada Siklus I menjadi 90% pada Siklus II, dengan yang terakhir dikategorikan sebagai "sangat baik." Perubahan ini kemudian dievaluasi dan tercermin dalam perencanaan inisiatif siklus kedua, yang mengarah pada penyempurnaan strategi pengajaran. Penelitian ini dilakukan dengan ukuran sampel yang kecil di satu sekolah pedesaan, yang mungkin membatasi generalisasi temuan. Namun, hasilnya memberikan panduan berharga untuk mengintegrasikan PBL dengan media interaktif guna meningkatkan pembelajaran yang berpusat pada siswa. Studi ini menawarkan bukti empiris efektivitas PBL dalam pendidikan dasar interdisipliner dalam konteks pedesaan, menyoroti peran strategi pengajaran fasilitatif dan integrasi multimedia dalam mendorong pemikiran kritis, kolaborasi, dan pemahaman yang lebih mendalam di kalangan pelajar muda.

I. INTRODUCTION

The pursuit of quality education hinges on the effectiveness of the learning process, a dynamic interplay crucial for fostering cognitive development. Moving beyond rote memorisation, meaningful engagement allows students to achieve their educational objectives genuinely (Ahmad et al., 2019; Kurniasih et al., 2025; Zh et al., 2024). This is especially pertinent in integrated subjects such as Science, Environment, and Social Studies (IPAS), where elementary education aims to

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cultivate conceptual understanding and the capacity to apply knowledge to real-world contexts (Mariska & Mustakim, 2024). Indeed, learning outcomes serving as measurable indicators of acquired knowledge and skills reflect both student mastery and, significantly, the efficacy of the pedagogical methods employed (Flavell, 1979; Wang & Williams, 2024). Nevertheless, the path to achieving these outcomes is often hindered by a pervasive challenge: a lack of student motivation and engagement, widely recognised as a cornerstone of academic success (Chatzistamatiou et al., 2015; Kurniasih et al., 2025). Engagement inevitably dwindles when motivation wanes, leading to a discernible decline in comprehension and performance.

The impetus for this research emerged from a stark, on-the-ground reality observed at SDN 86/II Timbolasi. Initial observations in July 2025 uncovered a concerning situation. Within a fourth-grade class of ten, a mere three met the minimum mastery criteria (KKM) for IPAS, leaving a substantial majority of seven struggling below the threshold. This performance gap was not an isolated statistic but visibly correlated with a classroom atmosphere marked by passivity. Students appeared disengaged, rarely posed questions, and showed little inclination for collaborative discussion. This pattern is alarmingly consistent with broader educational research, underscoring that a lack of active participation severely undermines comprehension. As scholars have noted, deep cognitive processing and the ability to effectively retain and apply information are intrinsically linked to meaningful classroom interaction (Annamma et al., 2011; Estuhono & Afriko, 2018; MY et al., 2024).

A critical examination of the prevailing teaching practices suggests a primary contributor to this issue—a persistent adherence to traditional, teacher-centric lecture methods. While arguably efficient for content coverage, this pedagogical approach often fails to resonate with the active learning needs of young, contemporary learners, potentially stifling their intrinsic curiosity and relegating them to a passive role (Ariyani et al., 2025; Kuswandi et al., 2025). Consequently, there is a pressing need to explore instructional strategies to ignite motivation and catalyse active involvement.

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In response to this need, Problem-Based Learning (PBL) emerges as a compelling pedagogical alternative. Grounded in constructivist theory, which emphasises that learners construct knowledge through experience and social negotiation, PBL positions students at the centre of their learning journey (Vygotsky, 1978). By engaging with authentic, ill-structured problems, learners are compelled to collaborate, investigate and devise solutions, thereby driving their inquiry (Best, 2017). This method nurtures subject-specific knowledge and higher-order competencies, including critical thinking, creativity, and collaborative problem-solving (Wulandari et al., 2023).

Empirical evidence robustly supports the efficacy of PBL. For example, a study by Aisyah et al. (2021) documented a significant positive impact on students' critical thinking capabilities. Meilasari et al. (2020) highlighted its beneficial effects on fostering collaboration and communication. Furthermore, it is noteworthy that integrating PBL with multimedia tools has further amplified comprehension and knowledge retention in scientific domains (Ariyani et al., 2025; Saputro et al., 2024).

Despite this strong theoretical and empirical backing, implementing PBL within Indonesian elementary schools, particularly in rural settings like SDN 86/II Timbolasi, remains limited. Practitioners often grapple with formidable constraints, including inadequate training, a scarcity of tailored teaching resources, and a general unfamiliarity with student-centred pedagogies. Moreover, a conspicuous gap exists in the literature regarding applying PBL within interdisciplinary subjects like IPAS, which synthesise natural and social science perspectives. Most existing studies focus on discrete subject areas, leaving the potential of PBL in integrated learning environments largely unexplored.

It is within this context that the present study is situated. Our research aims to address this gap by implementing and evaluating a PBL framework in a fourth-grade IPAS classroom. The purpose is twofold: firstly, to meticulously describe enhancements in the learning process, specifically in student participation, interaction, and motivation following the adoption of PBL; and secondly, to rigorously evaluate the subsequent improvement in cognitive learning outcomes. By interrogating both the process and product of learning, this study seeks to

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contribute nuanced, practical insights for educators and to enrich the academic discourse on active learning methodologies for integrated elementary education.

II. METHOD

This study employed a participant classroom action research (CAR) design, which, by nature, is both reflective and collaborative (Kemmis et al., 2014). The primary aim was to tackle real challenges encountered during teaching and learning through systematic, planned, and iterative actions. The researcher actively collaborated with teachers and students in this approach, engaging them in each stage. To guide this research, the study adopted the Kemmis and Taggart model, which consists of four key phases: planning, acting, observing, and reflecting (Kemmis et al., 2014). These stages were executed in cycles to enhance the quality of instruction and boost student engagement. This iterative model was chosen because of its capacity to foster continuous improvement, enabling adjustments based on the outcomes of earlier cycles, making it particularly suitable for improving learning outcomes in integrated subjects such as Science, Environment, and Social Studies (IPAS).

The research was conducted in collaboration with the homeroom teacher of the fourth grade at SDN 86/II Timbolasi. The study involved 10 students (4 male and six female), all of whom participated during the first semester of the 2024/2025 academic year. Two cycles were implemented, each consisting of lesson planning, instructional delivery through the Problem-Based Learning (PBL) model, classroom observation, and subsequent reflection to refine the approach. Data was collected using two primary methods: observation and written tests. Interestingly, while the initial abstract mentioned using questionnaires, they were ultimately not part of the final data collection process, which introduces a slight inconsistency in the earlier presentation.

Quantitative data analysis was conducted using descriptive statistics to assess students' individual and collective mastery. The success criterion was defined as a minimum of 75 per cent of students achieving the required competency threshold. Observational data were also utilised to provide additional context and insight,

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especially in evaluating the effectiveness of teacher strategies and student engagement during the lessons.

Adopting a participant CAR approach, this study sought to involve both the teacher and the students in reflective improvement cycles, fostering a collaborative effort to enhance the educational experience. The focus was not only on quantitative data, derived from test scores, but also on the qualitative insights gathered from classroom observations. This combination of data analysis allowed for a more comprehensive assessment of the effectiveness of the PBL model in improving student learning outcomes and overall academic performance.

III. FINDINGS & DISCUSSION

Overview of the Problem-Based Learning (PBL) Cycle Implementation

This chapter presents the objective findings from the Classroom Action Research (CAR) conducted in two cycles, along with an in-depth discussion of these findings, considering relevant theories and prior research. The findings focus on the learning process, teacher performance, student engagement, and learning outcomes after implementing the Problem-Based Learning (PBL) model. The study was designed using the CAR model, consisting of two cycles. Each cycle applied the PBL model through the planning, implementation, observation, and reflection stages. A complete flow of the implementation across both cycles, along with the improvements achieved, is illustrated in Diagram 1 below.

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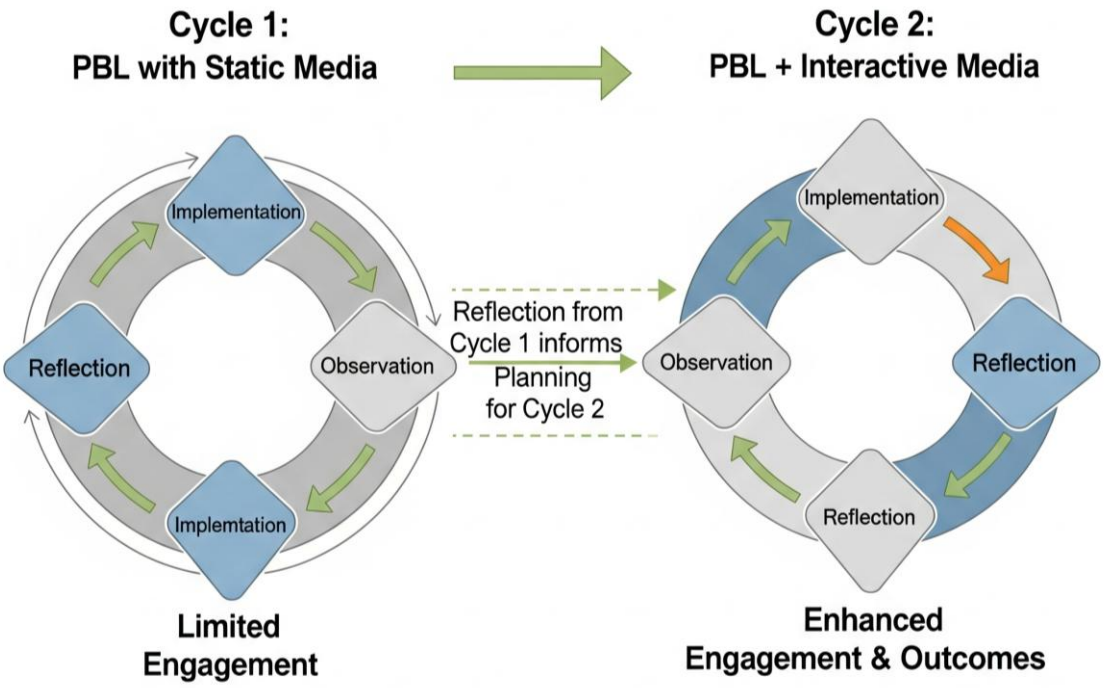

Diagram 1. *Classroom Action Research Flow and Achieved Improvements*

Based on Diagram 1, it is evident that the reflection from Cycle I formed the basis for improvements made in Cycle II, particularly regarding the integration of interactive learning media. In Cycle I, static media, such as images and text, proved less effective in fully engaging students, resulting in limited student participation in the learning process. The reflection conducted at the end of Cycle I determined that more dynamic and interactive media could be more effective in enhancing student engagement.

In Cycle II, interactive learning media such as educational videos and digital simulations were integrated into the learning process in response to these findings. This change proved to have a significant impact on the quality of student engagement. Students became more active in the learning process, better able to interact with the material being taught, and improved their conceptual understanding.

This cyclical approach demonstrates the importance of continuous reflection in classroom action research, where each cycle aims to implement the planned steps and evaluate and refine the learning process in real-time. Consequently, the learning experience becomes more flexible, responsive to students' needs, and capable of accommodating diverse learning styles. The improvements observed from Cycle I

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to Cycle II reflect a process of ongoing enhancement in applying the Problem-Based Learning model, contributing to better learning outcomes and an overall improvement in teaching quality.

Transformation of the Teacher's Role as Facilitator in Problem-Based Learning

In the initial observations, the learning process was predominantly teacher-centred, where the teacher was the primary source of information and students remained passive participants. This approach limited student engagement and active learning. In Cycle I, the implementation of Problem-Based Learning (PBL) aimed to shift this dynamic, requiring the teacher to be a facilitator rather than a direct information provider. Teacher performance was measured based on 20 facilitation indicators, divided into three phases: Introduction, Core, and Conclusion. These phases reflected the progression of the lesson, from introducing the topic to guiding students through problem-solving and finally helping them consolidate their learning.

The shift to a student-centred PBL approach required teachers to adjust their methods and foster a more interactive classroom environment. In Cycle I, teacher performance was evaluated to assess how well the teacher facilitated student engagement across these three phases. The data collected on teacher performance is presented in Diagram 2, which provides a clear view of the effectiveness of the PBL model in enhancing teacher facilitation and promoting a more active learning environment.

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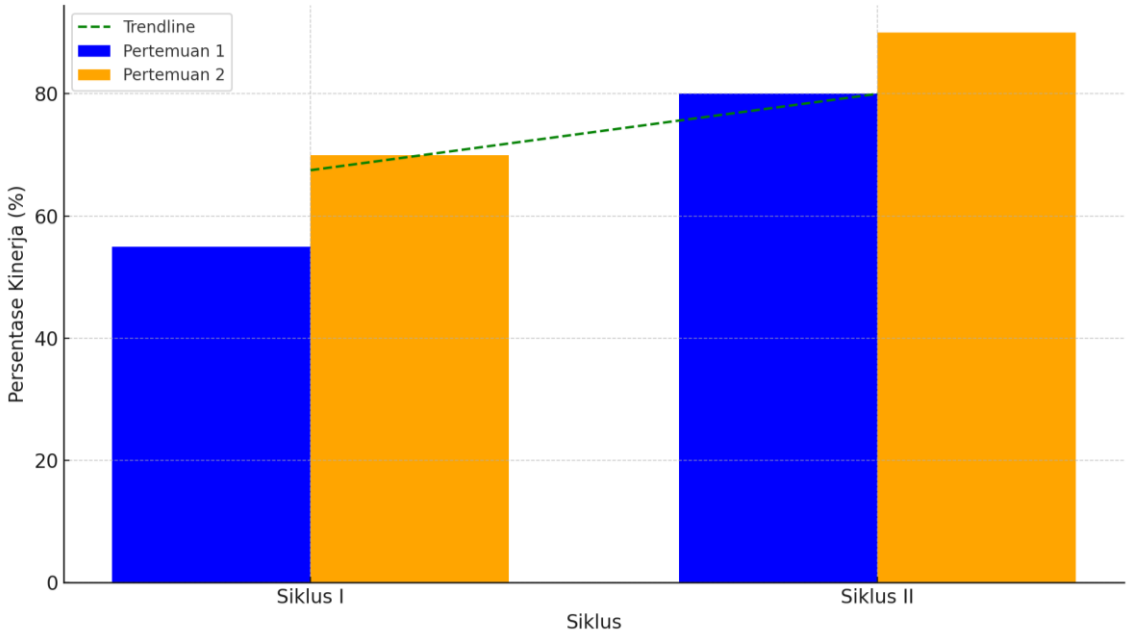

Diagram 2: *Percentage Improvement of Teacher Performance Indicators in Cycle I and Cycle II*

Diagram 2 objectively shows the improvement in teacher performance in applying PBL. In Cycle I, the first meeting reflected only 55% of the indicators (Adequate), with difficulties in guiding discussions and managing student investigations. However, through reflection, performance improved to 70% (Good) by the second meeting. This improvement continued significantly in Cycle II after the integration of interactive media. By the first meeting of Cycle II, performance reached 80% (Good), and ultimately, it peaked at 90% (Excellent) by the second meeting. The most noticeable improvement occurred in the core phase, where the teacher became more proficient at guiding group investigations, asking guiding questions, and facilitating reflection.

These findings align with the core principles of PBL, which position the teacher as a facilitator rather than the sole source of knowledge (Hmelo-Silver, 2004). The transition from the role of "sage on the stage" to "guide on the side" requires a process of adaptation, as evidenced by the Cycle I data that was still categorised as adequate. Reflection played a crucial role in this adaptation process, allowing the teacher to continuously assess and refine their facilitation practices.

The significant improvement in Cycle II indicates that the teacher successfully internalised their new role. The ability to ask open-ended questions that stimulate critical thinking and manage group dynamics clearly indicates successful PBL

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facilitation (Barell, 2007). Research by Yunitasari et al. (2025) also indicates that innovative PBL practices can enhance teacher performance and professional growth. The teacher's evolving role as a teacher and a continuous learner underscores the professional development aspect of PBL, highlighting its dual function: improving student learning outcomes and fostering teacher professional development.

Enhancement of Student Activity, Engagement, and Learning Outcomes

Student engagement was observed through participation in discussions, active involvement in group investigations, and confidence in presentations. Learning outcomes were measured through cognitive tests at the end of each cycle. Objective data are presented in Table 1.

Table 1. Comparison of Active Student Engagement and Learning Achievement in Cycle I and Cycle II

Aspect	Cycle I	Cycle II	Improvement
Teacher Performance	Improved slightly (from baseline)	Significant improvement in facilitation and guidance	Higher teacher facilitation and engagement with students
Student Engagement	Answering questions: Moderate decline- Summarising lessons: Decrease- Passive participation	Answering questions: 80% (Excellent)- Summarising lessons: 90% (Excellent)- Active involvement: 90% (Excellent)	Dramatic increase in participation and enthusiasm
Learning Outcomes (Cognitive Tests)	Class completion rate: 30%	Class completion rate: 87%	Significant increase in learning outcomes
Student Collaboration Skills	Limited collaboration	Increased collaboration and group work	Improvement in teamwork and problem-solving skills
Student Enthusiasm	Low enthusiasm	High enthusiasm and confidence in presentations	More motivated and engaged students

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Presentation Skills	Limited or low-quality presentations	High-quality, confident presentations	Improvement in 21st-century skills, including communication
Conceptual Understanding	Surface-level understanding	Deeper conceptual understanding	Firmer grasp of concepts, such as "Phase Changes in Matter"

Table 1 shows that despite improvements in teacher performance in Cycle I, student engagement did not significantly increase or even decrease in certain aspects, such as answering questions and summarising lessons. Reflection identified that the static media (images) used in Cycle I were less engaging. This limitation impacted learning outcomes, where the class completion rate was only 30% at the beginning and showed modest improvement by the end of Cycle I.

Intervention with interactive media (educational videos, digital simulations) in Cycle II brought dramatic changes. Active student engagement surged to 80% (Excellent) in the first meeting and 90% (Excellent) in the second. Students were observed to be more enthusiastic, willing to express opinions, and able to collaborate more effectively in groups. This directly reflected in learning outcomes, where the average class score significantly improved to 87%, substantially increasing class completion.

The dramatic increase in student engagement and learning outcomes in Cycle II can be explained through motivational and contextual learning theories. PBL presents real-world problems that provide a clear purpose and meaning for students to engage with (Cerezo, 2004). The integration of interactive media strengthened this further. According to cognitive theory, dynamic visual media such as videos and animations help encode information into long-term memory more effectively than static media (Mayer, 2009). This explains the better conceptual understanding observed among students.

This finding is supported by Permatasari's (2019) research, which concluded that PBL effectively improves IPAS learning outcomes by sparking interest and maintaining student motivation. Furthermore, the processes in PBL from identifying

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problems, researching, to presenting solutions naturally foster self-regulated learning skills and student collaboration (Tas & Sungur, 2012). The improved presentation and collaboration skills observed among students are tangible evidence of the development of 21st-century skills.

Thus, combining the cognitively challenging PBL model and the engaging, visually attractive learning media created an optimal learning environment. This environment not only enhanced surface-level engagement but also fostered deep engagement, where students genuinely understood the concepts and were able to apply them.

Reflection on Learning and Implications of Problem-Based Learning in Elementary Schools

Reflection at the end of each cycle became a valuable source of learning. The main issue in Cycle I was the reliance on static learning media, which failed to sustain student interest and meet diverse learning styles. The solution was the integration of technology through interactive media in Cycle II. This solution effectively stimulated curiosity and guided the student inquiry process.

The finding regarding media issues in Cycle I aligns with research by Hung et al. (2014), which stated that limited resources and media often hinder the full potential of PBL. This reflection led to adopting a solution supported by recent research on integrating digital technology. Küçük - Avcı et al. (2024) emphasised that the integration of ICT in PBL can make learning in elementary schools more engaging, inclusive, and effective.

The implications of this research suggest that the success of PBL does not solely depend on the instructional design but also on adequate resource support. Technology serves as a bridge connecting abstract problems with real-world contexts that students can explore, as demonstrated in the global inquiry model (Asilevi et al., 2025). For sustained implementation, teacher training is needed in designing PBL scenarios and selecting and utilising appropriate digital tools. Moreover, school support in providing technological infrastructure is a crucial factor. Therefore, technology-enhanced PBL offers promising implications for transforming

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IPAS learning in elementary schools into something more meaningful, relevant, and enjoyable for students.

IV. CONCLUSION

This classroom action research concluded that implementing the Problem-Based Learning (PBL) model in Science, Environment, and Social Studies (IPAS) for fourth-grade students significantly improved teacher performance, student engagement, and learning outcomes. Teacher performance increased from 55% in Cycle I to 90% in Cycle II. In comparison, student participation reached 90% in the "excellent" category, and the average achievement score rose to 87%, reflecting a stronger mastery of the material. These improvements were supported by interactive learning media, such as videos and animations, and collaborative group activities that fostered critical thinking and communication skills. However, the study was limited by the relatively short duration of the action cycles and the restricted variety of learning media employed, which may affect the generalizability of the findings. To address these limitations, future research should extend the implementation over a longer period, incorporate more diverse technology-based media, and involve broader samples across different subjects or grade levels. Such efforts are expected to provide a deeper understanding of how PBL can be optimised to sustain student engagement and achievement in elementary education.

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