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HOLISTIC LEARNING IN PHYSICAL EDUCATION WITH PROJECT-BASED LEARNING: INSIGHTS FROM A STUDY ON BADMINTON TECHNIQUES

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ABSTRAC

Purpose. This study aimed to evaluate the effectiveness of the Project-Based Learning (PJBL) model in improving students' cognitive, affective, and psychomotor outcomes in badminton short-service techniques. The research objectives included analyzing how PJBL fosters holistic learning and enhances the mastery of technical skills in physical education.
Method. The study employed a Classroom Action Research (CAR) design conducted over two cycles, each consisting of three sessions. The participants were 36 students of class X VII at SMAN 9 Gowa. The learning process incorporated PJBL activities, including collaborative projects, group discussions, and practical assessments, to engage students actively. Data were collected using cognitive tests, affective observation sheets, and psychomotor performance assessments. The results were analyzed quantitatively to measure individual, classwide mastery and cycle-to-cycle improvements.
Result. The findings demonstrated significant improvements in students' learning outcomes. In the cognitive domain, students showed an increased understanding of short-service concepts, with the percentage of students meeting the Minimum Competency Criteria (KKM) rising from 72% in Cycle I to 89% in Cycle II. Affective outcomes, including teamwork, discipline, and confidence, improved from a "sufficient" to a "good" category. Psychomotor skills, particularly in executing short-service techniques, also progressed substantially, as evidenced by better body positioning, wrist control, and shuttlecock contact consistency.
Conclusion. PJBL proved a practical pedagogical approach for enhancing students' holistic development in physical education. The model's emphasis on collaboration, critical thinking, and real-world application contributed to substantial improvements across all learning domains. However, limited time and resource constraints require attention for broader implementation. This study highlights PJBL's potential to transform skill-based education and encourages further exploration in diverse contexts.

Keywords: *Project-Based Learning, badminton, short-service technique, cognitive learning, affective learning, psychomotor learning*

INTRODUCTION

Physical education is an integral part of the educational system aimed at developing physical fitness, motor skills, and character. Law Number 3 of 2005 underscores the importance of physical education in improving students' skills, health, and as a foundation for

holistic development (Joensuu et al., 2021; Mazzardo et al., 2024). Badminton is significant in physical education in Indonesia due to its international prominence and complex techniques requiring structured learning. Challenges in physical education often include low student motivation, limited infrastructure, and ineffective teaching methods (Nuzul et al., 2023). Research has shown that innovative teaching models, such as Project-Based Learning (PJBL), can address these issues by providing contextual and meaningful learning experiences (Anugraha & Padmadewi, 2023; Oktiarmi et al., 2023). In badminton, particularly short-service techniques, PJBL offers an approach that actively engages students, fosters critical thinking, and encourages collaboration, improving conceptual understanding and practical skills (Bafadal & Haetami, 2021).

Observations at SMAN 9 Gowa revealed suboptimal student performance in badminton short-service techniques. Out of 36 students in class X VII, only 47.22% achieved the Minimum Competency Criteria (KKM ≥ 75), while 52.78% fell below the standard. This issue stems from a limited understanding of short-service techniques, low student motivation, and teaching methods that do not actively involve students (Essiet et al., 2023). A proposed solution is to implement the Project-Based Learning (PJBL) model. PJBL is designed to offer student-centered learning experiences through authentic projects relevant to real-world contexts (Ernawati, 2023). In badminton short-service learning, PJBL enables students to identify problems, design solutions, and practice techniques, enhancing their conceptual and technical abilities (Awaluddin, 2023).

Research by (Oktiarmi et al., 2023) demonstrates that PJBL effectively improves scientific process skills and attitudes toward learning, making it applicable across disciplines. PJBL provides a structured learning model in physical education that encourages collaboration, creativity, and critical thinking (Bafadal & Haetami, 2021). In badminton education, PJBL can be applied through projects like creating video tutorials demonstrating short-service techniques. (Anugraha & Padmadewi, 2023) highlight that project-based approaches like this enhance technical skills while increasing student motivation to participate actively. Furthermore, (Widad, 2023) found that integrating PJBL with technology, such as digital tools, significantly improves student learning outcomes in other sports, such as Pencak Silat, indicating its potential in badminton. PJBL's advantages in improving cognitive, affective, and psychomotor domains are also supported by (Ernawati, 2023), who emphasized that the model enhances creative thinking abilities. In the context of badminton, students not only learn basic techniques but also develop analytical skills to identify errors and propose improvements.

(Miseliūnaitė, 2024) further highlights that active, experience-based learning models like PJBL enhance students' emotional engagement, a crucial aspect of affective development.

Previous research has established PJBL's success across various educational contexts, including science and sports. (Awaluddin, 2023) reported that PJBL improves athletic competencies through practical activities. Similarly, (Bafadal & Haetami, 2021) found significant improvements in physical education students' abilities to organize sports competitions using PJBL cycles. However, applying PJBL in badminton education, particularly short-service techniques, remains underexplored. While PJBL is proven effective in enhancing cognitive, affective, and psychomotor outcomes, challenges such as the lack of structured implementation guidelines and sufficient infrastructure persist (Untari & Padmadewi, 2023). Moreover, time constraints and the need to align PJBL with national curricula, including the KKM standards, present additional hurdles (Tarp et al., 2021). This study aims to address these gaps by exploring the implementation of PJBL in teaching badminton short-service techniques in high school settings.

This study aims to evaluate the effectiveness of the Project-Based Learning (PJBL) model in improving short-service learning outcomes among students in class X VII at SMAN 9 Gowa. The objectives include enhancing students' learning outcomes in cognitive, affective, and psychomotor domains through PJBL-based authentic projects. The novelty of this research lies in integrating PJBL with a specific badminton technique short service which has rarely been discussed in previous studies. This research examines how PJBL can holistically improve learning outcomes by involving students in collaborative, practical, and theoretical activities (Ernawati, 2023; Widad, 2023). Additionally, the study explores the use of technology in learning, such as video tutorials and technique analysis tools, to further enhance the learning process. The scope of the study encompasses two cycles of classroom action research, each consisting of three sessions. The research involves 36 students from class X VII at SMAN 9 Gowa, and data is collected through observations, practical tests, and documentation. This approach is expected to contribute to developing innovative teaching models and provide valuable recommendations for teachers seeking to improve school sports education quality.

METHOD

Study Participants

The study involved students from class X VII at SMAN 9 Gowa as research participants. A total of 36 students, 16 males, and 20 females, were selected based on initial observations. These revealed that many students struggled with badminton short-service techniques, with only 47.22% achieving the Minimum Competency Criteria (KKM ≥ 75), while 52.78% did

not meet the standard (Setyawan, 2020). The participants had varying levels of experience with badminton, and all were within the appropriate age for secondary education. They were briefed about the study's purpose and consented to participate in the research.

Research Procedure and Instrument

This study uses a Classroom Action Research (CAR) design implemented in two cycles, each consisting of three sessions. The selection of two cycles is based on standards in classroom action research, where gradual learning improvements can be observed in two main stages: the first to identify problems and test initial interventions, and the second to improve and optimize learning outcomes (Ernawati, 2023). In preliminary studies, two cycles are generally sufficient to show a consistent pattern of improvement in student understanding and skills (Awaluddin, 2023). In addition, time constraints in the academic calendar are a significant consideration in determining the number of cycles. Suppose that, at the end of the second cycle, considerable limitations are still found. In that case, reflections on the results of this study can be the basis for developing further studies with additional cycles or modified approaches.

The first cycle introduced the basic techniques of badminton short service using the Project-Based Learning (PJBL) approach, while the second cycle focused on refining skills and evaluating student performance. Each cycle followed four main stages: planning, implementation, observation, and reflection. PJBL-based instructional modules were designed in the planning stage, covering problem identification, project design, implementation, and evaluation (Ernawati, 2023). Learning tools such as rackets, shuttlecocks, nets, and digital devices for video presentations were prepared. Assessment instruments were developed to evaluate cognitive, affective, and psychomotor learning domains. During the implementation stage, students were divided into small groups to collaborate on projects, such as creating video tutorials demonstrating short-service techniques. These projects were presented to the class for feedback, with the teacher providing guidance. Observation focused on students' participation, group interaction, and mastery of techniques. Reflection was conducted at the end of each cycle, analyzing observational data to identify obstacles and successes, which informed improvements in subsequent cycles.

The study utilized three primary instruments to assess student performance. Cognitive learning was measured using a written test comprising five essay questions on short-service techniques, scored on a 0–4 scale (Oktiarmi et al., 2023). Sample questions included explaining the steps for executing a short service and identifying common errors in the technique. Affective learning was assessed using an observation sheet with five indicators:

discipline, responsibility, teamwork, respect for peers, and self-confidence (Miseliūnaitė, 2024). Psychomotor learning was evaluated through practical assessments of short-service techniques, focusing on initial stance, core movement, and follow-through (Azeez, 2024). Each instrument provided a detailed and structured method to comprehensively evaluate the effectiveness of the PJBL model in improving learning outcomes.

Table 1. Short Service Test Instrument

Phase	Indicator	Quality of Movement (Score: 1–4)
Initial Movement	1. Hand grip uses backhand grip, positioned straight or slightly angled. 2. Shuttlecock is held at waist height. 3. Body weight is evenly distributed on both feet. 4. The hand holding the racket is prepared to move backward, with the wrist flexed.	
Follow-Through	1. Shift body weight to the front part of the feet or toes. 2. Use minimal wrist movement, or none at all 3. Contact the shuttlecock at thigh height. 4. Push the shuttlecock so that it travels low over the net and as close to the net as possible.	
Final Stance	1. Finish the motion with the racket pointing upward in line with the trajectory of the shuttlecock. 2. Cross the racket over the front of the shoulder holding the racket. 3. Rotate the hips and shoulders, finishing with both hands raised. 4. Return to the ready position.	

Study Organization

The study was conducted at SMAN 9 Gowa during the first semester of the 2024/2025 academic year. Each cycle comprised three sessions, with each session lasting 120 minutes. The badminton court at the school served as the primary location for practical activities, and the necessary equipment, including rackets, shuttlecocks, and nets, was provided to support the learning process. The roles of the teacher and researcher were clearly defined to ensure adequate study implementation. The teacher acted as a facilitator, supervising and guiding students during the learning activities. At the same time, the researcher was responsible for designing instructional modules, facilitating project-based learning activities, and collecting data. Each cycle followed a structured sequence of activities. The first session focused on introducing the learning material and assigning group projects, allowing students to familiarize themselves with the objectives and tasks. The second session involved project presentations and practice sessions for badminton short-service techniques, where students

demonstrated their understanding and applied the skills. Finally, the third session evaluated and assessed the students' performance across cognitive, affective, and psychomotor domains. This organized approach ensured consistency in implementing the Project-Based Learning (PJBL) model while facilitating an effective learning environment for the students.

Statistical analysis

The data collected in this study were analyzed using a descriptive quantitative approach, which included calculating averages, percentages, and frequencies. The analysis focused on three primary aspects: individual competency, classwide competency, and cycle-to-cycle improvement. Individual competency was assessed to determine whether students met the Minimum Competency Criteria (KKM) of 75. A student's performance was considered successful if their average score reached or exceeded this threshold. Classwide competency was analyzed to evaluate the overall effectiveness of the Project-Based Learning (PJBL) model. This was achieved by determining the percentage of students who completed the KKM. Classwide competency was considered sufficient if ≥75% of students met the criteria. Finally, cycle-to-cycle improvement was analyzed to measure progress between Cycle I and Cycle II across cognitive, affective, and psychomotor domains. This comparison provided insights into the intervention's effectiveness and highlighted growth areas.

Table 2 Learning Mastery Criteria

Mastery Criteria	Category
≥ 75	Mastery Achieved
< 75	Not Achieved

RESULT

Before conducting classroom action research, the researcher conducted initial observations to determine the conditions in the class and provide actions that the researcher would give. The following is the initial data obtained by the researcher in class X VII SMAN 9 Gowa.

Table 3. Initial Data Description of Short-Service Learning Outcomes for Class X VII Students at SMAN 9 Gowa

Mastery Criteria	Category	Frequency	Percentage
≥ 75	Mastery Achieved	17	47.22%
< 75	Not Achieved	19	52.78%
Total		**36**	**100%**

This table reflects the initial data on students' learning outcomes in short-service badminton techniques, showing that 47.22% of students achieved the mastery criteria (KKM ≥ 75), while 52.78% did not meet the standard.

Table 2. Description of Learning Outcomes After Cycle I for Class X VII Students at SMAN 9 Gowa

Mastery Criteria	Category	Frequency	Percentage
≥ 75	Mastery Achieved	26	72%
< 75	Not Achieved	10	28%
Total		**36**	**100%**

This table reflects the learning achievement after cycle I, where 72% of students achieved the completion criteria (KKM ≥ 75), while 28% were still below standard. For more details, see the bar chart of percentage scores in cycle I below:

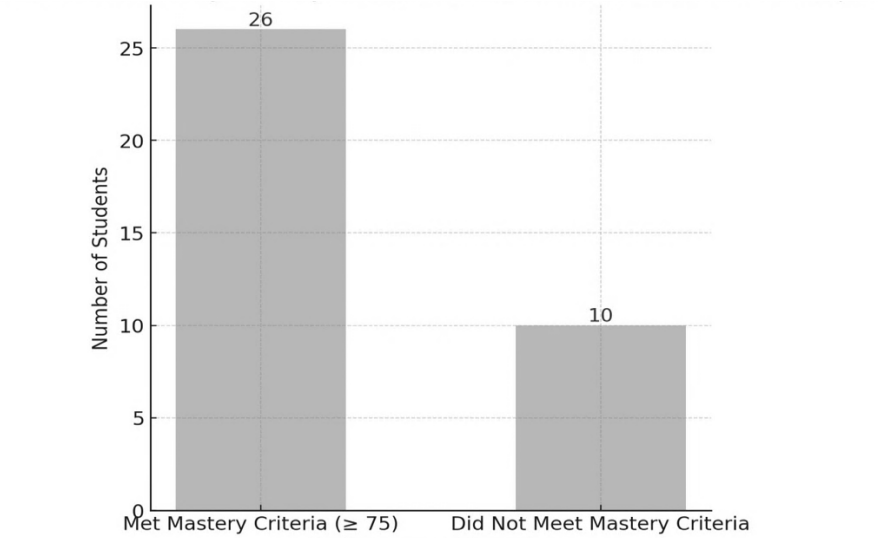

Figure 1. Bar chart of student learning outcomes in cycle I

Table 3. Description of Learning Outcomes After Cycle II for Class X VII Students at SMAN 9 Gowa

Mastery Criteria	Category	Frequency	Percentage
≥ 75	Mastery Achieved	32	89%
< 75	Not Achieved	4	11%
Total		**36**	**100%**

This table reflects the learning outcomes after the second cycle, where 89% of students achieved the mastery criteria (KKM ≥ 75), while only 11% remained below the standard. For more details, see the bar chart of percentage scores in cycle II below:

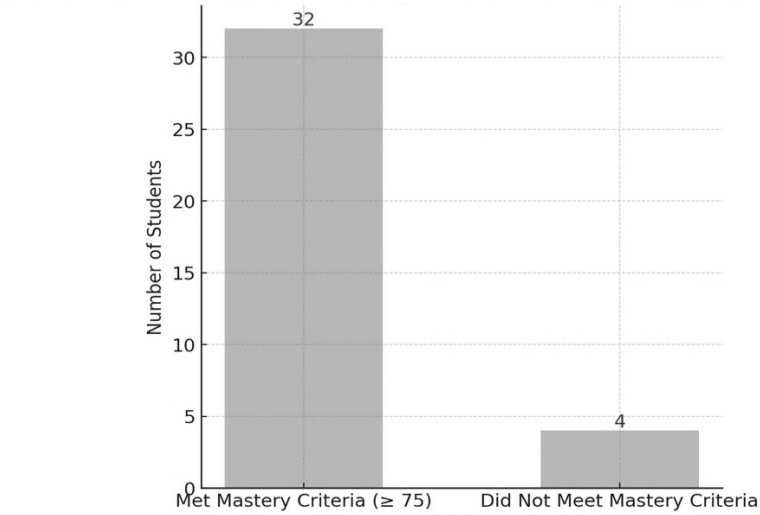

Figure 2. Bar chart of student learning outcomes in cycle II

DISCUSSION

The study aimed to evaluate the effectiveness of Project-Based Learning (PJBL) in enhancing cognitive, affective, and psychomotor outcomes in teaching badminton short-service techniques. The findings revealed significant improvements in students' understanding, attitudes, and motor skills across iterative cycles of PJBL implementation. These results emphasize the potential of PJBL to foster holistic student development by integrating real-world problem-solving and active participation into learning processes (Geng, 2023; Geng et al., 2023; Meng, 2021). The study also aligned with literature highlighting PJBL's ability to engage students dynamically, improve motivation, and enhance learning outcomes across disciplines (Fauziah, 2024; Pangesti, 2023).

The improvement in students' cognitive understanding of badminton short-service techniques reflects the success of PJBL in fostering deeper comprehension and knowledge retention. From Cycle I to Cycle II, there was a notable increase in students who could articulate theoretical concepts, identify errors, and explain corrective measures for short-service techniques. Cognitive strategies such as elaboration, organization, and active reflection played a crucial role in these improvements (Iqlima, 2023; Tahmina, 2023). For instance, students engaged in tasks like creating video tutorials, which allowed them to apply theoretical knowledge to practical scenarios. This finding aligns with (Azizan, 2023), who emphasized that technology-enhanced learning environments facilitate cognitive engagement and knowledge application. Additionally, metacognitive strategies, such as reflecting on learning processes, further supported students in assimilating complex concepts, enabling them to transfer their knowledge to real-world applications (Discipulo & Bautista, 2022; Yeo, 2024).

Significant enhancements were observed in students' affective domains, including discipline, teamwork, responsibility, and confidence. The collaborative nature of PJBL provided a platform for students to develop interpersonal skills and a sense of accountability toward group tasks. Students learned to manage their roles effectively by engaging in teamwork activities, contributing to their academic success and personal growth (Chianchana & Swangjang, 2022; Lin et al., 2023). Additionally, students exhibited increased self-confidence during project presentations, reflecting the role of PJBL in creating a supportive and inclusive learning environment. These outcomes align with findings by (Zalewski & Brudvig, 2022), who noted that teamwork fosters discipline and time management (Eddi, 2023), who highlighted the connection between collaborative problem-solving and confidence building. Integrating problem-based learning approaches further reinforced these outcomes, allowing students to navigate challenges collectively and develop critical affective skills essential for lifelong learning (Velasco et al., 2023).

The structured and iterative implementation of PJBL significantly enhanced students' motor skills, particularly in executing badminton short-service techniques. Improvements were evident in body positioning, wrist control, and shuttlecock contact, which were developed through consistent practice and direct feedback. The progression from Cycle I to Cycle II highlights the value of repeated drills and structured physical education programs in mastering technical skills (Setyawan et al., 2021). Game-based learning and manipulative activities further supported motor skill development by providing realistic contexts for practice (Dewi & Verawati, 2021; Sîrghi, 2022). Students also benefited from the integration of video tutorials, which allowed them to analyze their movements and make targeted adjustments. These findings are consistent with research emphasizing the importance of experiential and active learning in refining physical competencies and building confidence (Setyawan et al., 2021).

The analysis of learning outcomes across Cycle I and Cycle II demonstrated significant improvements in all measured domains. For instance, cognitive scores increased due to refined teaching strategies and more engaging learning activities. Affective outcomes also improved as students gained confidence and developed stronger teamwork skills. Psychomotor performance exhibited the most notable progress as students became more consistent and precise in executing short-service techniques. These findings are consistent with studies by (D. D. Putri, 2024; Syamsuriyanti, 2022), highlighting the importance of iterative cycles in refining teaching methods and enhancing student outcomes. The use of reflective practices after Cycle I informed the adjustments in Cycle II, leading to a more effective learning environment and higher achievement levels (Arifin et al., 2022).

The percentage of students achieving the KKM increased significantly between cycles. This upward trend highlights the effectiveness of PJBL in addressing learning gaps and supporting student mastery of essential competencies. Similar results have been observed in studies by (Rosfiani, 2024; Widyastuti, 2023), which reported improvements in student achievement after implementing iterative and collaborative learning approaches. The positive impact of PJBL on meeting the KKM can be attributed to its ability to engage students actively, promote critical thinking, and foster a sense of ownership over their learning. These findings align with research by (Putri & Nurkhamidah, 2023), who emphasized the role of collaborative learning models in enhancing student outcomes across diverse contexts.

The findings confirm the effectiveness of PJBL in promoting holistic student development across cognitive, affective, and psychomotor domains. By integrating real-world problem-solving and active engagement, PJBL encourages students to think critically, collaborate effectively, and apply their knowledge meaningfully (Marta, 2024). These benefits extend beyond skill acquisition, fostering attitudes and competencies essential for lifelong learning. In the cognitive domain, PJBL enhances understanding by emphasizing active exploration and application of knowledge. In the affective domain, it promotes emotional engagement, motivation, and teamwork. The psychomotor domain provides hands-on experiences that refine technical skills (Rahim, 2024). These findings are consistent with literature emphasizing the versatility and impact of PJBL across educational contexts (Doni, 2023; Khusna et al., 2022).

Applying PJBL in physical education offers practical benefits that extend beyond the classroom. By fostering critical thinking, collaboration, and problem-solving skills, PJBL prepares students for real-world challenges. These attributes are particularly valuable in sports education, where teamwork and strategic thinking are critical for success (Arya, 2023; Fuldiaratman, 2023). Moreover, PJBL can be adapted to various sports and skills, allowing educators to tailor learning activities to specific objectives and student needs. Using digital tools and technology further enhances the effectiveness of PJBL by facilitating collaboration and enabling students to engage dynamically with content (Harizon, 2023).

Despite its effectiveness, implementing PJBL poses challenges, including limited teacher training and resource availability. Teachers may struggle to design and execute projects effectively, particularly in resource-constrained environments (Rati & Rediani, 2021). Additionally, traditional teacher-dominated schedules can restrict opportunities for collaborative learning, detracting from the benefits of PJBL (Alkautsar, 2023). To address these challenges, comprehensive professional development programs must equip teachers with

the skills to facilitate PJBL. Integrating technology into PJBL can also streamline project management and enhance student engagement (Yasa, 2023). Continuous evaluation and feedback mechanisms should be implemented to monitor the effectiveness of PJBL and guide necessary adjustments (Sartika et al., 2022).

The results of this study have broad implications for physical education teachers, especially in implementing Project-Based Learning (PJBL) in other sports skills and its implementation strategies in schools with limited resources. The PJBL model can be applied not only to badminton learning but also to various sports. For example, in soccer, PJBL can be used to improve understanding of game tactics by asking students to analyze matches, design team strategies, and create video tutorials on basic techniques such as passing and shooting. In basketball, students can work collaboratively to analyze biomechanical factors that affect free throw accuracy and conduct match simulations to understand the implementation of strategies in more depth. Meanwhile, in swimming learning, students can document their swimming techniques through video recordings and use simple software to analyze the movement's effectiveness. In addition, in athletics such as sprinting and long jump, PJBL can be applied by comparing various starting techniques and conducting simple experiments related to the impact of dynamic warm-ups on sprint speed.

For schools with limited facilities and resources, the PJBL implementation strategy can be adjusted to continue to provide maximum benefits. Teachers can utilize available facilities, such as using limited fields by implementing theoretical game strategy simulations before direct practice. Students can be directed to compile simple exercise modules or conduct technical analysis in pairs based on direct observation if there is limited sports equipment. In addition, project documentation and presentations do not have to use sophisticated video recording devices. If mobile phones are unavailable to all students, they can create manual illustrations, infographics, or live simulations in the classroom as alternative project visualizations. Teachers can also utilize community-based learning, for example, by collaborating with local sports clubs and inviting professional coaches or experienced alums to share insights in project-based learning sessions.

Evaluation in PJBL can also be adjusted based on the available resources. If it is not possible to use movement analysis software, teachers can apply a simple observation rubric to evaluate the development of student skills. Students can also assess each other through peer assessment, observing and evaluating their friends' techniques based on predetermined parameters. This strategy helps overcome the limitations of measuring instruments and improves students' reflective understanding of the skills they are learning. Thus, implementing

PJBL in physical education can provide a more contextual, interactive, and reflection-based learning experience despite the limited resources in schools. In addition to improving students' technical skills, this approach also develops critical thinking, teamwork, and reflection skills, which are relevant in sports and everyday life. Therefore, this study encourages physical education teachers to adopt PJBL more widely by adjusting its implementation methods to remain effective in various learning conditions.

CONCLUSIONS

This study demonstrates the effectiveness of the Project-Based Learning (PJBL) model in enhancing students' learning outcomes in badminton short-service techniques across cognitive, affective, and psychomotor domains. The iterative implementation of PJBL led to substantial improvements in students' understanding of short-service techniques, attitudes toward learning, and motor skills. The findings revealed that the percentage of students achieving the Minimum Competency Criteria (KKM) increased from 72% in Cycle I to 89% in Cycle II, highlighting the significant impact of this innovative teaching approach. PJBL fosters active engagement, collaboration, and critical thinking, making it a versatile tool for holistic education. The model allowed students to apply theoretical knowledge in practical contexts, improving their cognitive comprehension and technical proficiency. Furthermore, the collaborative nature of PJBL enhanced students' teamwork, discipline, and confidence, contributing to their overall personal and social development. Despite its success, the study also identified challenges, such as adequate teacher training and time allocation for project-based activities. Addressing these challenges through targeted professional development and resource allocation can further optimize the implementation of PJBL in future educational contexts. Overall, this research highlights the potential of PJBL to transform teaching and learning practices in physical education. By promoting holistic development and real-world readiness, PJBL emerges as an effective strategy to improve student outcomes, particularly in skill-based learning environments. Future studies could explore its application in other sports and disciplines, ensuring broader adoption and refinement of this pedagogical approach.

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