



Improving Martial Arts Movement Analysis Skills Using PBL

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ABSTRACT

Physical Education, Sports, and Health (PJOK) under the Merdeka Curriculum emphasizes the development of higher-order thinking skills, including students' ability to analyze movement concepts and procedures in martial arts learning. However, preliminary observations in Class XI-8 of SMAN 2 Martapura revealed that students' martial arts movement analysis skills remained low, with only 32.4% of students achieving the Learning Objective Achievement Criterion (KKTP) of 80. Therefore, an innovative learning approach was needed to enhance students' analytical abilities. This study aimed to improve the martial arts movement analysis skills of Class XI-8 students through the implementation of the Problem Based Learning (PBL) model. This research employed a Classroom Action Research (CAR) design based on the Kemmis and McTaggart spiral model, consisting of two cycles with the stages of planning, acting, observing, and reflecting. The participants were 34 students of Class XI-8 during the even semester of the 2025/2026 academic year. Data were collected through structured observation sheets, written tests measuring C4-level analytical skills, and documentation. Quantitative data were analyzed using comparative descriptive techniques, while qualitative data were analyzed through data reduction, data display, and conclusion drawing. The results demonstrated a substantial improvement in students' martial arts movement analysis skills. The class average score increased from 60.8 in the pre-cycle stage to 73.7 in Cycle I and 82.8 in Cycle II. Classical learning completeness improved from 32.4% to 61.8% and reached 85.3% in Cycle II, exceeding the predetermined success criterion of 80%. Student learning activity also increased significantly from 52% (poor category) to 82% (good category). In conclusion, the Problem Based Learning model proved effective in improving students' martial arts movement analysis skills and learning participation. PBL can therefore be recommended as an instructional strategy for developing higher-order thinking skills in PJOK learning.

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- Conception and design of the study;
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- Analysis and interpretation of data;
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INTRODUCTION

Physical Education, Sports, and Health (PJOK) plays a strategic role in Indonesia's educational system because it contributes not only to students' physical development but



also to cognitive, affective, and psychomotor growth (Mustafa & Dwiyoogo, 2020). In line with contemporary educational reforms, the implementation of the Merdeka Curriculum emphasizes the development of higher-order thinking skills (HOTS), problem-solving abilities, collaboration, communication, and critical thinking across all learning domains, including physical education (Kemendikbudristek, 2022). Consequently, PJOK learning is no longer limited to the mastery of movement techniques but is also directed toward students' ability to analyze, evaluate, and apply movement concepts in various physical activities (Suryadi et al., 2023).

Within the Phase F Learning Outcomes for senior high school students, martial arts instruction, particularly pencak silat, requires learners to analyze facts, concepts, and procedural knowledge related to attack and defense techniques (Kemendikbudristek, 2022). This requirement reflects Bloom's revised taxonomy, which places analytical ability (C4) as an essential cognitive competence that enables students to identify movement components, compare techniques, classify movement patterns, and determine the effectiveness of specific actions in different situations (Anderson & Krathwohl, 2016). However, the reality in many schools indicates that the achievement of analytical competencies in PJOK remains relatively low. Traditional teaching approaches continue to dominate classroom practice, where teachers primarily demonstrate movements while students passively imitate them (Suherman et al., 2021). Such teacher-centered approaches tend to limit students' opportunities to engage in critical thinking, movement analysis, collaborative discussion, and reflective learning processes (Kurniawan & Hidayat, 2023).

The preliminary observation conducted in Class XI-8 of SMAN 2 Martapura revealed a substantial discrepancy between curriculum expectations and students' actual performance. Out of 34 students, only 11 students (32.4%) achieved scores above the Learning Objective Achievement Criterion (KKTP) of 80 in martial arts movement analysis. Meanwhile, 23 students (67.6%) scored below the expected standard. These findings indicate that most students experienced difficulties in identifying movement errors, comparing attack and defense techniques, and explaining procedural aspects of pencak silat skills. Such conditions suggest that learning activities have not yet optimally facilitated analytical thinking and problem-solving abilities, which are central objectives of the Merdeka Curriculum (Rahmat et al., 2024).

The persistence of this issue highlights the need for innovative learning models capable of fostering active participation and higher-order cognitive engagement in PJOK learning. One pedagogical approach that has received considerable attention in recent years is Problem Based Learning (PBL), which emphasizes authentic problem-solving, collaborative inquiry, and student-centered learning processes (Hmelo-Silver, 2017). Problem Based Learning is a constructivist learning model that encourages students to actively construct knowledge through the investigation and resolution of real-world problems (Savery, 2019). In PBL environments, students work collaboratively to identify problems, formulate hypotheses, collect information, analyze data, and propose solutions, thereby promoting deeper conceptual understanding and critical thinking skills (Yew & Goh, 2016).

Numerous studies have reported positive impacts of PBL implementation in physical education settings. Research by Naibaho et al. (2025) demonstrated that PBL significantly improved cognitive, affective, and psychomotor learning outcomes among secondary school students, with more than 85% of learners achieving the Minimum Completeness Criteria in the second cycle of classroom action research. Similarly, Kelasim et al. (2025) found that students' learning achievement increased from 75.8% in Cycle I to 85.6% in Cycle II following the application of PBL in senior secondary education.

Several international studies have also confirmed the effectiveness of PBL in developing critical thinking and analytical skills. Liu et al. (2021) reported that PBL enhanced students' reasoning abilities, collaborative competencies, and knowledge retention compared with conventional instructional approaches. Likewise, Sungur and Tekkaya (2020) concluded that PBL environments facilitate deeper learning because students become actively involved in inquiry and reflective thinking processes.

Within physical education contexts, PBL has been shown to improve tactical understanding, decision-making, and movement comprehension (Casey & MacPhail, 2018). Students exposed to PBL demonstrate higher engagement levels and greater ability to analyze movement situations than those taught through direct instruction methods (Harvey et al., 2019). These findings align with contemporary PJOK objectives that prioritize not only skill performance but also cognitive understanding of movement principles.

More specifically, research in martial arts education has indicated promising outcomes. Syayyadi et al. (2025) reported that implementing PBL in pencak silat instruction increased student learning completeness to 100% during the second cycle. Other studies have found that problem-solving activities integrated into martial arts learning improve students' tactical awareness, movement evaluation skills, and self-regulated learning capacities (Prasetyo et al., 2023; Wibowo & Nugroho, 2024).

Theoretically, the effectiveness of PBL can be explained through constructivist learning theory, which emphasizes active knowledge construction through meaningful experiences (Vygotsky, 1978). Through collaborative discussion and authentic problem-solving tasks, students develop higher-order cognitive processes that support analytical thinking and conceptual understanding (Hmelo-Silver, 2017). Therefore, PBL appears highly compatible with the competencies expected in the Merdeka Curriculum, particularly those related to movement analysis and critical thinking.

Despite the growing body of evidence supporting PBL in physical education, several important gaps remain evident in the literature. First, most existing studies focus on general learning outcomes, including cognitive achievement, psychomotor performance, motivation, and participation levels (Naibaho et al., 2025; Kelasim et al., 2025). Relatively few investigations specifically examine students' movement analysis skills as an independent learning outcome. Second, studies addressing martial arts instruction primarily assess mastery of movement execution rather than analytical competencies associated with understanding movement structures, identifying errors, comparing techniques, and evaluating procedural effectiveness (Syayyadi et al., 2025; Prasetyo et al., 2023). Consequently, empirical evidence concerning the impact of PBL on higher-order analytical

skills in martial arts learning remains limited. Third, classroom action research conducted in Indonesian PJOK settings frequently measures learning completeness based on overall scores without explicitly focusing on Bloom's C4 analytical dimension, which constitutes a central requirement of the Merdeka Curriculum (Rahman et al., 2023). As a result, the effectiveness of PBL in developing movement analysis skills has not been sufficiently documented. Furthermore, limited research has been conducted within the specific context of senior high school students in South Kalimantan, particularly at SMAN 2 Martapura. Educational contexts differ across regions due to variations in learning culture, student characteristics, and instructional practices, making contextualized investigations necessary to strengthen empirical evidence and practical implementation strategies (Siregar et al., 2022). Based on the identified problems and gaps, this study aims to: (1) describe the implementation of the Problem Based Learning model in martial arts instruction for Class XI-8 students at SMAN 2 Martapura, and (2) improve students' martial arts movement analysis skills through systematic implementation of the PBL model.

The novelty of this research lies in its explicit focus on movement analysis skills as a higher-order cognitive outcome within martial arts education. Unlike previous studies that predominantly examined general learning achievement or technical skill mastery, this study specifically investigates students' abilities to analyze, compare, classify, and evaluate martial arts movement patterns based on Bloom's C4 cognitive level. Additionally, the study aligns directly with the competency demands of the Merdeka Curriculum and provides empirical evidence regarding the application of PBL in fostering analytical thinking within PJOK learning. The action hypothesis proposed in this study is that systematic implementation of the Problem Based Learning model across two Classroom Action Research cycles will improve students' martial arts movement analysis skills, resulting in at least 80% of students achieving a KKTP score of 80 or higher.

In summary, the transformation of PJOK learning under the Merdeka Curriculum requires instructional approaches capable of developing students' higher-order thinking skills, particularly movement analysis competencies. Preliminary findings at SMAN 2 Martapura indicate that students' martial arts movement analysis abilities remain below expected standards due to the predominance of teacher-centered instruction. Although previous studies have demonstrated the effectiveness of Problem Based Learning in improving general learning outcomes, evidence regarding its impact on martial arts movement analysis skills remains limited. Therefore, this study seeks to address this gap by implementing PBL in martial arts instruction and evaluating its effectiveness in enhancing students' analytical competencies, thereby contributing both theoretically and practically to the advancement of PJOK learning in Indonesia.

METHODS

This study employed a Classroom Action Research (CAR) design, which is widely recognized as an effective approach for improving instructional practices through systematic cycles of planning, implementation, observation, and reflection (Susilo et al.,

2022). Classroom Action Research enables teachers and researchers to collaboratively identify classroom problems, implement interventions, evaluate outcomes, and continuously refine teaching strategies to enhance student learning (Mertler, 2020). The present study adopted the Kemmis and McTaggart spiral model, consisting of four interconnected stages: planning, acting, observing, and reflecting. This model has been extensively utilized in educational research because it provides a structured framework for improving learning processes through iterative cycles of action and evaluation (Burns, 2019).

The research was conducted in Class XI-8 of SMAN 2 Martapura, Banjar Regency, South Kalimantan Province, Indonesia, during the even semester of the 2025/2026 academic year, from February to June 2026. The participants consisted of all 34 students enrolled in the class, including 20 male students and 14 female students. The class was selected purposively based on preliminary observation findings indicating that students experienced considerable difficulties in analyzing martial arts movements, particularly in identifying attack and defense techniques, comparing movement patterns, and explaining procedural aspects of pencak silat. Initial assessment results showed that only 32.4% of students achieved the Learning Objective Achievement Criterion (KKTP) score of 80, indicating the need for pedagogical intervention.

The study was conducted in two action cycles, with each cycle consisting of two learning meetings of three class periods per meeting. The instructional intervention was implemented using the Problem Based Learning (PBL) model. PBL was selected because it promotes active learning, collaborative problem-solving, critical thinking, and higher-order cognitive processes that align with the analytical competencies required in the Merdeka Curriculum (Yew & Goh, 2016; Hmelo-Silver, 2017). The implementation followed the five standard phases of PBL: problem orientation, organizing students for learning, guiding investigation, developing and presenting solutions, and evaluating the problem-solving process (Savery, 2019).

Data collection employed methodological triangulation using three complementary instruments to enhance research validity and credibility (Creswell & Creswell, 2023). First, structured observations were conducted using teacher activity observation sheets consisting of 15 indicators and student activity observation sheets consisting of 12 indicators. Each indicator was assessed using a four-point rating scale ranging from very poor to very good. Observation data were collected by a collaborating teacher during the implementation of learning activities. Second, students' martial arts movement analysis skills were measured through written tests comprising multiple-choice and essay items developed according to Bloom's revised taxonomy at the analysis level (C4). These tests assessed students' abilities to identify, compare, classify, and evaluate martial arts movement techniques. The instruments were validated through expert judgment by experienced PJOK teachers to ensure content validity and instructional relevance (Fraenkel et al., 2019). Third, documentation data were collected through photographs of learning activities, field notes, attendance records, and student worksheets (LKPD) to provide supporting evidence of the learning process. Quantitative data obtained from

students' cognitive test scores were analyzed using descriptive-comparative techniques.

This approach is commonly used in classroom action research to determine improvements in student achievement across cycles (Arikunto, 2021). Meanwhile, qualitative data obtained from observations and field notes were analyzed using the interactive model of Miles, Huberman, and Saldaña (2020), consisting of data reduction, data display, and conclusion drawing. The integration of quantitative and qualitative analyses enabled a comprehensive evaluation of both learning outcomes and instructional processes.

The research was considered successful when three criteria were achieved: (1) at least 80% of students attained a KKTP score of 80 or higher; (2) average student learning activity reached a minimum of 80% and was categorized as "Good"; and (3) all five phases of the Problem Based Learning model were implemented with at least a "Good" level of performance. These criteria were established based on the principles of mastery learning and classroom action research effectiveness commonly applied in PJOK learning improvement studies (Suprijono, 2022; Rahman et al., 2023).

RESULTS AND DISCUSSION

Result

Pre-Cycle Description

Prior to the intervention, initial observation results showed that PJOK instruction on martial arts material still employed direct demonstration methods (teacher-centered). Students only observed and imitated teacher movements without opportunity to analyze or discuss independently. Student activity level reached only 52% (Poor category). Diagnostic test results showed a class average of 60.8 with only 11 students (32.4%) achieving KKTP ≥ 80 . The lowest score obtained was 42 and the highest was 88.

Cycle I Research Results

Cycle I actions were carried out over two meetings in April 2026 implementing five PBL phases: problem orientation through martial arts technique demonstration videos containing movement errors, small group organization (4-5 students), field investigation, analysis result presentation, and joint evaluation. In the first meeting (April 2, 2026), students observed videos and conducted direct practical investigation. The second meeting (April 9, 2026) focused on presentation of analysis results and evaluative discussion.

Cycle I observation results showed that average student activity improved from 52% to 68% (Sufficient category). The teacher successfully implemented 3 of 5 PBL phases at a Good category. Written test results showed the class average improved from 60.8 to 73.7, and classical completeness increased from 32.4% to 61.8% (21 students). Although significant improvement occurred, the $\geq 80\%$ success indicator was not yet achieved.

Cycle I reflection identified several weaknesses: the movement problems presented were too abstract for some students; the LKPD did not provide adequate analytical guidance; time management for presentations was suboptimal causing Phase 5 to proceed hastily; and scaffolding was insufficiently structured for lower-ability students. Based on these findings, an improvement plan was developed for Cycle II.

Cycle II Research Results

Improvements in Cycle II included: (1) presentation of more contextual real sparring videos that students could more easily connect to their experiences; (2) LKPD revision with added columns for stepwise analytical guidance questions; (3) provision of illustrated movement analysis cards as additional scaffolding; and (4) establishment of a maximum 7-minute presentation time per group. Implementation took place on April 16 and 23, 2026.

Cycle II results showed highly significant improvement. Average student activity increased to 82% (Good category), and all 5 PBL phases were implemented at a Good category. The class average increased to 82.8, with 29 of 34 students (85.3%) achieving KKTP ≥ 80 , surpassing the established success indicator. With all success indicators achieved, the research was declared successful in Cycle II.

Table 1.

Martial Arts Movement Analysis Skills Score Data Per Student

No	Student Name	Sex	Pre-Cycle	Cycle I	Cycle II	Final Status
1	Aditya Rizky	M	82	86	88	Pass
2	Ahmad Hafi Madani	M	55	68	80	Pass
3	Ahmad Sofa Anwari	M	85	88	90	Pass
4	Ahmad Syihabuddin	M	50	65	74	Not Pass
5	Akhmad Dwi Setya	M	60	85	83	Pass
6	Alya Ramadhani	F	87	80	93	Pass
7	Andrew Christian Girsang	M	48	63	74	Not Pass
8	Ashawati	F	80	85	88	Pass
9	Asma'ul Husna	F	55	70	82	Pass
10	Fadil Ridwansyah	M	50	66	73	Not Pass
11	Faқи Tri Wanur	M	82	88	89	Pass
12	Kharisma Ramadhani	F	45	62	85	Pass
13	Lisda Amelia	F	58	85	84	Pass
14	Lutfi Hasan	M	83	86	91	Pass
15	Melinda Rizkia	F	52	85	88	Pass
16	Muhammad Al Riyannur	M	48	64	72	Not Pass
17	Muhammad Arya	M	60	86	86	Pass
18	Muhammad Fahri Firmansyah	M	55	85	82	Pass
19	Muhammad Hanafi	M	45	63	73	Not Pass
20	Muhammad Jumaidi	M	87	80	93	Pass
21	Muhammad Muqarrab	M	58	85	85	Pass
22	Muhammad Rafik	M	50	66	88	Pass
23	Muhammad Rizki	M	80	86	87	Pass
24	Muhammad Zull Adha R.	M	48	65	89	Pass
25	Nabila	F	55	85	83	Pass
26	Naila Nur Alifa	F	82	87	89	Pass
27	Nasyita Sa'da	F	42	62	85	Pass
28	Nayadha	F	60	85	86	Pass
29	Nia Rhamadhani	F	80	85	88	Pass
30	Putri Lestari	F	50	67	80	Pass
31	Rayhanza Fatturrifqi At T.	M	58	85	85	Pass
32	Siti Pirdaus	F	82	86	90	Pass
33	Talytha Raissa Ozora	F	52	65	88	Pass
34	Tengku Vatryas Raysha Z.	M	65	85	85	Pass
Class Average Score			60.8	73.7	82.8	
Students Passing KKTP (≥ 80)			11 (32.4%)	21 (61.8%)	29 (85.3%)	

Source: Research data, 2026

Table 2.
 Recapitulation of Pre-Cycle, Cycle I, and Cycle II Results

Aspect	Pre-Cycle	Cycle I	Cycle II
Class Average Score	60.8	73.7	82.8
Students Passing KKTP	11 (32.4%)	21 (61.8%)	29 (85.3%)
Completion Category	Low	Moderate	Successful ✓
Student Learning Activity	Poor (52%)	Sufficient (68%)	Good (82%) ✓
PBL Phase Implementation	-	Sufficient (3 Phases)	Good (5 Phases) ✓

Source: Research data, 2026

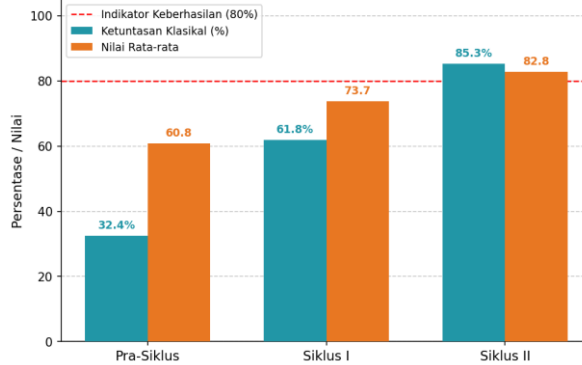


Figure 1.

Comparison of Classical Completeness and Class Average Score Across Research Phases

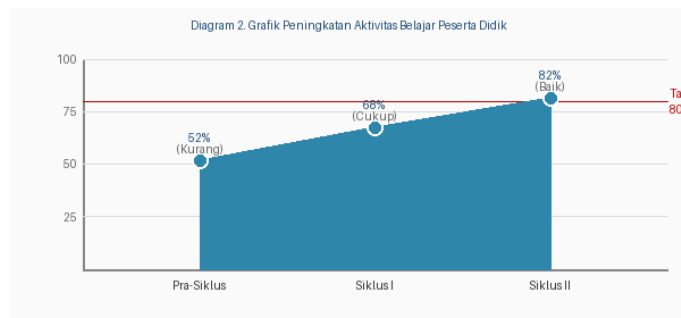


Figure 2.

Student Learning Activity Improvement Across Research Phases

Discussion

The findings of this study demonstrate that the implementation of the Problem Based Learning (PBL) model successfully improved students' martial arts movement analysis skills in Class XI-8 of SMAN 2 Martapura. The improvement occurred consistently across all stages of the classroom action research. The class average score increased from 60.8 in the pre-cycle stage to 73.7 in Cycle I and reached 82.8 in Cycle II. Similarly, classical learning completeness improved substantially from 32.4% during the pre-cycle to 61.8% in Cycle I and finally 85.3% in Cycle II. These findings indicate that the intervention exceeded the predetermined success criterion requiring at least 80% of students to achieve the Learning Objective Achievement Criterion (KKTP) score of 80.

From a cognitive learning perspective, the improvement confirms that PBL is effective in facilitating higher-order thinking skills, particularly analytical abilities associated with the C4 level of Bloom's revised taxonomy. Analytical competence

requires students to identify movement components, compare technical variations, classify movement patterns, and evaluate the effectiveness of movement execution (Anderson & Krathwohl, 2016). According to Zainudin and Ubabuddin (2023), these cognitive processes are essential indicators of analytical thinking because they require learners to actively deconstruct information and reconstruct knowledge through logical reasoning. In the context of martial arts learning, students were encouraged to examine attack and defense techniques, identify movement errors, and formulate corrective solutions based on observed performance. Such activities directly correspond to analytical thinking processes and explain the significant improvement in cognitive achievement observed throughout the research cycles.

The effectiveness of PBL can be explained through constructivist learning theory, which emphasizes that knowledge is actively constructed through experience, interaction, and reflection rather than passively received from teachers (Hmelo-Silver, 2017; Savery, 2019). In conventional PJOK instruction, students often act merely as recipients of information, limiting opportunities to engage in critical analysis and independent problem-solving (Mustafa & Dwiyoogo, 2020). In contrast, the PBL model transforms students into active learners who investigate authentic problems and collaboratively develop solutions. This learning environment promotes deeper conceptual understanding because students become directly involved in meaning-making processes (Yew & Goh, 2016).

The five phases of PBL implemented in this study contributed significantly to the observed improvement. During the problem orientation stage, students were exposed to authentic martial arts movement problems that stimulated curiosity and cognitive engagement. Previous studies have demonstrated that authentic problem situations increase students' motivation to learn and encourage deeper exploration of subject matter (Liu et al., 2021; Fanany et al., 2024). During the organizing stage, students collaborated within groups to discuss movement analysis tasks, fostering communication and social interaction. Research indicates that collaborative learning enhances cognitive processing because students exchange ideas, challenge assumptions, and collectively construct knowledge (Harvey et al., 2019).

The investigation phase represented the core of the learning process. Students analyzed movement demonstrations, compared correct and incorrect techniques, and identified procedural errors. According to Casey and MacPhail (2018), inquiry-based activities such as observation and analysis facilitate the development of tactical understanding and movement comprehension in physical education settings. Similarly, Sungur and Tekkaya (2020) reported that problem investigation activities improve students' reasoning skills because learners must gather evidence, evaluate alternatives, and justify conclusions. These processes are particularly relevant in martial arts education, where movement effectiveness depends on technical precision and strategic decision-making.

The presentation and evaluation phases further strengthened students' analytical abilities. By presenting findings and defending their analyses before peers, students

engaged in reflective thinking and metacognitive regulation. Research by Prasetyo et al. (2023) and Rahman et al. (2024) demonstrates that reflective discussion activities enhance conceptual understanding because students are required to articulate reasoning and evaluate alternative perspectives. Consequently, the PBL process not only improved learning outcomes but also strengthened students' confidence in analyzing martial arts movements independently.

The findings of this study are consistent with numerous previous investigations. Naibaho et al. (2025) reported that the implementation of PBL in PJOK learning resulted in more than 85% classical completeness during Cycle II, indicating substantial improvements in cognitive and psychomotor learning outcomes. Similarly, Kelasim et al. (2025) documented an increase in student achievement from 75.8% in Cycle I to 85.6% in Cycle II at the senior secondary level. In the specific context of pencak silat instruction, Syayyadi et al. (2025) demonstrated that PBL increased learning completeness to 100% during the second cycle. The consistency of these findings suggests that PBL possesses strong potential to improve learning outcomes across diverse educational contexts and subject areas.

An important observation from this study is that the improvement achieved in Cycle II was substantially greater than that observed in Cycle I. This pattern supports the fundamental principle of Classroom Action Research, which emphasizes continuous improvement through reflection and revision (Susilo et al., 2022). Reflection conducted after Cycle I identified several weaknesses, including students' difficulties in interpreting movement analysis tasks and limited scaffolding support during group investigations. Consequently, modifications were introduced in Cycle II through the provision of illustrated movement analysis cards, revised student worksheets (LKPD), and more structured guidance from the teacher.

The significant improvement following these revisions confirms the importance of evidence-based reflection in maximizing the effectiveness of PBL implementation. Triviona et al. (2025) emphasized that the success of PBL depends heavily on the quality of problem design and the availability of instructional scaffolding. When learning tasks are sufficiently challenging yet appropriately supported, students are more likely to engage in meaningful problem-solving and analytical thinking. The findings of the present study strongly support this argument, demonstrating that improved instructional design contributed directly to higher learning achievement during Cycle II.

Another important finding concerns the simultaneous increase in student learning activity. Student participation improved from 52% during the pre-cycle stage to 68% in Cycle I and reached 82% in Cycle II. This improvement parallels the increase in learning outcomes and supports the constructivist assumption that active engagement is essential for meaningful learning (Vygotsky, 1978). Fanany et al. (2024) reported that PBL consistently increases student participation because learners become responsible for investigating problems and generating solutions. Similarly, Siregar et al. (2022) found that active learning environments foster greater motivation, concentration, and conceptual understanding among secondary school students.

The positive relationship between learning activity and cognitive achievement observed in this study aligns with previous findings in physical education research. Students who actively participated in discussions, observations, and movement analyses demonstrated stronger conceptual understanding than students who remained passive during learning activities (Suherman et al., 2021; Kurniawan & Hidayat, 2023). Therefore, the increase in learning activity can be considered one of the primary mechanisms through which PBL improved martial arts movement analysis skills.

Despite these positive findings, several limitations should be acknowledged. First, the study was conducted in only one class within a single school, limiting the generalizability of the results to broader educational contexts. Future studies involving larger samples and multiple schools are recommended to strengthen external validity. Second, although the research focused primarily on cognitive analysis skills, more comprehensive assessments integrating psychomotor and affective dimensions would provide a more holistic evaluation of martial arts learning outcomes. Third, external variables such as students' physical condition, prior martial arts experience, learning motivation, and availability of sports facilities could not be fully controlled during the intervention. These factors may have influenced learning performance and should be considered in future investigations.

Overall, the findings provide strong empirical evidence that Problem Based Learning constitutes an effective instructional approach for improving martial arts movement analysis skills in senior high school students. Through systematic problem-solving activities, collaborative investigation, reflective discussion, and continuous instructional refinement, PBL successfully promoted higher-order thinking skills, increased student participation, and enhanced learning achievement in accordance with the competency demands of the Merdeka Curriculum.

CONCLUSION

Based on the results of classroom action research conducted in two cycles in Class XI-8 SMAN 2 Martapura, it can be concluded: (1) The implementation of the Problem Based Learning (PBL) model was proven to progressively improve student learning activity from 52% (Poor) in the pre-cycle to 68% (Sufficient) in Cycle I and 82% (Good) in Cycle II, surpassing the established success indicator; and (2) The PBL model successfully improved students' martial arts movement analysis skills significantly, evidenced by the increase in class average from 60.8 (pre-cycle) to 82.8 (Cycle II) and classical completeness from 32.4% to 85.3%, exceeding the $\geq 80\%$ success indicator target.

Based on research findings, it is recommended that: (1) PJOK teachers implement the PBL model consistently by designing contextual authentic problems, LKPDs with stepwise analytical guidance, and visual media scaffolding for lower-ability students; (2) School administration facilitate PBL training and encourage CAR implementation as a data-driven instrument for improving learning quality; and (3) Future researchers expand

the research scope to more classes/schools and combine PBL with mobile-application-based movement video analysis technology to optimize learning effectiveness.

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