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Artificial Intelligence in Physical Education: A Systematic Review of Personalized Learning, Assessment, and Performance Analytics

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ABSTRACT

The purpose of the study. This systematic review examines how artificial intelligence (AI) is applied to personalized learning, assessment, and performance analytics in physical education (PE) across K–12 and higher-education settings, with the aim of synthesizing empirical evidence, identifying patterns of implementation, and proposing evidence-based directions for future research and practice.

Materials and methods. A systematic review was conducted following the PRISMA 2020 guidelines. Seven electronic databases (Web of Science, Scopus, EBSCOhost, PubMed, ACM Digital Library, Taylor & Francis Online, and Wiley Online Library) were searched from January 2014 to December 2025, using a reproducible Boolean search string centered on "artificial intelligence," "machine learning," "physical education," and related terms. Inclusion criteria covered empirical studies (experimental, quasi-experimental, case studies, and mixed-methods) that reported AI applications in PE focusing on personalized instruction, automated assessment, or performance analytics. Two reviewers independently screened titles, abstracts, and full texts; extracted data; and appraised quality using the Mixed-Methods Appraisal Tool (MMAT).

Results. A total of 87 studies (from an initial pool of 2,945 records) met all inclusion criteria and were synthesized narratively. AI-based systems most commonly supported: (a) personalized learning through adaptive exercise plans and intelligent tutoring systems; (b) assessment via motion analysis and automated feedback mechanisms; and (c) performance analytics through wearable-driven dashboards and learning-analytics platforms. Overall, AI-enhanced PE was associated with improved student engagement, more accurate and objective assessment, and tailored motor-skill development. However, persistent concerns included data privacy vulnerabilities, algorithmic bias, and insufficient frameworks for teacher–AI collaboration.

Conclusions. AI holds substantial potential to transform PE into a more personalized, data-informed, and student-centered discipline, particularly in large-class and inclusive settings. Future research should prioritize longitudinal designs, standardized outcome measures, and robust ethical frameworks to ensure equitable and sustainable integration of AI in PE contexts.

Keywords: artificial intelligence; physical education; personalized learning; automated assessment; performance analytics; systematic review.

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INTRODUCTION

Physical education (PE) is increasingly recognized as a foundational contributor to physical literacy, health-related fitness, and lifelong physical activity patterns in students of all ages. As contemporary educational systems grapple with issues of differentiation, equity, and outcome accountability, there is a growing imperative to harness emerging technologies to optimize learning processes in PE (Martín-Rodríguez & Madrigal-Cerezo, 2025; Wang & Wang, 2024). In this context, artificial intelligence (AI) — encompassing machine learning, deep learning, natural language processing, and computer vision — has emerged as a transformative force with broad applicability across educational settings.

AI technologies such as intelligent tutoring systems (ITS), motion-capture analysis platforms, wearable biometric sensors, and generative AI-assisted dashboards are increasingly being explored to support more individualized, timely, and evidence-based

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