Integrating Ethical Standards in AI-Driven Physical Education: Challenges and Opportunities in School Settings

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How to Cite this Article:

Surender, D. V. (2026). Integrating Ethical Standards in AI-Driven Physical Education: Challenges and Opportunities in School Settings. International Journal of Creative and Open Research in Engineering and Management, 02(03). https://doi.org/10.55041/ijcope.v2i3.273

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Abstract

The use of Artificial Intelligence (AI) in school education is actively developing, especially physical education (PE), as wearable fitness trackers, AI-based performance analysis, individual training programs, and virtual coaches are already observed. Such innovations can be used to increase student engagement, facilitate individualized instruction and facilitate data-driven pedagogical practices. Nevertheless, the ethical issues of AI implementation in school PE are also quite substantial with such aspects as a risk to data privacy, an algorithmic bias, surveillance challenges, poor access and absence of informed consent. This paper looks into the ethical issues and the opportunities of AI-driven PE in schools. The study is conducted in descriptive research design that is based on the secondary data, analyzing the available literature, world frameworks, and usage of AI in education and sports. The paper also suggests the necessity of incorporating ethical principles, including transparency, accountability, fairness, inclusivity, etc., into AI implementation. The results point to the fact that AI has transformational potential, although it can only be successfully implemented with the help of good ethical governance, teacher readiness, and policy support. The research would help in creating a balanced model that would promote responsible, fair, and sustainable use of AI in school physical education.

Keywords: Artificial Intelligence (AI), Ethical Standards, Data Privacy, Algorithmic Bias, AI Ethics

Introduction

Artificial intelligence is an emerging phenomenon in the world of education, with harnessing machine learning, data analysis, and adaptive algorithms to customize learning, automate testing and scoring, and promote instructional activity being applicable especially to physical education, where the optimization of training and evaluation is difficult and can be complicated by other factors.<|human|>In physical education, AI is especially becoming an effective tool in areas such as 1) individualized coaching 2) real-time health monitoring with wearable fitness trackers 3) movement assessment with performance analytics 4) personalized training with video analysis tools, which are challenging

Although these opportunities exist, the introduction of AI in schools requires strong ethical principles to reduce the risks of data privacy breaches, biased algorithms that will increase inequities, excessive dependence on technology that reduces teacher authority, and security risks in the collection of biometric data of students (Hu et al., 2024; Tohănean et al., 2025).

Problem Statement

Although AI has the potential to transform PE, offering a non-discriminative, evidence-based practice, the lack of holistic ethical standards in educational institutions puts students into privacy jeopardy, promotes biases, and prevents the implementation of AI in a non-discriminatory manner, so there is an acute need to integrate standards ensuring both innovativeness and responsibility.

Objectives of the Study

1. To examine the conceptual foundations and applications of AI in PE within school environments.
2. To identify key ethical challenges and opportunities in AI-driven PE.
3. To propose a framework for embedding ethical standards in AI-PE implementations.
4. To evaluate the impact of ethical integration on teaching efficacy and student outcomes.

Research Questions

1. What are the primary applications and growth trends of AI technologies (e.g., fitness tracking, performance analytics) in school physical education?
2. What ethical challenges arise from AI use in PE, particularly regarding privacy, equity, and bias?
3. How can ethical standards be effectively integrated to address these challenges and maximize opportunities?
4. What is the perceived impact of ethically aligned AI on PE pedagogy and student engagement in schools?

Review of Literature

Overview of AI Applications in Education

Adaptive learning systems, intelligent tutoring systems, automated tests, and data analytics are artificial intelligence applications that have transformed education by providing personalized instruction and ensuring learning is maximized (Chembe et al., 2023, p. 32, Das and Das, 2023, p. 1, Gyo nyuer and Katona, 2025, p. 172 and Rawas, 2024, p.). 7) AI applications around the world are used to analyze student data and tailor content, interactive support with natural language processing, and predict performance, which allows making dynamic modifications to meet individual needs and engage at the primary, secondary, and higher levels of education (Chembe et al., 2023, p. 32).

AI in Physical Education: Global Perspectives

Wearable sensors to provide real-time biomechanics feedback, machine learning to make training programs more personalized, video analyzers, such as OpenPose, and predictive analytics to prevent injuries are some of the AI applications in physical education applications in the context of school settings (Dey, 2023, p. 9; Hu et al., 2024; Mănescu, 2025, p. 129; Tohănean et al., 2025, p.; Zhou et al., 2023 91) The research identifies the core trends of health tracking and performance optimization based on AI globally, but their application is region-specific, depending on access and infrastructure disparities (Zhou et al., 2023).

Ethical Concerns in AI

The use of AI in education and PE also causes significant ethical concerns, such as the abuse of privacy through the collection of biometric data, algorithmic biases that contribute to inequity, and the fact that too much surveillance reduces the human factor (Bodemer, 2023, p. 7; Dey, 2023, p. 9; Fragkaki et al., 2025, p. 9; Hong, 2024, p. 3269; Sabharwal et al., 2023, p. 6)These issues require precautions to guarantee autonomy, fairness, and to stop these problems such as academic misconduct or cognitive laziness (Hong, 2024, p. 3269).

Existing Ethical Frameworks

The use of ethical AI in education is directed by international frameworks. The Recommendation on the Ethics of AI issued by UNESCO focuses on principles that are human-centered, such as fairness, transparency, privacy, and accountability, and the tools of readiness assessment and impact evaluation can be adapted to schools (Chinta et al., 2024, p. 23; Hong, 2024, p. 3273; Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) In order to encourage the growth and prosperity of the area, the human rights, and protect against discrimination, the OECD AI Principles advocate the inclusion, the strength, and the human rights whereas the EU recommendations and the AI Act emphasize non-discrimination and the data protection (Hong, 2024, p. 3273).

Research Gaps

In spite of all these improvements, PE-specific ethical guidelines have not been sufficiently researched, and most of the existing studies concentrate on general education or high-level sports but not K-12 developments (Mănescu, 2025, p. 129; Zhou et al., 2023) There is a lack of empirical research on AI adaptation barriers in schools, with the majority of studies focusing on either general education or elite sports as opposed to K-12 development (Hu et al., 2024; Tohănean et al)

Theoretical Framework

Ethics in Education

Ethical theories offer theoretical frameworks on how the AI can be analyzed regarding its role in education, especially, physical education. Deontology sticks to the duty and rules principle and evaluates AI usage in terms of net benefits, e.g., how much better student engagement or learning are promoted through the use of an AI, against the harm, e.g., loss of privacy or bias of use (Bohick, 2018).<|human|>Deontology is concerned with the development of moral character in teachers and learners and promotes such tools to produce autonomy and critical thinking over-reliance, e.g., loss of privacy or biases of use (Bohick, 2018

Technology Ethics Models

The principles of AI ethics, which are presented globally, implement the theory of ethics in the use of technology. Fairness provides fair treatment to reduce the bias in the algorithm, which might disfavor students based on socioeconomic status or demographics in PE performance analytics(Chinta et al., 2024, p. 23; Fragkaki et al., 2025, p.). 9) accountability requires the explicit responsibility of AI decisions, which may be audited and controlled by humans in schools (Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) Explicability of AI processes can be used to achieve transparency, allowing educators to make sense of the intelligibility of technology tools like video analysis in PE(Chinta et al., 2024, p. 23; Hong, 2024, p. 3269) The principles do not contradict UNESCO and OECD principles, which focus on human-centered design flexible to education(Marger et al., 2025, p. 4; Mouta et al., 2023, p.)

Application to AI in PE

In PE when these frameworks are applied to AI, there is an equal balance of integration strategies. Deontological ethics would suggest strict privacy measures of wearables and sensors in schools, as they would support the rights of the students (Dey, 2023; Zhou et al., 2023). Utilitarian ethics would encourage schools to train teachers to demonstrate ethical judgment, and transparent AI would help them to create more resilient students (Hu et al., 2024; Tohănean et al., 2025). Virtue ethics would support fairness in gamified PE settings, and transparent AI is the way to achieve it.

Artificial Intelligence in Physical Education

The idea of AI technologies is changing physical education because it allows monitoring and analysis of students at K-12 schools, as well as individualizing their activities. The main ones are fitness tracking apps and wearables, AI-based performance analysis, individual training programs, and virtual fitness coaches, which provide real-time feedback and adaptive training and coaching and fill the gap between elite sports and school settings (Dey, 2023, p. 9; Mănescu, 2025, p. 129; Zhou et al., 2023).

Fitness Tracking Apps and Wearable Devices

Physical activity, heart rate, and movement patterns are tracked in real-time by fitness tracking apps and wearable devices, including smartwatches, IMU sensors, and mobile apps like Strava or MyFitnessPal. Since they can be integrated into the school curriculum, these tools will encourage a significant level of student engagement and awareness of their health during PE classes, enabling them to become long-term physical activity solutions and aid in avoiding injuries by tracking fatigue (Dey, 2023, p. 9).

AI-Based Performance Assessment

AI-performance assessment applies to video analysis software (e.g., OpenPose, Dartfish) and machine learning to measure biomechanics, technique, and skill, and execution in PE activities. Such systems can provide objective, data-driven feedback on sports such as sprinting or jumping and outperform more traditional methods that rely on observation, while when adapted to school settings, they can be used to assess performances in a larger scale (Mănescu, 2025, p. 129; Tohănean et al., 2025; Zhou et al., 2023).

Individualized Training Programs

One-on-one training programs also utilize AI algorithms to process personal student data, such as fitness levels, progress, and preferences to create unique workout programs. Through working with large volumes of data, AI can help to optimize workloads towards endurance building or skill development, accommodating different abilities and eliminating disparities in access to coaching (Bodemer, 2023, p. 7; Dey, 2023, p. 9; Zhou et al., 2023) AI can be used to promote inclusive PE, which is also in line with evidence-based adaptations to K-12 students (Hu et al., 2024).

Virtual Coaching Systems

Virtual coaching systems make use of simulators and chatbots powered with AI to provide immersive, on-demand coaching to simulate scenarios to practice skills without actual coaches. Such platforms have adaptive feedback, gamification, and progress tracking, which improves motivation and autonomy in PE(Dey, 2023, p. 9; Tohănean et al., 2025) Future integrations can resolve the generalization problems in all sports, implying equal benefits in schools.

Ethical Challenges in AI-Driven PE

Data Privacy and Security

Wearables and fitness apps based on AI in PE are quite sensitive in collecting information about student health, such as heart rate, movement, and fatigue, so improper handling can cause data breach, unauthorized profiling, or non-educational use, like with intelligent sports devices such as smart wristbands that can expose physical fitness problems(Fragkaki et al., 2025, p. 9; Tohănean et al., 2025; Zhou et al., 2023) 6) Ethical theories emphasize the strong measures to ensure this information is secured in schools (Mouta et al., 2023, p. 25).

Algorithmic Bias

The wrong end result of the application of AI in the assessment of algorithmic biases of AI performance and personalized training can favor students according to body type, gender, demographics, or socioeconomic status, perpetrating inequalities in the assessment of biomechanics or skill execution (Bodemer, 2023, p. 7; Mănescu, 2025, p. 129). As an example, AI-based fairness audits and varied datasets can promote the fair use of AI in assessing biomechanics or skill execution ((Bodemer, 2023, p. 7).

Surveillance Concerns

Continuous surveillance during PE classes through sensors, IMUs, and video cameras creates the feeling of surveillance that can take away student autonomy and trust (Hong, 2024, p. 3269; Prazeres and Pina, 2024, p.). 6) Invasive surveillance of posture, activity, and health indicators becomes normalized, which reflects ethical concerns at large in the educational AI field because predictive systems control experiences(Fragkaki et al., 2025, p. 9; Zhou et al., 2023)

Equity and Access

Also, the digital divide leads to exacerbation of inequities since not every school can afford AI-based products such as virtual coaches or other sophisticated analytics, which further increase disparities in the quality and results of PE training (Bodemer, 2023, p. 7; Fragkaki et al., 2025, p.). 9) Policies should be inclusive in order to close this gap with the focus on fair allocation and the education of teachers (Mager et al., 2025, p. 4; Mouta et al., 2023, p. 25).

Informed Consent

The informed consent between students and parents is important but not accomplished during integration of AI-PE, as the awareness of the data usage in the apps or the assessment is also low (Fragkaki et al., 2025, p. 9; Prazeres and Pina, 2024, p.). 6) Lack of transparency on such risks as data sharing or AI decision-making leads to a loss of autonomy, and, therefore, clear policies that are consistent with UNESCO guidelines are required (Chinta et al., 2024, p. 23; Hong, 2024, p. 3269; Mouta et al., 2023, p. 25).

Opportunities of Ethical AI Integration

The application of AI in the physical-education field is grounded in transformational possibilities with the help of ethical principles like personalized learning and training, enhanced student interaction, early detection of health problems, and data-driven decision-making by teachers, as well as adaptive and inclusive physical-education programs (Dey, 2023, p. 9; Mănescu, 2025, p. 129; Zhou et al., 2023).

Personalized Learning and Training

AI can facilitate one-on-one education and training by studying the personal student data (e.g., fitness, progress, likes, etc.) to create a unique workout program. Machine learning algorithms can optimize workloads to achieve a goal, such as endurance or skill development, and consider a variety of abilities and minimize differences in coaching (Bodemer, 2023, p. 7; Dey, 2023, p. 9; Hu et al., 2024; Zhou et al., 2023).

Improved Student Engagement

Fitbit apps, wearable, and virtual coaching products enhance student motivation by providing real-time feedback, gamification, and simulations. Smartwatches and applications (e.g., Strava) track the activity and give instant feedback on such metrics as steps and posture, which motivates and encourages continued engagement in PE (Dey, 2023, p. 9; Tohănean et al., 2025; Zhou et al., 2023).

Early Identification of Health Issues

With wearables and AI sensors, health problems can be detected early as they monitor the heart rate, fatigue, movement patterns, and biomechanics in real-time. Such systems facilitate prevention of injuries and health tracking and notify of potential dangers before they become critical, as is the case with intelligent devices such as smart wristbands(Dey, 2023, p. 9; Hong, 2024, p. 3269; Zhou et al., 2023).

Data-Driven Decision Making for Teachers

AI can assist teachers in getting data-driven information by means of performance analysis, video software, and predictive algorithms, which can help them make objective judgments about student technique and progress. This is better than the traditional approach which can provide scalable feedback to large classes and can provide curriculum feedback(Mănescu, 2025, p. 129; Tohănean et al., 2025; Zhou et al., 2023).

Inclusive and Adaptive PE Programs

Inclusive and adaptive PE is reinforced by ethical AI, which will ensure that individual differences are considered, biases are reduced, and that PE is generalized between elite sports and school scenarios. Individual programs and equity audits will provide fair access to bridge digital gaps and student needs (Bodemer, 2023, p. 7; Chinta et al., 2024, p. 23; Hu et al., 2024; Mănescu, 2025, p. 129).

Professional Ethics and Practices.

This is the reason why AI in physical education requires ethical standards and guidelines to reduce risks and maximize benefits, and these guidelines are based on the key principles of transparency, accountability, fairness, privacy protection, and inclusivity (Chinta et al., 2024, p. 23; Mouta et al., 2023, p.). 25) These postulates backed by the functions of policymakers, schools, and educators are consistent with the international frameworks to facilitate responsible AI integration (Mager et al., 2025, p. 4).

Transparency

AI-PE systems should be transparent, which means that the algorithms are explainable, and the use of the data and other decisions is transparently disclosed (Chinta et al., 2024, p.). 23) This helps build trust, as black-box models can be interpreted and teachers and learners can learn about the recommendations on biomechanics or training(Zhou et al., 2023).

Accountability

Responsibility makes developers, educators, and institutions accountable to the outcomes of AI, such as inaccuracies in the analysis of performance or injury prediction (Mouta et al., 2023, p.). 25) Strong governance, including ethical impact assessments, will keep the stakeholders responsible to biases or misuse of data and encourage an active and constant monitoring (Mager et al., 2025, p. 4).

Fairness

Fairness also requires bias audits and mixed datasets to avoid discrimination when evaluating AI by reference to demographics (Bodemer, 2023, p. 7; Chinta et al., 2024, p.). 23) The algorithms and models should solve the problem of algorithmic inequities in video analysis or personalized training, which should ensure equitable assessments among student profiles (Fragkaki et al., 2025, p. 9; Gao, 2025)

Privacy Protection

Privacy protection entails safe processing of sensitive wearable and app data, protocols against leakage, protection of health records such as heart rate and fatigue levels (Prazeres and Pina, 2024, p. 6) Schools will be asked to minimize data collection and implement high levels of encryption (Fragkaki et al., 2025, p. 9).

Inclusivity

Inclusivity will encourage equitable access to AI technology to overcome digital disparities by introducing adaptive programs to various capabilities (Hu et al., 2024; Mănescu, 2025, p. 129) To be able to generalize elite sports AI to PE in schools, it is necessary to take fair measures to support all students, irrespective of their social economic status (Bodemer, 2023, p. 7; Chinta et al., 2024, p. 23).

Role of Policymakers, Schools, and Educators

Such regulations as readiness tests should be enacted by the policymakers; schools offer infrastructure and training; teachers combine AI ethically and under human control(Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) The collaborative approach guarantees the AI literacy of teachers and student-centered approach (Dey, 2023, p. 9; Zhou et al., 2023).

Alignment with International Guidelines

These are the same principles mentioned in the ethics recommendations of the UNESCO, such as transparency, fairness, and inclusiveness(Chinta et al., 2024, p. 23; Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) and EU AI standards on high-risk education systems and IEEE/OECD standards of responsible AI.(Chinta et al., 2024, p. 23).

Discussion

Balancing Innovation with Ethical Responsibility

The integration of AI in physical education is a two-sided sword, not only it offers new opportunities to train and engage on a personal level but also requires solid ethical protection due to the risk of bias, invasion, and inequity of high-risk educational application (UNESCO, 2020, ethics; EU, 2020, AI Act). 25) It is necessary that the developers and educators focus on the human control and use AI as the addition, not the replacement of pedagogical knowledge, which will bring about trust and eliminate the risk of data misuse through wearables (Fragkaki et al., 2025, p. 9; Prazeres and Pina, 2024, p. 6)

Implication on Indian and Global School Systems

Ethical AI systems such as the IEEE and OECD principles allow scalable PE improvements all over the world and encourage inclusiveness in various contexts(Chinta et al., 2024, p. 23; Mager et al., 2025, p.). 4) In the context of Indian school systems, where disparities in resources and large classes are basic features, AI provides the prospect of equity of access through low-cost wearables generalized on the basis of elite tools, although local policies concerning digital inequalities and cultural biases would be necessary to leverage the benefits and control risks such as surveillance in poorly-resourced conditions (Bodemer, 2023, p. 7; Hu et al., 2024; Mănescu, 2025, p. 129).

Recommendations

Develop School-Level AI Ethical Policies

UNESCO suggests that schools should create local AI ethical policies with readiness assessments and ethical impact assessments, which should be implemented to assess AI readiness and physical education risks (Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) These policies should include the rules of transparent AI application, bias control, and on-going monitoring so that they meet international regulations, such as the EU AI Act of high-risk educational use (Chinta et al., 2024, p. 23).

Teacher Training in AI Ethics

Teachers will need thorough training on AI ethics, along with literacy, human control, and pedagogical implementation to overcome such issues as algorithmic biases and overtrust (Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) Programme must be focused on critical skills of AI age so that teachers can be able to scrutinize AI judgments, promote student-driven implementation, and hold them responsible in case of problems with performance analysis or feedback (Chinta et al., 2024, p. 23; Zhou et al., 2023).

Strong Data Protection Mechanisms

Enforce an effective data protection by collecting as little data as possible, encrypting, and ensuring protocols against breaches, especially when it comes to sensitive wearable information such as heart rate and fatigue(Fragkaki et al., 2025, p. 9; Hong, 2024, p. 3269; Prazeres and Pina, 2024, p.). 6) The AI-PE systems should have policies that promote informed consent, secure management, and regulation of unauthorized profiling and privacy risks (Chinta et al., 2024, p. 23; Dey, 2023, p. 9).

Inclusive AI Design for Diverse Learners

AI tools must have an inclusive design, including bias audits, heterogeneous datasets, and adaptability to overcome digital separations and provide assessments and accessibility to varied student classifications, socioeconomic backgrounds, and demographics (Bodemer, 2023, p. 7; Hu et al., 2024, p. 23; Mănescu, 2025, p. 129).

Government and Institutional Regulation

The authorities and organizations should implement policies to ensure ethical models, infrastructural investments, and joint supervision based on the IEEE, OECD, and UNESCO principles (Chinta et al., 2024, p. 23; Mager et al., 2025, p. 4; Mouta et al., 2023, p.). 25) In the case of such settings as Indian schools, the local policies that will cover the resource differences, cultural biases, and risks of surveillance will allow the integration of AI to be scalable and equitable (Bodemer, 2023, p. 7; Mănescu, 2025, p. 129).

Conclusion

Summary of Key Findings

The application of AI in physical education has brought groundbreaking possibilities such as individual training, real-time health metrics, and increased inclusivity, especially with wearables and adaptive technology. Nevertheless, issues like algorithmic biases, privacy threats posed by gathering and storing of data, digital inequalities, and teacher low AI literacy remain, particularly in unequal circumstances such as Indian schools. Such active solutions as ethical policies, teacher training, strong data protection, and inclusive design can help to exploit opportunities over the dangers to foster just and creative PE.

Importance of Ethical AI Integration in PE

Moral AI protects fairness, transparency, and human control, establishing trust without causing inequities and abuse. It guarantees the enhancement of pedagogy by AI, reduction of biases, and encouragement of diverse students, promoting sustainable development of world and local educational systems.

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