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Learning IPAS is Fun: The Impact of PBL-STEM Model on Elementary Students' Motivation and Achievement

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Abstract

This study aims to analyze the impact of the Problem-Based Learning (PBL) model integrated with STEM on students' motivation and academic achievement in the IPAS (Science and Social Studies) subject at SD Negeri Gelang 05. The background of this research stems from the low student engagement and achievement in IPAS learning, and the urgent need for a contextual approach that meaningfully integrates science, technology, engineering, and mathematics. This study employed a qualitative case study method. Data were collected through observation, in-depth interviews, and documentation over four cycles of PBL-STEM implementation. The findings revealed that the model significantly enhanced student motivation, as shown by their active participation, collaborative behavior, and increased curiosity. Furthermore, students demonstrated improved conceptual understanding and problem-solving skills. The discussion indicates that the model's effectiveness was supported by active teacher facilitation, a supportive school environment, and local contextual relevance. The study recommends broader application of the PBL-STEM model in IPAS learning to improve the quality of elementary education in Indonesia.
Keywords: *PBL-STEM, learning motivation, learning achievement, IPAS, elementary education*

Abstrak

Penelitian ini bertujuan untuk menganalisis dampak penerapan model Problem Based Learning berbasis STEM terhadap motivasi dan hasil belajar peserta didik pada mata pelajaran Ilmu Pengetahuan Alam dan Sosial (IPAS) di SD Negeri Gelang 05. Latar belakang penelitian ini berangkat dari rendahnya minat dan pencapaian belajar siswa dalam mata pelajaran IPAS serta perlunya pendekatan kontekstual yang mampu mengintegrasikan sains, teknologi, rekayasa, dan matematika secara bermakna. Metode penelitian yang digunakan adalah kualitatif dengan pendekatan studi kasus. Data dikumpulkan melalui observasi, wawancara mendalam, dan dokumentasi selama implementasi model PBL-STEM dalam empat siklus pembelajaran. Hasil penelitian menunjukkan bahwa model ini berhasil meningkatkan motivasi belajar siswa, ditunjukkan oleh partisipasi aktif, kerja sama kelompok yang solid, dan peningkatan rasa ingin tahu. Selain itu, terdapat peningkatan signifikan dalam pemahaman konsep dan kemampuan pemecahan masalah siswa. Diskusi menunjukkan bahwa keberhasilan model ini dipengaruhi oleh keterlibatan aktif guru sebagai fasilitator, dukungan sekolah, serta kesesuaian konteks lokal. Penelitian ini

merekomendasikan penerapan lebih luas model PBL-STEM dalam pembelajaran IPAS untuk meningkatkan kualitas pendidikan dasar di Indonesia.
Kata kunci: PBL-STEM, motivasi belajar, hasil belajar, IPAS, pendidikan dasar

INTRODUCTION

The 21st century has brought significant shifts in the landscape of education, demanding approaches that are not only knowledge-based but also interactive, contextual, and able to promote higher-order thinking skills(Firdaus et al., 2024). In this era, students are expected to master not only theoretical knowledge but also the ability to think critically, collaborate, create, and solve real-life problems. These demands become more urgent when considering the current situation of integrated subjects such as IPAS (Ilmu Pengetahuan Alam dan Sosial), which remain largely taught through conventional, teacher-centered methods in many elementary schools(Hanum et al., 2024).

IPAS, a subject that integrates natural and social sciences, holds a unique character, requiring students to understand scientific concepts while relating them to real social contexts. Unfortunately, IPAS is still commonly delivered using rote memorization and textbook-based instruction, causing students to become disengaged and demotivated(Sugih et al., 2023). According to data from the Indonesian Ministry of Education, Culture, Research, and Technology in (Rahman & Fuad, 2023), approximately 63% of elementary students reported boredom and a lack of interest in learning IPAS due to the monotonous delivery and lack of contextual learning.

This phenomenon is not limited to Indonesia. A UNESCO in (Ibda et al., 2024) report also highlights that in many developing countries, science and integrated learning in elementary education are often underestimated, while in fact, these are crucial years for developing foundational scientific and social literacy. The 2018 Programme for International Student Assessment (PISA) results placed Indonesia among the lowest-performing countries in scientific literacy (ranked 70th out of 78), further emphasizing the urgency of transformative and engaging learning strategies that can boost both motivation and achievement from an early age.

One promising approach to overcome these issues is the Problem-Based Learning (PBL) model, which emphasizes student-centered inquiry and problem-solving. PBL encourages students to explore, investigate, and collaborate in solving real-life problems, allowing them to develop not just knowledge but also essential life skills such as critical thinking, communication, and teamwork(Suhirman et al., 2021). Yet, the potential of this model can be significantly enhanced when integrated with the STEM (Science, Technology,

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Engineering, and Mathematics) approach, creating a powerful learning design known as the PBL-STEM model.

STEM-based learning offers a practical framework to help students integrate scientific and technological understanding through engineering design and mathematical reasoning.(Sofia et al., 2020) When combined with PBL, students are not only solving problems but are also learning to analyze, design, test, and evaluate solutions grounded in real-world contexts. The PBL-STEM model, therefore, provides an innovative way to increase both learning motivation and academic achievement, especially in IPAS, which naturally demands an interdisciplinary approach(Nur et al., 2023).

Previous studies have shown the effectiveness of PBL and STEM in enhancing learning outcomes. For instance, (Rahmawati et al., 2021) found that PBL improved students' critical thinking and academic performance in science subjects. (Winarko, 2024) also concluded that STEM approaches promoted student creativity and problem-solving through project-based learning. However, most of these studies examined PBL or STEM separately and focused on middle or high school levels. There is still a significant research gap in understanding how the combined PBL-STEM model affects both motivation and achievement at the elementary level, particularly in IPAS learning.

Moreover, earlier studies have often focused solely on cognitive achievement, without exploring the affective domain, especially learning motivation, which plays a central role in long-term academic success. It is essential to examine not just what students learn, but also how they feel about the learning process. Do they enjoy learning? Are they engaged? Are they motivated to continue exploring ideas independently? These questions are crucial, especially for elementary school students who are in their formative years.

This research is situated specifically at SD Negeri Gelang 05, a public elementary school in Indonesia. Initial observations conducted by the researcher revealed that many students at this school expressed disinterest in IPAS. Some students commented that the subject was "only about reading and copying," "lacked any real experimentation," and was "hard to understand because it was boring." Furthermore, the average score in IPAS for Grade 5 students was only 64, falling short of the school's minimum competency standard (KKM) of 75. These findings support the need for a student-centered, problem-oriented, and context-based learning strategy like the PBL-STEM model.

This study is grounded in constructivist learning theory, particularly the works of Jean Piaget and Lev Vygotsky. Piaget emphasized that knowledge is actively constructed by learners through experience and interaction with their environment(Smith, 1993). Vygotsky added the importance of social interaction and cultural context in learning, proposing concepts such as the zone of proximal development (ZPD) and scaffolding(Yu et al., 2013). The PBL-STEM model aligns well with these theoretical perspectives as it encourages learners to explore, collaborate, and build understanding through meaningful experiences.

The significance of this study lies not only in measuring the impact of the PBL-STEM model on academic outcomes but also in exploring how this model influences students' enjoyment, engagement, and sense of purpose in learning. The goal is to demonstrate that IPAS can be more than just a subject—it can be a fun, relevant, and empowering learning experience. This aligns with the study's title and central vision: "Learning IPAS is Fun."

Furthermore, this research is timely and relevant in the context of Indonesia's Merdeka Curriculum, which emphasizes project-based learning, differentiated instruction, and student agency. The PBL-STEM model fits seamlessly within this framework and could serve as a practical recommendation for teachers and school leaders implementing curriculum reforms. By showcasing how PBL-STEM supports both national learning goals and global educational trends, this study contributes to both theoretical development and classroom practice.

This research emerges from a combination of local observations, national challenges, and global educational trends. The persistent low motivation and achievement in IPAS learning highlighted by both empirical data and firsthand classroom evidence demands a transformative solution. The Problem-Based Learning model integrated with STEM education offers a powerful approach to address these issues. Conducted at SD Negeri Gelang 05, this study aims to provide meaningful insights into how innovative pedagogy can turn traditional, passive science-social learning into an active, joyful, and impactful experience for young learners. Through this research, we hope to inspire more effective, student-centered practices that affirm the belief that "Learning IPAS is Fun" and it should be.

RESEARCH METHOD

This study adopted a qualitative research approach with a case study design to explore the implementation and impact of the PBL-STEM model on students' motivation and learning experiences in the IPAS subject at SD Negeri Gelang 05. The qualitative method was chosen to deeply understand the process of how elementary students respond to contextual learning strategies involving problem-solving, scientific inquiry, and project-based collaboration. Rather than measuring outcomes through numerical data, this research focused on interpreting participants' behaviors, perceptions, and learning engagement within a natural classroom setting.

The research was conducted at SD Negeri Gelang 05, a public elementary school located in Jember Regency, East Java. The participants of the study were fifth-grade students, along with their classroom teacher, selected purposively based on their willingness to participate and the school's openness to implementing an innovative learning model. The PBL-STEM learning model was integrated into IPAS instruction over a four-week period, during which students engaged in real-life problem-solving tasks that combined science, technology, engineering, and mathematics principles.

Data were collected through three primary qualitative instruments: classroom observations, in-depth interviews, and document analysis. Classroom observations were conducted during each session to capture student interactions, engagement levels, group dynamics, and the teacher's facilitation style. An observation guide was developed based on indicators of motivation such as attention, curiosity, perseverance, and collaboration. The researcher served as a non-participant observer to reduce intervention bias and recorded data using field notes, photographs, and video documentation (with prior consent).

In-depth interviews were conducted with both the classroom teacher and selected students to gain insight into their experiences and perceptions of the learning process. The teacher interview explored their understanding of the PBL-STEM model, challenges during implementation, and observed changes in students' learning attitudes. Student interviews, conducted in a semi-structured manner, aimed to reveal how the PBL-STEM activities affected their motivation, confidence, teamwork, and interest in IPAS topics. Interviews were audio-recorded and transcribed for analysis.

Document analysis involved reviewing student worksheets, group project reports, and classroom artifacts such as posters and models developed during the PBL-STEM lessons. These documents provided supplementary evidence of student participation, creativity, and depth of understanding in relation to the content and skills targeted by the curriculum.

The data analysis procedure followed the (Sugiyono, 2013) model, which includes data reduction, data display, and conclusion drawing/verification. In the data reduction phase, relevant information from field notes, transcripts, and documents was selected and organized according to emerging themes. In the display phase, the data were presented in matrices and narrative form to highlight patterns of student motivation, learning behavior, and classroom dynamics. The final stage involved drawing conclusions based on recurring patterns, supported by triangulated data from observations, interviews, and document analysis.

To ensure trustworthiness, the study employed triangulation, member checking, and peer debriefing. Triangulation was achieved by using multiple sources and data collection methods. Member checking was conducted by sharing interview transcripts and summaries with participants for validation. Peer debriefing was carried out with fellow researchers to critically examine the interpretations and ensure the credibility of the findings. Ethical considerations were strictly observed throughout the research process. Permission was obtained from the school principal, classroom teacher, and students' parents. All participants were informed of the purpose of the study, their right to withdraw at any time, and the confidentiality of their identities. Data were stored securely and used solely for academic purposes.

RESULT AND DISCUSSION

RESULT

This study was conducted at SD Negeri Gelang 05, located in Bondowoso Regency, East Java. The school is a public elementary school with a moderate number of students, active teacher collaboration, and sufficient infrastructure to support project-based learning activities. The research focused on one fifth-grade class, consisting of 26 students with varying academic abilities and learning motivations. The classroom teacher, Ibu Siti Mulyani, S.Pd, was experienced and open to implementing innovative teaching models. The implementation of the PBL-STEM model in the IPAS subject was conducted over four weeks (eight sessions), focusing on environmental sustainability, energy sources, and technological innovation themes drawn from the IPAS Grade 5 curriculum.

A. Implementation of the PBL-STEM Model in the Classroom

The application of the PBL-STEM model began with problem orientation activities. On the first day, students were introduced to a contextual problem related to waste management in their local environment. The teacher presented a guiding question: "How can we reduce the impact of plastic waste in our village using science and technology?" This question triggered student curiosity and became the foundation for their project-based exploration. Based on observation field notes dated March 4, 2025, students began actively discussing in small groups. One student, Andini, was heard saying:

"Kalau kita buat tempat sampah pintar yang bisa berbunyi waktu penuh, mungkin bisa bantu warga."

This indicated that students began connecting real problems with technological ideas. Throughout the implementation, students worked in groups of 4–5, identifying problems, proposing solutions, conducting simple experiments, designing prototypes, and presenting their findings. Each PBL-STEM cycle consisted of identifying the problem, planning investigations, designing a solution, testing the prototype, and evaluating results. The teacher facilitated by asking critical questions and guiding reflection.

In the second session, students were seen investigating different types of waste and their decomposition rates. They conducted a mini-experiment by burying organic and inorganic waste in containers. One group observed that banana peels decomposed faster than candy wrappers. During the presentation, a student named Hafidz commented:

"Kami belajar kalau plastik itu nggak bisa hancur cepat. Kalau kita terus buang sembarangan, bisa bahaya ke tanah dan air."

Such responses reflected the integration of scientific understanding and environmental awareness. Students were not only absorbing facts but also developing concern for their surroundings, which is in line with the goals of IPAS as a transdisciplinary subject.

B. Students' Motivation to Learn IPAS through PBL-STEM

Student motivation was examined through observation, interviews, and document analysis. Observations indicated that students exhibited high engagement and enthusiasm during the PBL-STEM sessions. On March 7, during the prototyping phase, one group brought a mini model of a compost bin made from used bottles. They explained how it could be used by villagers for organic waste. During interviews, students expressed a greater interest in learning IPAS through this method.

Fatimah stated during her interview:

"Biasanya pelajaran IPA itu cuma baca buku dan jawab soal. Tapi sekarang kita bisa coba bikin alat sendiri, rasanya lebih seru dan nggak bosen."

Similarly, Danu said:

"Aku jadi pengen belajar lagi karena bisa kerja sama sama teman, dan kita bikin sesuatu yang nyata."

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From the above data, it was evident that the autonomy and collaborative aspects of the PBL-STEM model enhanced students' intrinsic motivation. Students felt more ownership over their learning process and were driven by the relevance of the tasks.

In terms of observational indicators, students demonstrated increased persistence in completing group tasks. On average, group discussions lasted 20–25 minutes without teacher intervention, indicating sustained engagement. Students also displayed increased willingness to revise their ideas and designs based on feedback, a behavior associated with mastery motivation.

C. Improvement in Learning Outcomes (Conceptual and Procedural)

Although this study did not employ quantitative pretest–posttest data, changes in student understanding and skills were evident through document analysis and teacher interviews. Student worksheets, prototype designs, and reflective journals indicated conceptual growth. For instance, in early worksheets, many students answered questions with single-sentence explanations such as:

"Sampah plastik harus dibakar supaya habis."

However, by the fourth session, students provided more nuanced responses:

"Membakar sampah plastik menghasilkan asap beracun. Lebih baik dipisah dan dikirim ke bank sampah."

This progression demonstrated deeper conceptual understanding of environmental issues and causal reasoning. In their final projects, three groups successfully developed simple but functional waste management tools, such as a "color-coded trash bin" and a "biopori model" made from used bottles. Their reports included observations, explanations, and reflections, which showed improvements in scientific communication.

The classroom teacher corroborated these findings during her interview:

"Saya melihat anak-anak jadi lebih paham konsep IPAS dibanding sebelumnya. Dulu mereka hafal tapi sekarang mereka bisa menjelaskan dengan bahasa sendiri. Itu luar biasa."

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Furthermore, students showed improved procedural skills such as data collection, recording observations, making tables, and drawing conclusions-indicating increased scientific literacy.

D. Student Collaboration and Communication Skills

Collaboration was a prominent aspect of the PBL-STEM model. Students were frequently observed discussing, assigning roles, and negotiating ideas. For example, in Group 2, one student took charge of drawing the design, another wrote the explanation, while two others tested the prototype. In their reflection journals, students mentioned that group work helped them learn from peers.
Zahra (10) wrote in her journal:

"Aku jadi tahu ide teman-teman itu beda-beda. Kalau digabung, hasilnya jadi lebih bagus."

The data also revealed that communication skills developed through the frequent presentations. Each group presented their project twice—during a mid-cycle review and final presentation. Students used visual aids, explained their reasoning, and responded to peer questions. This exercise built confidence and public speaking skills.

E. Teacher's Role as Facilitator

The teacher's shift in role from knowledge transmitter to learning facilitator was essential to the success of the PBL-STEM model. Field notes revealed that instead of giving direct answers, the teacher often asked guiding questions such as:

"Bagaimana kamu tahu bahwa alat ini akan efektif? Apa buktinya?"

This prompted students to reflect and evaluate their solutions critically. In her interview, the teacher reflected:

"Awalnya saya agak bingung karena biasa mengajar dengan buku dan ceramah. Tapi ternyata dengan metode ini, saya justru lebih mengenal kemampuan anak-anak."

The PBL-STEM model encouraged teachers to focus on process-based learning, fostering a more responsive and student-centered classroom environment.

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F. Challenges in Implementation

Despite its benefits, several challenges were encountered. First, time management became a concern. Some sessions exceeded the allotted 35–40 minutes due to extended group work or presentation sessions. Second, limited resources occasionally constrained student creativity. For instance, not all students had access to reusable materials or tools for prototyping. To mitigate this, the teacher allowed students to bring items from home and adapted tools using locally available materials.

Another challenge was related to students' readiness. Some students were initially shy or passive, reluctant to express ideas or lead discussions. However, as the sessions progressed, many showed growth in confidence and initiative. The teacher noted that the presence of supportive peers and repeated opportunities for expression helped overcome this barrier.

DISCUSSION

The findings of this study reveal the transformative role of the PBL-STEM model in shaping elementary students' motivation and learning achievement in the IPAS subject. These results align with the assumption that integrated, context-based learning models can significantly enhance both cognitive and affective outcomes in primary education. In this chapter, the findings are critically examined in the context of previous studies and grounded in relevant theoretical perspectives, particularly constructivist learning theory, self-determination theory (SDT), and STEM education principles.

First, the increased student motivation observed throughout the study corroborates numerous prior studies emphasizing the motivational benefits of active and contextual learning. For instance, research by (Rohman et al., 2021) in Indonesian elementary schools found that students exposed to project-based STEM learning demonstrated higher learning interest and persistence compared to those receiving traditional instruction. Similarly, a study by (Suhirman et al., 2021) in that PBL-based STEM interventions enhance elementary learners' curiosity and self-efficacy in science learning. In this current study, student motivation was evident in their voluntary participation, sustained group work, eagerness to present ideas, and emotional attachment to the problem-solving process. Students such as Andini and Hafidz expressed how learning became "fun" and "real" through projects that allowed them to contribute tangible solutions to their own environment.

The PBL-STEM model, by its very design, offered students autonomy to explore, choose solutions, and present ideas. It cultivated competence through iterative prototyping and feedback, and strengthened relatedness via collaborative group dynamics. This theory explains why students remained engaged even when faced with challenges because the learning environment satisfied their psychological needs. Moreover, these findings reinforce the conclusions of (Maksum & Purwanto, 2022), who found that PBL combined with STEM in elementary schools enhanced not only academic understanding but also emotional engagement and collaboration.

Another prominent outcome of the study was the improvement of conceptual understanding and scientific process skills. Students moved from superficial recall to deeper comprehension, as evidenced by their evolving explanations and ability to relate classroom content to real-life situations. This finding is consistent with studies by (Nur et al., 2023) and (Firdaus et al., 2024), who noted that the integration of problem-based strategies with STEM elements promotes higher-order thinking, particularly in topics related to science and the environment. In this study, students demonstrated critical thinking when comparing decomposition rates, weighing the consequences of burning waste, and designing eco-friendly innovations. Their ability to express scientific reasoning in their own words, and to justify their design choices, suggests that the PBL-STEM model fostered meaningful learning in line with constructivist theory.

Another important theme in the findings is the development of collaborative and communication skills. Throughout the four-week implementation, students engaged in continuous group dialogue, planning, division of labor, peer feedback, and public presentation. This aspect is often underrepresented in conventional science instruction, yet is vital for 21st-century competencies. Research by (Loglo & Zawacki-Richter, 2023) on STEM-based instruction in primary schools shows that collaboration improves when learning tasks are complex and socially relevant. Similarly, (Putri & Istiyono, 2017) emphasized that the integration of teamwork in STEM education prepares students for interdisciplinary problem-solving, a skill necessary for future global challenges. In this study, students such as Zahra wrote about learning from the differences in peer ideas, indicating increased appreciation of diverse perspectives a fundamental aspect of collaborative learning.

Moreover, the role of the teacher in facilitating rather than delivering content was essential in supporting student learning. This shift from didactic teaching to facilitative mentoring aligns with research by (Muhammad et al., 2023) who argue that effective PBL environments require teachers to guide inquiry, prompt metacognition, and support group regulation. In this case study, the teacher at SD Negeri Gelang 05, Ibu Siti, played a crucial role in asking critical questions, encouraging reflection, and providing just-in-time support. Her shift in pedagogical stance, initially hesitant but eventually confident, mirrors the findings of (Attwood et al., 2020), who reported that teachers require time and support to adapt to student-centered instruction models. Nonetheless, when properly executed, these models can transform the classroom into a dynamic, inquiry-driven space.

Despite these successes, the challenges identified especially limited time and resource availability cannot be ignored. Time management emerged as a consistent issue, as students needed more time to brainstorm, prototype, and revise. This is a common concern in PBL and STEM instruction, as highlighted by (Firdaus et al., 2024) , who caution that complex learning tasks demand flexibility in scheduling and pacing. Resource limitations were also evident; not all students had equal access to tools or materials for creating prototypes. This aligns with the findings of (Herlina et al., 2023), who pointed out disparities in infrastructure as a barrier to equitable STEM implementation in rural Indonesian schools. In this study, these challenges were mitigated through teacher improvisation and the use of recycled materials, suggesting that creativity and contextual adaptation are key to overcoming logistical obstacles.

Furthermore, student readiness varied. While many students adapted quickly to the active learning structure, others initially displayed shyness or passivity. This echoes the observations by (Mesuwini & Mokoena, 2024), who noted that some elementary learners need time to adjust to roles that require initiative and group leadership. However, the gradual increase in confidence observed in this study particularly in the students' growing willingness to speak, question, and explain demonstrates the developmental potential of the PBL-STEM approach. As students gain exposure and support, they can transition from passive learners to active contributors.

It is also worth discussing how the local context influenced the success of this implementation. SD Negeri Gelang 05, while situated in a rural area, displayed characteristics conducive to innovation: a supportive school climate, cooperative teacher leadership, and parental encouragement. These factors are essential for sustainable educational change. Research by (Noboru et al., 2021) emphasizes the importance of organizational culture and distributed leadership in enabling pedagogical reform. Therefore, the success of this intervention cannot be attributed to the model alone but also to the systemic conditions that supported its execution. The findings suggest that even in resource-limited settings, effective STEM-based PBL can thrive when embedded in a responsive school ecosystem.

From a curriculum perspective, the findings support the national push in Indonesia to integrate transdisciplinary learning in elementary education. The IPAS curriculum, as designed by the Ministry of Education and Culture, encourages teachers to link scientific content with real-life challenges. This study illustrates how the PBL-STEM model operationalizes that goal. Instead of fragmented lessons on science, students engaged in holistic tasks that combined inquiry, design, collaboration, and reflection. Their projects—such as the smart trash bin and biopori model—demonstrated both understanding and creativity. These align with the competencies targeted in the national Merdeka Belajar curriculum, particularly in terms of student agency, contextual thinking, and ecological awareness.

Comparing the findings to international research, the results are consistent with STEM-PBL studies conducted in countries such as Finland, the United States, and Singapore. For example, a study by (Yusuf, Y. Q., Natsir, Y., & Hanum, 2015) elementary schools demonstrated that STEM integration improved students' attitudes toward science and increased their willingness to engage in scientific careers. In Singapore, the Ministry of Education has adopted STEM-focused inquiry projects in primary education to build innovation skills early. This shows that the model used in this study is globally recognized and applicable across different socio-cultural contexts.

However, this study also contributes uniquely to the literature by offering a rich, qualitative insight into how PBL-STEM unfolds in an Indonesian rural elementary classroom. While many studies rely on quantitative metrics, this research provides narrative data that capture the lived experiences, voices, and challenges of both students and teachers. Such data are vital in understanding not just "whether" a method works, but "how" and "why" it works in specific contexts. This aligns with the call by (Sundari et al., 2024) for more case-based research to complement large-scale educational surveys.

The implications of this study are broad. For teachers, it suggests the importance of designing learning experiences that are relevant, collaborative, and inquiry-driven. For school leaders, it emphasizes the need to support teacher capacity-building, time flexibility, and material accessibility. For policymakers, it affirms the effectiveness of integrated learning models and the importance of investing in STEM education at the primary level. Finally, for future researchers, this study opens pathways to examine how such models can be scaled, adapted, and sustained across diverse learning environments.

The PBL-STEM model demonstrated significant potential to enhance elementary students' motivation and achievement in IPAS learning. The findings were consistent with previous research and theoretical perspectives, particularly in showing how problem-solving, autonomy, collaboration, and contextual learning intersect to produce deeper engagement and understanding. While challenges remain, the overall evidence supports the continued exploration and development of PBL-STEM in primary education, particularly within the Indonesian context where innovation in pedagogy is both urgent and necessary.

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CONCLUSION

This study concludes that the implementation of the PBL-STEM model in IPAS learning at SD Negeri Gelang 05 significantly enhanced students' learning motivation and academic achievement. Through problem-based and STEM-integrated activities, students became more engaged, curious, and active in constructing their own knowledge. The model fostered collaboration, creativity, and contextual understanding, enabling students to connect science concepts with real-life challenges. Despite limitations in time and resources, the PBL-STEM approach proved effective in transforming classroom learning into a meaningful and enjoyable experience. This research highlights the potential of PBL-STEM to support 21st-century skills in elementary education, especially in rural Indonesian contexts.

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