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Improving Learning Outcomes in Physical Fitness Materials through Project-Based Learning (PJBL) Models

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ABSTRACT

This study was motivated by the low learning outcomes of Class X K students at SMA Negeri 1 Pontianak in physical fitness materials, which reflected limited cognitive understanding, insufficient psychomotor performance, and minimal active engagement. Grounded in constructivist learning theory and student-centered pedagogy, this research aimed to examine the effectiveness of the Project-Based Learning (PJBL) model in improving physical fitness learning outcomes. The study employed a Classroom Action Research (CAR) design conducted in two cycles involving 36 students. Each cycle consisted of planning, action, observation, and reflection stages to systematically refine instructional practices. Data were collected through written tests to assess cognitive achievement and structured observation sheets to evaluate psychomotor skills and student engagement. The success criteria referred to the Learning Objective Achievement Criteria (KKTP) score of ≥78 with a minimum classical mastery target of 90%. The findings demonstrated a substantial and progressive improvement across cycles. Classical mastery increased from 25% (9 students) in the pre-cycle phase to 63.89% (23 students) in Cycle I, and reached 100% (36 students) in Cycle II. These results empirically confirm that the PJBL model effectively enhances integrated learning domains in physical fitness education by promoting active participation, collaborative inquiry, and authentic task engagement.

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INTRODUCTION

Developments in the 21st century have fundamentally transformed the global education system. Education is no longer solely oriented toward knowledge transfer, but rather toward developing holistic competencies such as critical thinking, creativity, collaboration, communication, and complex problem-solving skills (OECD, 2019; World Economic Forum, 2020). This paradigm demands a fundamental shift in learning approaches, from teacher-centered models to student-centered learning. However, in the Indonesian context, structural and pedagogical challenges remain significant obstacles. Programme for International Student Assessment (PISA) data shows that Indonesian students' literacy achievements in reading, mathematics, and science remain below the OECD average, reflecting weak higher-order thinking skills (OECD, 2019).

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These low achievements are inextricably linked to the dominance of conventional, lecture- and memorization-based learning models still widely used in schools (Darling-Hammond et al., 2020). A one-way model tends to minimize active student participation, limit the exploration of ideas, and provide little space for authentic experiences (Hattie, 2017; Fullan, 2021). In the context of Physical Education, Sport, and Health (PJOK), similar issues occur. Learning is often instructionally mechanical, with students simply following movements without understanding physiological concepts, exercise principles, and their relevance to long-term health (Kirk, 2019; Casey & MacPhail, 2018).

This condition results in low intrinsic motivation and active engagement in physical activity (Deci & Ryan, 2020; Susanti et al., 2024). Yet, literature shows that cognitive and emotional engagement are strongly correlated with improved learning outcomes and the formation of healthy lifestyle habits (López-Carril et al., 2020; Sallis et al., 2018). Specifically, in physical fitness, learning is often limited to physical testing and repetition of exercises without individualized planning. As a result, students lack a deep understanding of how to design exercise programs tailored to their physical conditions.

Based on initial observations at Pontianak State Senior High School 1, it was found that student learning outcomes in physical fitness were still below the minimum completion standard. Low scores not only indicate weak cognitive aspects, but also a lack of conceptual understanding and critical reflection on the benefits of fitness as part of a healthy lifestyle. This situation emphasizes the gap between the demands of 21st-century education and learning practices in the field.

In response to the demands of 21st-century competencies, various innovative learning models have been developed, one of which is Project-Based Learning (PJBL). Conceptually, PJBL is rooted in constructivist theory, which emphasizes that knowledge is built through authentic experiences and active reflection (Bell, 2010; Thomas, 2017). PJBL positions students as active learning subjects in designing, implementing, and evaluating meaningful projects (Darling-Hammond & Oakes, 2021).

Meta-analytic research shows that PJBL significantly improves conceptual understanding, critical thinking skills, and long-term retention compared to traditional learning (Chen & Yang, 2019; Condliffe et al., 2017). In the context of physical education, PJBL enables the integration of cognitive, affective, and psychomotor dimensions through the design of physical activity-based projects (Casey et al., 2021).

Empirically, Utami et al. (2021) found that PJBL significantly improved students' coordination and agility compared to conventional methods. Ahwan et al. (2023) reported improved collaboration skills and social responsibility through group fitness projects. Studies by Febriyanti et al. (2024) and Sakinah et al. (2023) demonstrated that PJBL encourages students' creativity in designing innovative and individualized exercise variations.

Furthermore, Siregar et al. (2025) revealed that the application of PJBL to physical fitness materials increased students' emotional engagement and self-awareness of the importance of physical activity. Anggraini and Wulandari (2020) added that PJBL can foster self-regulated learning in physical education. Globally, a study by Harris and Jones

(2020) confirmed that project-based learning in physical education improves students' leadership and problem-solving.

Within the framework of physical fitness, PJBL enables students to transform from mere exercise participants to fitness program designers. This model aligns with the health literacy approach, which emphasizes individual abilities to understand, evaluate, and apply health information (Nutbeam, 2019). Thus, PJBL not only improves technical learning outcomes but also builds sustainable health literacy.

Although numerous studies have demonstrated the effectiveness of PJBL, several significant research gaps remain. First, most studies focus on improving motor skills or collaboration in general, but have not specifically explored the impact of PJBL on improving comprehensive physical fitness learning outcomes (cognitive, affective, and psychomotor) at the high school level.

Second, previous research has tended to be conducted in elementary or junior high school contexts (Utami et al., 2021; Febriyanti et al., 2024), thus limiting generalizability to high school students. High school students are in the formal-operational cognitive development phase, which allows for exploration of more complex project designs (Santrock, 2018).

Third, there are not many studies that systematically integrate Project-Based Learning (PJBL) into physical fitness materials, focusing on designing training programs based on individual student needs. Global literature primarily discusses PJBL in the context of STEM or general education (Chen & Yang, 2019; Harris & Jones, 2020), while specific studies in physical education remain relatively limited and fragmented.

Fourth, there are no empirical studies specifically testing the effectiveness of PJBL in improving physical fitness learning outcomes at SMA Negeri 1 Pontianak. The local context has different social, cultural, and infrastructure characteristics, necessitating contextual research based on real-world needs.

Therefore, there is a gap between the theoretical potential of PJBL as an innovative learning model and its empirical implementation in physical fitness materials at the high school level. Based on this gap, this study aims to improve physical fitness learning outcomes through the implementation of the Project-Based Learning (PJBL) model for students at SMA Negeri 1 Pontianak. Specifically, this study evaluates the extent to which the PJBL intervention can improve cognitive (understanding of exercise concepts), affective (motivation and health awareness), and psychomotor (practical fitness skills).

The novelty of this study lies in: (1) The integration of PJBL into the design of a fitness program based on individual student needs, enabling students to act as fitness designers; (2) A comprehensive approach to three domains of learning outcomes in the context of high school physical fitness; (3) Contextualization of PJBL implementation in high schools in Pontianak, which enriches the national and international literature on innovations in PJOK pedagogy, and (4) Conceptual contributions to strengthening health literacy and self-regulated physical activity as part of 21st-century education.

Therefore, this study not only contributes empirically to improving learning outcomes but also strengthens the paradigm of competency-based PJOK learning and sustainable health literacy.

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METHODS

This study employed a Classroom Action Research (CAR) design based on the cyclical model of Kemmis and McTaggart, which emphasizes iterative improvement through planning, action, observation, and reflection. CAR is widely recognized as an effective approach for improving instructional practice in authentic classroom contexts (Mertler, 2017; Burns, 2019). In physical education, action research enables teachers to systematically refine pedagogical strategies while directly observing their impact on students' cognitive, affective, and psychomotor development (Casey et al., 2021; Harvey & Jarrett, 2018).

The study aimed to improve learning outcomes in physical fitness materials through the implementation of the Project-Based Learning (PJBL) model. PJBL is grounded in constructivist learning theory, emphasizing student-centered inquiry, authentic problem-solving, and collaborative project design (Darling-Hammond & Oakes, 2021; Thomas, 2017). Empirical evidence demonstrates that PJBL significantly enhances higher-order thinking skills, motivation, and long-term knowledge retention compared to traditional instruction (Chen & Yang, 2019; Condliffe et al., 2017). In physical education settings, PJBL has been shown to improve engagement, responsibility, and self-regulated learning behaviors (Casey et al., 2021; Siregar et al., 2025).

The research was conducted at SMA Negeri 1 Pontianak, located on Jalan Johan Idrus, Pontianak City. The participants were 36 students of Class X K, selected purposively based on preliminary observations indicating low achievement in physical fitness materials. Prior studies emphasize that targeted intervention in classes with identified learning gaps allows for measurable instructional improvement (Hattie, 2017; Fullan, 2021).

The research was implemented in two cycles, each consisting of four stages: planning, acting, observing, and reflecting. During the planning stage, the researcher developed PJBL-based lesson plans, project guidelines, cognitive test instruments, performance rubrics, and structured observation sheets. The instructional design followed the standard PJBL syntax: (1) posing essential questions, (2) designing project plans, (3) scheduling activities, (4) monitoring project progress, (5) assessing project outcomes, and (6) evaluating learning experiences (Yulianto et al., 2017). This structured sequence aligns with research indicating that clearly defined project phases improve learning coherence and accountability (Bell, 2010; Harris & Jones, 2020).

During implementation, students worked collaboratively to design and execute structured physical fitness programs tailored to identified health components (e.g., endurance, strength, flexibility). Such authentic task design supports experiential learning and promotes meaningful physical literacy (López-Carril et al., 2020; Kirk, 2019). The researcher acted as practitioner-teacher, while Mr. Rahmad Frasjoyo Pandi, S.Pd., served as collaborator-observer to ensure instructional fidelity and reduce observer bias.

Data collection included cognitive, psychomotor, and affective assessments. Cognitive achievement was measured through validated written tests assessing conceptual understanding of physical fitness principles. Psychomotor performance was

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evaluated using structured performance rubrics aligned with national curriculum standards. Affective engagement and collaborative skills were measured using observation sheets and behavioral indicators adapted from contemporary physical education assessment frameworks (Casey & MacPhail, 2018; Deci & Ryan, 2020).

Data were analyzed using descriptive statistical techniques to examine individual and classical mastery improvement across cycles. In accordance with the academic standards of SMA Negeri 1 Pontianak, the success indicator was defined as at least 90% of students achieving the Learning Objective Achievement Criteria (KKTP) score ≥ 78. This benchmark aligns with competency-based mastery learning principles emphasizing high collective achievement (Guskey, 2015; OECD, 2019).

RESULTS AND DISCUSSION

Result

This classroom action research was conducted at SMA Negeri 1 Pontianak in Class X K (36 students) to address the low learning outcomes in physical fitness materials. The implementation of the action was carried out in two cycles, where Cycle I consisted of two meetings and Cycle II consisted of one meeting. Overall, there was a significant increase in classical mastery from the Pre-cycle stage to Cycle II.

Table 1.
Recapitulation of Student Learning Outcomes Comparison Across Cycles

NO	Research Phase	Number of Students Passed	Mastery Percentage	Notes
1	Pre-cycle	9 Students	25%	Blow Mastery
2	Cycle I	23 Students	68,89%	Improved
3	Cycle II	36 Students	100%	Classical Mastery Achieved

In the Pre-cycle stage, only 25% of students achieved the Learning Objective Achievement Criteria (KKTP). Following the implementation of the Project-Based Learning (PJBL) model in Cycle I, the mastery rate increased to 63.89%. However, this result had not yet met the 90% classical target, necessitating a reflection to refine the instructional actions. In Cycle II, through intensive guidance and peer tutoring strategies, student learning mastery reached an optimal point of 100%.

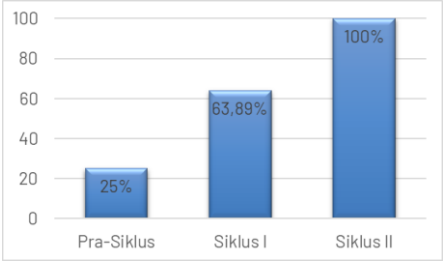

Figure 1.
Improvement of Learning Outcomes: Pre-cycle, Cycle I, and Cycle II

Discussion

The progressive improvement in learning outcomes from the pre-cycle phase to Cycle II provides strong empirical evidence of the effectiveness of the Project-Based

Learning (PJBL) model in transforming the instructional paradigm from teacher-centered to student-centered learning. The substantial increase culminating in 100% classical mastery reflects not merely procedural success but a fundamental pedagogical shift in how students construct knowledge and experience physical fitness learning. Contemporary educational research consistently emphasizes that student-centered approaches foster deeper conceptual understanding, autonomy, and long-term retention compared to traditional direct instruction models (Hattie, 2017; Darling-Hammond et al., 2020; OECD, 2019).

The effectiveness observed in this study is rooted in the core characteristics of PJBL, which emphasize authentic inquiry, collaborative problem-solving, and the production of meaningful learning artifacts (Thomas, 2017; Chen & Yang, 2019). Rather than passively following teacher demonstrations, students at SMA Negeri 1 Pontianak actively engaged in designing, implementing, and evaluating their own structured physical fitness programs. This aligns with constructivist theory, which posits that knowledge is best acquired when learners actively construct meaning through direct experience (Bell, 2010). In physical education contexts, such experiential engagement has been shown to significantly increase cognitive integration and motor performance (Casey et al., 2021; Kirk, 2019).

In the domain of physical fitness materials, the principle of "learning by doing" becomes particularly relevant. Physical fitness education is not limited to theoretical comprehension; it requires embodied practice and reflective awareness of bodily processes. Metzler (2017) argues that granting students autonomy in managing their practice enhances active motor engagement and skill acquisition. The present findings corroborate this view. Students performed push-ups, sit-ups, shuttle runs, and endurance tasks not simply to comply with teacher directives but to collect performance data for their project outputs. This transformation from task compliance to purposeful engagement illustrates authentic learning, where students perceive direct relevance between classroom activity and personal health benefits (Bender, 2017; Lund & Kirk, 2019).

Moreover, the integration of digital technology through exercise video production significantly enriched the learning experience. The use of video-based documentation encouraged students to critically analyze movement technique, posture alignment, and execution quality. Video-supported reflective practice has been shown to enhance metacognitive awareness and motor correction accuracy (Casey et al., 2019; López-Carril et al., 2020). When students observe and evaluate their own performances, they engage in deeper cognitive processing, leading to improved skill refinement. This process embodies 21st-century learning principles, particularly creativity, digital literacy, and self-directed evaluation (Fullan, 2021).

The significant increase from Cycle I to Cycle II (36.11% improvement to reach full mastery) indicates that the refinement of instructional strategies—particularly scaffolding and peer assessment—played a crucial role. Vygotskian social constructivism highlights the importance of scaffolding within the Zone of Proximal

Development (ZPD), where learners achieve higher competence through guided interaction (Santrock, 2018). In this study, heterogeneous grouping and peer tutoring enabled students who initially struggled with psychomotor tasks to receive immediate, context-sensitive support from classmates. Research in cooperative learning in physical education confirms that peer-supported environments reduce anxiety and increase movement confidence (Dyson & Casey, 2016; Harvey & Jarrett, 2018).

The integration of structured peer assessment further strengthened the intervention. According to Carless and Boud (2018), feedback literacy—the ability to interpret and apply evaluative information—is a critical component of effective learning. By requiring students to assess their peers' exercise videos using standardized rubrics, the study activated higher-order thinking processes. Students engaged in analytical comparison, criteria-based judgment, and reflective revision, thereby reinforcing self-regulation mechanisms (Panadero, 2017). Empirical findings suggest that formative peer assessment significantly enhances learning outcomes when students are trained to provide constructive, criteria-referenced feedback (Tai et al., 2018).

From a motivational perspective, the findings align with Self-Determination Theory (SDT), which emphasizes the importance of autonomy, competence, and relatedness in fostering intrinsic motivation (Ryan & Deci, 2020; 2024). PJBL provided autonomy through project design freedom, competence through mastery of physical skills, and relatedness through collaborative group work. Such alignment is known to increase sustained engagement in physical activity contexts (Deci & Ryan, 2020; Sallis et al., 2018). Students became more aware of their individual fitness levels and began linking physical performance outcomes to personal health goals. This shift from extrinsic compliance (performing tasks for grades) to intrinsic health awareness represents a meaningful transformation in physical literacy development (Kirk, 2019).

Importantly, the integration of cognitive, psychomotor, and affective domains was evident in the results. Unlike traditional physical fitness instruction, which often isolates physical testing from conceptual understanding, PJBL required students to understand training principles (frequency, intensity, time, and type), apply them in practice, and reflect on outcomes. Such holistic alignment supports competency-based education frameworks advocated in recent curriculum reforms (OECD, 2019; World Economic Forum, 2020). Studies in physical education consistently demonstrate that integrated domain assessment leads to stronger retention and behavioral transfer (Casey & MacPhail, 2018; Harris & Jones, 2020).

The transition from Cycle I to Cycle II also highlights the importance of iterative refinement inherent in Classroom Action Research. Reflection on initial barriers—particularly inconsistent technique execution and uneven participation—enabled targeted instructional adjustments. CAR frameworks emphasize that sustainable pedagogical improvement occurs through systematic cycles of evidence-based reflection (Mertler, 2017; Burns, 2019). The achievement of 100% classical mastery in Cycle II suggests that combining PJBL with structured scaffolding and formative evaluation can create optimal learning conditions in physical education settings.

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Furthermore, the findings contribute to growing evidence that PJBL enhances Higher Order Thinking Skills (HOTS). Students were required to analyze physical performance data, design exercise schedules, justify training choices, and evaluate outcomes. Such tasks extend beyond procedural execution and activate analytical, evaluative, and creative thinking processes (Sani, 2019; Chen & Yang, 2019). In the context of Indonesian education reform emphasizing HOTS development, these results are particularly relevant.

Holistically, the success of this intervention demonstrates that PJBL, when reinforced with technological integration, scaffolding strategies, and formative peer feedback, can effectively elevate learning outcomes across all domains in physical fitness education. The study confirms that innovative, student-centered pedagogical models are not merely theoretical ideals but practical solutions capable of addressing persistent learning gaps. The transformation observed at SMA Negeri 1 Pontianak illustrates how structured project-based approaches can cultivate physical competence, critical thinking, intrinsic motivation, and health literacy simultaneously.

In conclusion, the implementation of PJBL in physical fitness materials successfully realigned instructional practice with 21st-century educational principles. By empowering students as active designers of their own learning and physical development, the intervention not only improved measurable achievement but also fostered sustainable engagement with healthy lifestyle behaviors. These findings reinforce the strategic relevance of PJBL as a pedagogical model for advancing competency-based physical education in contemporary secondary schooling contexts.

CONCLUSION

This Classroom Action Research demonstrates that the implementation of the Project-Based Learning (PJBL) model effectively improves learning outcomes in physical fitness materials for Class X K students at SMA Negeri 1 Pontianak. Empirical findings reveal a substantial and progressive increase in classical mastery, rising from 25% in the pre-cycle phase to 63.89% in Cycle I and reaching 100% in Cycle II, thereby surpassing the predetermined success indicator of 90%. These results confirm that a structured, student-centered instructional approach can significantly enhance cognitive understanding, psychomotor performance, and affective engagement in physical education.

Conceptually, the success of PJBL lies in its alignment with constructivist and self-determination principles, positioning students as active designers of their own learning. The integration of digital technology through project-based exercise videos strengthened reflective practice and movement analysis, while scaffolding strategies and peer tutoring effectively reduced psychomotor learning barriers. Furthermore, peer assessment fostered feedback literacy, self-regulation, and critical awareness of performance standards.

Despite its effectiveness, the implementation required substantial instructional time and depended on access to digital devices, which may limit scalability. Nevertheless, PJBL offers a robust pedagogical alternative for competency-oriented physical fitness education.

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