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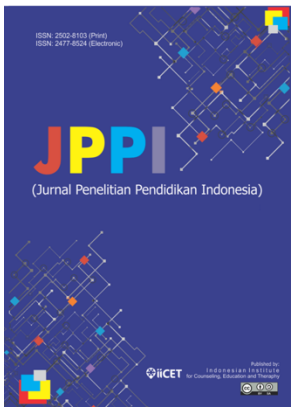

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Differentiated instruction, physical fitness, and motivation on PE learning outcomes: a literature review

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ABSTRACT

This systematic literature review examines how differentiated instruction, physical fitness, and learning motivation independently and interactively influence learning outcomes in physical education (PE). Drawing on peer-reviewed national and international studies published between 2018 and 2025, the review synthesizes evidence related to pedagogical practices, students' physical readiness, and motivational processes in school-based PE. The findings indicate that differentiated instruction consistently enhances engagement and learning readiness, although its direct effects on psychomotor outcomes, particularly at the secondary level, remain limited. Physical fitness shows a stable association with motor performance and participation, while autonomous motivation supports sustained effort and persistence. However, most studies examine these factors in isolation, offering limited insight into their combined effects. This review highlights a clear gap in integrative research and underscores the need for comprehensive instructional models that align pedagogical, physiological, and motivational dimensions to improve PE learning outcomes.

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Introduction

In physical education (PE), effective learning is increasingly understood as a multidimensional process that encompasses motor, cognitive, and affective development. Ideally, PE instruction should be inclusive, adaptive, and responsive to students' diverse characteristics, including differences in physical readiness, learning pace, and motivational orientation. However, many PE programs continue to rely on uniform instructional approaches that inadequately address learner variability, resulting in uneven learning outcomes and reduced engagement across student populations.

Differentiated instruction (DI) has emerged as a pedagogical framework aimed at addressing learner diversity by adapting content, processes, and learning environments based on students' readiness, interests, and learning profiles (Gheyssens et al., 2020; Smale-Jacobse et al., 2019; Matiyenga & Ajani,

2024; Ituma, 2025). While DI has been widely studied in general education contexts, its application in PE presents unique challenges due to the embodied, time-bound, and performance-oriented nature of motor learning. Existing PE research suggests that alignment between instructional design and learner characteristics can enhance engagement and conceptual understanding, yet evidence of DI's direct contribution to psychomotor outcomes remains inconsistent, particularly at higher grade levels (Cagongon & Occidental, 2022; Mcmillian, 2024; Mir, 2025).

Beyond pedagogy, physical fitness constitutes a foundational condition for effective PE learning. Cardiorespiratory endurance, muscular strength, and motor competence have been linked to attentional control, executive functioning, and persistence during physically demanding tasks, all of which are critical for skill acquisition in PE (Ventura et al., 2017; Martín-Rodríguez et al., 2025). Nevertheless, prior studies often treat fitness as an outcome rather than a prerequisite for learning, offering limited insight into how fitness disparities among students interact with instructional strategies during PE lessons.

Motivation represents a further dimension shaping students' engagement and learning behaviors in PE. Grounded largely in Self-Determination Theory, motivation research consistently shows that autonomy-supportive learning environments foster greater effort, persistence, and positive attitudes toward physical activity (Parker et al., 2020; Osei & Bjorklund, 2024; Siacor et al., 2024). However, motivational processes are frequently examined independently of instructional design and physical readiness, limiting understanding of how motivation functions as a mediator or moderator within complex PE learning systems.

Despite substantial research on DI, physical fitness, and motivation, existing studies predominantly investigate these variables in isolation. Systematic reviews on DI tend to prioritize academic subjects and rarely address psychomotor learning outcomes in PE (Smale-Jacobse et al., 2019; Hermoso et al., 2021; Adi, 2023). Similarly, research linking fitness to learning outcomes demonstrates methodological variability and provides limited explanation of how instructional contexts shape these relationships (Claver et al., 2020; Rodriguez et al., 2020). Motivation-focused studies emphasize engagement benefits but seldom examine how motivational support aligns with differentiated instructional practices in PE (Taylor & Macleod, 2024; Patzak & Zhang, 2025).

These limitations are particularly evident in the Indonesian context. Empirical studies indicate that many students exhibit low physical fitness levels and fluctuating motivation, contributing to inconsistent PE learning outcomes (Arif et al., 2021; Andika et al., 2023; Martono et al., 2024). At the same time, PE teachers face structural constraints such as limited instructional time, insufficient professional training, and restricted access to adaptive teaching resources (Stains & Vickrey, 2017; Gibbs, 2023; Z. Wang & Yang, 2025). Although the Merdeka Belajar curriculum emphasizes learner-centered instruction and individual readiness, practical guidance on integrating pedagogical differentiation with students' physical and motivational profiles remains limited (Hartono & Akhiruyanto, 2019).

In response to these gaps, this literature review aims to synthesize and critically examine evidence on differentiated instruction, physical fitness, and motivation in PE within a unified conceptual framework. By integrating findings from international and Indonesian studies, this review seeks to clarify how these pedagogical, physiological, and psychological factors interact to influence PE learning outcomes. Such a synthesis is timely given ongoing curriculum reforms emphasizing holistic and inclusive education (Bhardwaj et al., 2025), and it is intended to inform future research, instructional design, and policy development by advancing theoretically grounded and context-sensitive models of PE instruction.

Method

This study adopted a systematic literature review approach to synthesize empirical and theoretical research on differentiated instruction, physical fitness, motivation, and learning outcomes in physical education (PE). The review was guided by the general structure proposed by Snyder (2019), with adaptations to accommodate the characteristics of PE research, particularly its focus on psychomotor learning and school-based contexts. Literature searches were conducted in several international and

national academic databases, including peer-reviewed journals relevant to education and sport sciences. Studies published between 2018 and 2025 were considered to capture recent developments in pedagogy, fitness research, and motivational theory. Search terms were combined using Boolean operators and included variations of "differentiated instruction," "physical fitness," "motivation," "self-determination theory," and "physical education learning outcomes." Only studies published in English or Indonesian were included. The selection process was documented to enhance transparency, although no meta-analytic or statistical procedures were applied due to the qualitative-descriptive orientation of the review.

Inclusion criteria required that studies focused on school-aged populations (elementary to secondary level) and examined at least one of the three focal constructs in relation to PE learning outcomes using quantitative, qualitative, mixed-methods, or review designs. Studies outside formal PE settings or lacking sufficient methodological clarity were excluded. Screening was conducted in three stages title and abstract review, full-text assessment, and final eligibility determination based on relevance and methodological adequacy. Data were extracted using a structured coding framework capturing study characteristics, research design, sample context, variables, instruments, key findings, and reported limitations. The analysis followed a thematic synthesis procedure in which findings were first grouped into three thematic domains differentiated instruction, physical fitness, and motivation and then examined across domains to identify convergences, inconsistencies, and research gaps. Rather than evaluating effect sizes, the synthesis emphasized patterns of evidence and conceptual linkages, forming the basis for proposing an integrative perspective on PE learning.

Results and Discussions

Key Findings on Differentiated Instruction and Physical Fitness in Physical Education

The synthesis of reviewed literature reveals consistent patterns regarding the influence of differentiated instruction (DI) and physical fitness on student learning outcomes in physical education (PE). Both international and national studies report that DI enhances student engagement, conceptual understanding, and active participation in motor activities. However, empirical evidence directly linking DI to improvements in psychomotor performance remains limited, particularly in secondary education contexts in Indonesia.

Physical fitness emerges as a strong predictor of students' ability to maintain attention, process instructions effectively, and perform fundamental movement skills. Fitness disparities among students have been identified as a significant barrier to effective PE learning. These findings indicate that teachers' capacity to implement DI must be supported by systematic strategies to develop students' physical fitness. Overall, the literature underscores the importance of integrating pedagogical strategies with students' physical readiness.

Table 1. Summary of findings on differentiated instruction and physical fitness

Theme	Key Findings	Representative Studies
Differentiated Instruction	Increases engagement, conceptual understanding, and task adaptation; direct evidence for psychomotor outcomes remains limited.	Alafnan (2025); Smale-Jacobse et al. (2019); Y. Wang et al. (2020)
Physical Fitness	Strong predictor of motor performance and participation; fitness disparities hinder learning.	Anderson et al. (2021); Bahmani et al. (2018); Kal et al. (2018)

These findings suggest that while DI positively influences affective and participatory aspects of learning, its direct effect on motor skills varies depending on teacher readiness and resource availability. Physical fitness, by contrast, plays a stable and predictive role in motor performance, highlighting the challenge of accommodating students with lower fitness levels. Consequently, DI should be implemented alongside continuous efforts to improve students' physical fitness, addressing a clear research gap for models that explicitly consider physical readiness.

Key Findings on Learning Motivation and Integrated Models in Physical Education

The literature further shows that learning motivation, particularly autonomous motivation, strongly and consistently relates to PE learning outcomes. Students with intrinsic motivation or those supported by autonomy in instruction exhibit greater persistence, effort, and achievement in physical tasks. Motivation also often acts as a mediator between instructional quality and student performance. In Indonesia, however, students' motivation tends to fluctuate, influenced by limited instructional time and varying teacher competence.

Few studies examine DI, physical fitness, and motivation simultaneously. Most research investigates only two of these variables at a time, highlighting an urgent need for integrative PE learning models that combine pedagogical, physiological, and psychological dimensions.

Table 2. Summary of findings on motivation and integrative PE learning models

Theme	Key Findings	Representative Studies
Motivation in PE	Autonomous motivation enhances effort, participation, and achievement; mediates instructional quality.	Feng et al. (2019); Torbergsen & Karin (2023); J. Wang et al. (2022)
Integrative Models	Very few studies examine DI, fitness, and motivation simultaneously; most remain partial.	Andika et al. (2023); Reinboth et al. (2022); Sarstedt et al. (2022)

Motivation is thus a critical driver of student learning behaviors in PE, especially when students perceive autonomy, choice, and positive feedback. Contextual factors in Indonesia such as school facilities, learning culture, and perceptions of PE further shape motivation. The scarcity of integrative studies leaves the functional relationships among DI, fitness, and motivation largely unexplored. These findings highlight a gap between current research and holistic learning theories, which emphasize the need for alignment among physical readiness, pedagogical strategies, and psychological factors. This review identifies a clear research opportunity for developing comprehensive PE learning models.

This review confirms that differentiated instruction (DI) contributes positively to student engagement and learning readiness in physical education (PE), aligning with prior evidence that adaptive teaching supports inclusivity and cognitive involvement across diverse educational contexts (Jimoh et al., 2024; Ugalde et al., 2021; Yang, 2024). PE-specific studies further suggest that structured differentiation can enhance task understanding and learning processes (Moon, 2022; Tassignon et al., 2021). However, these benefits appear more consistent for affective and cognitive dimensions than for direct psychomotor outcomes, indicating that DI alone may be insufficient to drive motor skill improvement without supportive conditions.

Differences in DI effectiveness across educational levels warrant particular attention. Stronger psychomotor effects are more frequently reported in elementary PE than in secondary settings (Marmeleira et al., 2019; Santos et al., 2022; Yıldızer & Süleyman Munusturlar, 2021), likely reflecting developmental differences in motor plasticity, task complexity, and learner autonomy. At the secondary level, increased curricular demands and reduced instructional time may limit teachers' capacity to design and manage differentiated motor tasks, suggesting that the success of DI depends not only on pedagogical intent but also on contextual feasibility and teacher expertise.

Physical fitness emerged as a consistently strong correlate of motor learning and performance, reinforcing the view that PE learning is shaped by physiological readiness as well as instructional quality. Higher fitness levels are associated with improved motor competence, attentional regulation, and working memory, all of which support skill acquisition (Malambo et al., 2022; Zhang et al., 2022). While these associations are well documented, most studies remain correlational, limiting causal interpretation. Nevertheless, evidence that fitter adolescents demonstrate greater confidence, participation, and technical execution underscores the practical relevance of fitness as a condition that enables learning rather than merely an outcome of PE instruction (Burton et al., 2023; Filipe et al., 2025; Gómez et al., 2023; Meester et al., 2020).

Cross-national comparisons further highlight the contextual nature of fitness–learning relationships. In countries with structured school-based physical activity programs, fitness levels and learning outcomes tend to be more uniform (Bann et al., 2019; Castro-Sánchez et al., 2019; Mata et al.,

2021). In contrast, persistent fitness disparities in Indonesia reflect limited instructional time, uneven facility access, and inconsistent curriculum implementation. These structural factors shape how fitness influences learning and suggest that instructional planning in PE must explicitly account for students' physical readiness to avoid widening performance gaps.

Motivation, particularly autonomous motivation, consistently emerged as a central driver of learning behaviors in PE. Autonomy-supportive environments are linked to greater effort, engagement, and positive attitudes toward physical activity (Guo et al., 2025; Xia et al., 2025). Motivation also functions as a mediating mechanism through which teaching practices influence motor learning and longer-term physical literacy (Cairney et al., 2019; Quitério, 2018). However, the strength of this mediating role varies across contexts, and few studies specify the conditions under which motivational support may be constrained by time, assessment pressures, or cultural expectations.

In Indonesia, students' motivational profiles appear more variable than those reported in many European contexts, reflecting differences in school culture, curriculum priorities, and perceptions of PE as an academic subject (Abas et al., 2023; Hornstra et al., 2021; Lazarides et al., 2019). These findings caution against direct generalization of motivational models across cultural settings and highlight the need for context-sensitive instructional strategies that align autonomy support with local educational norms and resource conditions.

Taken together, the findings of this review support the argument that effective PE instruction requires an integrated approach in which differentiated instruction, physical fitness, and motivation are viewed as interdependent rather than parallel influences. While existing evidence largely supports this integration at a conceptual level, empirical studies explicitly modeling these interactions remain scarce. The primary contribution of this review lies in clarifying this gap and reinforcing the need for future research to move beyond isolated variables toward comprehensive, system-oriented models of PE learning that are theoretically grounded and contextually responsive.

Conclusions

This literature review concludes that differentiated instruction, physical fitness, and autonomous motivation each contribute essential yet distinct roles in shaping learning outcomes in physical education, and the integration of these components offers a more comprehensive understanding of student performance than examining them independently. The findings advance current knowledge by highlighting that differentiated instruction strengthens engagement and readiness, physical fitness enhances motor competence and learning capacity, and motivation functions as a psychological driver that sustains effort and participation; however, the review also reveals that very few studies investigate how these dimensions interact within a unified instructional framework. This study provides scientific justification for developing integrated pedagogical models that align instructional strategies with students' physical readiness and motivational needs, thereby offering practical implications for curriculum designers, teachers, and policymakers. The review also underscores the need for future research employing multivariate or mixed-method designs to examine how differentiated instruction, fitness interventions, and motivational supports can be combined to produce more equitable and effective PE learning environments. Furthermore, longitudinal or intervention-based studies are recommended to test whether integrated approaches yield sustained improvements in students' physical literacy and academic outcomes, especially in diverse school contexts.

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