

Artificial Intelligence in Women's Physical Education: A Systematic Review of Student Engagement, Pedagogical Optimization, and Educational Equity

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Abstract: *Against the backdrop of accelerating digital transformation in education, this study critically examines the integration of Artificial Intelligence (AI) within women's physical education (PE) settings, with the overarching objectives of enhancing student engagement, refining pedagogical content, and advancing educational equity across gender lines. Employing a comprehensive and systematic literature review methodology, the study maps the current landscape of AI-driven educational innovations, investigating how personalized training systems, real-time motion recognition feedback, and sophisticated data analytics can be leveraged to address gender-specific learning needs, improve female students' PE experiences, and foster holistic physical and affective development. The synthesized evidence indicates that AI technologies significantly enhance teaching interactivity and learner autonomy, thereby boosting intrinsic motivation and cultivating sustainable physical literacy among female participants. Concurrently, however, the analysis unveils critical implementation challenges, including unequal access to technical infrastructure, heightened concerns over data privacy and security, and the latent risk of algorithmic bias that may inadvertently perpetuate rather than mitigate existing gender disparities. By systematically delineating both the transformative potential and the inherent limitations of AI applications in this domain, this study contributes a robust theoretical foundation and offers actionable practical guidance for policymakers, curriculum developers, and PE practitioners seeking to navigate the intelligent transformation of women's physical education in a globally connected and digitally mediated era.*

Keywords: Artificial intelligence; Women's physical education; Student engagement; Educational equity; Personalized training; Algorithmic bias; Digital transformation; Pedagogical innovation.

1. Introduction

Physical Education (PE) plays an irreplaceable role in promoting students' physical and mental health, shaping self-identity, and enhancing social participation. However, women have long faced structural inequalities in terms of participation, resource access, and teaching emphasis in PE courses. These disparities are often rooted in socio-cultural norms, gender stereotypes, and institutional neglect within the education system, marginalizing women in sports, limiting their athletic potential, and affecting their health and confidence.

Against the backdrop of rapid educational intelligence development, Artificial Intelligence (AI) technology offers new possibilities to break traditional gender barriers in PE. For instance, tools like motion capture, intelligent feedback systems, personalized training platforms, and data-driven analytics have achieved positive results in various educational settings, yet their application in women's PE remains limited, necessitating systematic research and practical exploration. Based on this, the study seeks to explore how AI can promote women's participation and growth in PE through personalized learning, dynamic feedback, and data-driven decision support. It also addresses ethical challenges brought by smart technologies, including algorithmic bias, privacy protection, and technological accessibility, emphasizing AI as a tool for fostering educational equity and inclusive transformation rather than a replacement solution.

This study aims to propose a sustainable and replicable strategic pathway, providing theoretical support and practical

guidance for deeper integration of AI technology into women's PE, contributing to broader goals of gender equality and educational fairness.

2. Literature Review

2.1 Gender Differences in Physical Education

In the current school physical education system, gender inequality remains significant, mainly reflected in four aspects: participation, teacher expectations, evaluation criteria, and curriculum design.

In terms of participation, gender stereotypes lead to the implicit exclusion of female students. A large number of studies have shown that in school physical education classes, female students have relatively fewer opportunities to receive positive feedback and encouragement when participating in sports activities. Manoj Ti (2021) [1] pointed out that physical education teachers in class are more inclined to encourage male students to participate in various competitive sports activities, while female students are often ignored or guided to participate in less competitive activities. Behind this phenomenon lies deeply - rooted gender stereotypes: men are considered naturally suitable for strength and competitive activities, while women should engage in "gentle" and "elegant" sports. This concept not only limits female students' opportunities for self - challenge but also suppresses their development potential in the sports field. For example, in some physical education classes, after the teacher announces "free activities", some female students often choose to watch or chat in the corners, showing obvious "self -

marginalization" behavior (Ding Yiliang, 2023) [2]. Although this phenomenon seemingly stems from students' choices, it actually reflects the implicit bias in teaching organization and cultural guidance.

Differences in teacher expectations also affect students' self-identity. Teachers' attitudes and expectations play a crucial role in shaping students' sense of sports identity. However, research has found that teachers generally have lower expectations for female students' athletic performance. This low expectation is not only manifested in the lack of positive evaluations for female students but also often appears as tolerance or neglect in teaching feedback. Ding Yiliang (2023) pointed out that during basketball classes, when boys miss a shot, teachers often provide timely guidance and encouragement, whereas when female students face the same situation, they are often "tacitly allowed" to fail, with teachers not intervening or even considering it "normal." Female students who remain in a low-expectation environment for a long time may gradually internalize this preset, forming a denial of their own athletic abilities, thereby reducing their motivation to participate and willingness to develop. Educational psychology research shows that teachers' positive expectations can effectively stimulate students' potential, whereas the opposite can inhibit the formation and development of students' self-confidence.

The irrationality of the evaluation system has exacerbated gender inequality. Currently, the evaluation criteria for physical education courses in primary and middle schools and colleges generally center around physical fitness indicators, such as speed, strength, and explosive power. These evaluation contents give male students an advantage at the physiological level. Although female students have obvious strengths in flexibility, coordination, rhythm, etc., they are often overlooked by the evaluation system. For example, in physical education exams, boys can easily score in events like the sprint and the shot put, while girls may perform outstandingly in events like rope skipping, yoga, and dance. However, these events are not included in the mainstream evaluation system. Wang Zhexiang (2025) [3] pointed out that the unified evaluation standard lacking gender sensitivity not only weakens the sense of achievement of female students but also subtly reinforces the social stereotype that "physical education 强者 are men" and forms a negative evaluation orientation for female students.

The design of course content also exhibits bias. Traditional physical education curriculum design tends to favor highly competitive and confrontational activities such as soccer, basketball, and track and field. While these activities have significant physical training value, they may not align with every female student's interests or physical characteristics. On the other hand, activities like dance, badminton, and rhythmic gymnastics are often marginalized, with fewer class hours or insufficient teaching resources. The inadequate gender compatibility in course offerings makes some female students feel a lack of identification and motivation to participate in physical education classes. This "implicit exclusion" may not be intentional but rather stems from a lack of diverse perspectives in curriculum development, failing to fully consider the actual needs and interest differences of students of different genders.

2.2 Artificial Intelligence in Education and Sports Training

With the rapid development of Artificial Intelligence (AI) technology, its application in the fields of education and sports training has deepened, showing broad prospects. AI technology offers irreplaceable advantages in enhancing teaching efficiency, optimizing training quality, and promoting individualized development.

In the field of education, artificial intelligence is reshaping the traditional education system. It plays an increasingly important role in promoting student engagement, improving assessment accuracy, and achieving personalized teaching (Barabási, 2002; Cindy He et al., 2023). First, enhancing student engagement. AI creates immersive learning environments for students through intelligent teaching systems, virtual reality (VR), and augmented reality (AR) technologies. For instance, AI-based learning platforms can analyze students' interests, learning preferences, and behavior patterns to deliver personalized learning resources and interactive tasks, thereby stimulating students' enthusiasm for active learning (Cindy He, Tianyu Wu, Letian Zhou, 2023) [4]. Additionally, VR/AR experiences make abstract knowledge more tangible, increasing learning enjoyment and engagement. Second, improving the scientific nature and accuracy of assessments. Traditional teaching evaluations often rely on paper-and-pencil tests, which have drawbacks such as long cycles, slow feedback, and strong subjectivity. AI technology can precisely identify learning bottlenecks and behavior patterns by multidimensional analysis of students' learning data (e.g., click-through rates, completion times, error types), providing teachers with data-driven decision support. Automated grading systems enable objective and fair homework correction and exam evaluation, significantly improving assessment efficiency (Cindy He et al., 2023). Third, achieving personalized teaching. AI provides personalized teaching plans and feedback based on students' knowledge graphs and learning paths, tailoring teaching to individual needs and enhancing learning outcomes (Cindy He et al., 2023).

In the field of sports training, artificial intelligence also shows great potential. Pose recognition technology, consisting of high-precision cameras and deep learning algorithms, can capture athletes' movements in real time, analyze and correct errors, such as optimizing technical movements in swimming training. Wearable sensors with multiple functions can collect physiological and motion data in real time, aiding in training analysis, fatigue prediction, and risk assessment, and scientifically formulating training plans. AI-driven real-time feedback systems dynamically evaluate athletes' posture, movement quality, and training intensity during exercise, providing instant prompts, such as offering technical improvement suggestions in weightlifting training, significantly enhancing training efficiency and precision (Shiqing Wei et al., 2021) [5].

2.3 Personalized Intelligent Sports Training Model

With the continuous advancement of artificial intelligence and sensor technology, Personalized Intelligent Sports Training

Models have gradually become a significant direction in physical education and professional training. This model integrates biomechanical recognition, machine learning analysis, and human-computer interaction systems to provide precise dynamic training paths and feedback.

In terms of intelligent recognition and the construction of personalized training paths, the model uses sensors and deep learning algorithms to accurately identify the biomechanical characteristics of individual athletes. For example, the "AI Coach" system proposed by Jianbo Wang et al. (2019) [6] can automatically recognize the trainer's movements, analyze performance, and provide correction and teaching suggestions. Meanwhile, based on an individual's athletic ability, status, and goals, the model automatically generates a suitable training path and can dynamically adjust it according to real-time feedback and physiological data, achieving precise training tailored to each individual.

Data-driven feedback and collaborative learning are its core advantages. Training data is collected through multiple terminals and analyzed and evaluated in real-time by AI algorithms to provide feedback on the correctness of actions, intensity matching, etc. For example, the AI-assisted table tennis training system developed by Kevin Ma (2020) [7] can provide error correction and advanced strategies. In addition, the model has the ability of collaborative learning, supporting interactions between trainees and coaches, peers, or virtual assistants. For example, the collaborative human-computer interaction training system proposed by Daniel Delgado Bellamy and Praminda Caleb-Solly (2019) [8] can provide dialogue feedback, build a personalized database, and offer optimization suggestions, breaking the isolation of traditional training and creating a training environment with multi-party participation.

3. Research Design

3.1 Research Objectives

This study explores the application and value of artificial intelligence in women's physical education from multiple dimensions. The specific objectives are: to evaluate the feasibility and effectiveness of integrating AI technology into women's sports training, providing references for educational practice; to analyze the mechanisms by which it enhances female students' participation, literacy, and learning happiness in sports, supporting the creation of a positive sports learning environment; to identify and mitigate the risk of reinforcing gender stereotypes in technology applications, ensuring data privacy and fair resource allocation, and promoting ethical development in education; and to propose forward-looking, actionable AI-empowered physical education development strategies from both practical and theoretical perspectives, aiding the intelligent transformation of university sports teaching.

3.2 Methodology

This study employs the methods of literature review and thematic analysis to ensure theoretical systematicity and diversity in research perspectives. By extensively collecting research literature from fields such as artificial intelligence in

education, physical education, women's sports development, and gender equality both domestically and internationally, a systematic review is conducted to establish a theoretical foundation and clarify the academic context. Thematic analysis is used to code and categorize the literature, identifying key themes, research trends, and logical gaps, summarizing influencing factors and interaction mechanisms, providing a basis for proposing research questions, constructing analytical frameworks, and defining research directions. This research design aims to bridge theory and practice, offering systematic insights and strategic references for empowering women's physical education through artificial intelligence.

4. Results Analysis

4.1 Significant Improvement in Teaching Effectiveness

Artificial intelligence technology significantly enhances the quality and efficiency of physical education teaching across dimensions such as teaching methods, student learning outcomes, and teacher instructional decision support.

In terms of teaching methods, on one hand, posture recognition systems and wearable heart rate monitoring devices play an important role. Teachers use these devices to monitor students' movements and physiological indicators in real time, adjusting teaching pace and exercise intensity accordingly, such as adjusting load based on heart rate during physical training and using posture recognition systems to check movement standards and assist in error correction teaching, effectively improving students' level of movement standardization. Research shows that these systems have clear advantages in enhancing students' movement standardization levels (Borman et al., 2022; Shi Yuzhuo & Ma Xiaoyun, 2024; Li Yuanbo, 2021) [9, 10, 11]. On the other hand, visualization feedback modules present students' movements via video or images, making it easier for students to compare with standard movements, enhancing their understanding of movement essentials and error correction efficiency, particularly benefiting groups with relatively weaker technical learning abilities. Students generally find this feedback more acceptable and motivating compared to traditional verbal guidance.

For female students' physical education learning, artificial intelligence has brought about positive impacts. Empirical studies show that in physical training courses incorporating AI systems, students' movement standardization rates increase by an average of 23%, and physical test scores improve by 15% (Borman et al., 2022; Shi Yuzhuo & Ma Xiaoyun, 2024), effectively enhancing motor skills and physical fitness levels. Meanwhile, the "visible progress" brought by visual feedback enhances students' motivation and sense of purpose, encouraging them to train more actively and improve participation and satisfaction in physical education courses.

In terms of comprehensive application advantages, artificial intelligence systems can optimize personalized teaching paths based on students' physical conditions, technical levels, and training goals to meet the needs of different students. The system also has real-time feedback and self-adjustment

mechanisms, allowing teachers to dynamically adjust teaching while students can self-regulate and engage in autonomous learning, forming an efficient and transparent teacher-student interaction loop. Additionally, the system collects and analyzes large amounts of training data, providing teachers with scientific and objective teaching decision-making support, helping them assess training load suitability and adjust teaching priorities, significantly improving the scientific nature and effectiveness of teaching.

4.2 Enhancement of Student Engagement and Learning Interest

Research shows that artificial intelligence technology significantly boosts students' active participation and sustained learning engagement in physical education, particularly in stimulating interest among female students.

In personalized goal setting and self-paced progress tracking, AI platforms can create tailored training plans and track progress, enabling students to set goals based on their own conditions and interests. Real-time data feedback allows them to monitor progress, enhancing motivation and a sense of achievement through "goal orientation + instant feedback." Additionally, gamified and task-based elements make training more engaging. Surveys indicate that 87% of female students found physical education courses more enriching as a result, and 80% were willing to exercise independently outside of class (Yang et al., 2020; Wang Ming, 2020) [12].

Differentiated instruction stimulates learning motivation among female students. Artificial intelligence generates personalized training paths based on students' physical fitness, skills, and preferences, avoiding the frustration caused by a "one-size-fits-all" approach. Through voice interaction and other methods, it provides coach-like companionship, enhancing their sense of presence and accomplishment in class and boosting participation enthusiasm.

In addition, AI empowers sports teaching with high flexibility and strong sustainability. Students can exercise by connecting to the platform via devices anytime, and 80% of students are willing to train independently after class, integrating sports learning into daily life and helping to cultivate exercise habits (Villegas-Ch et al., 2024) [13]. Artificial intelligence platforms expand learning scenarios and extend study time, forming a full-time learning loop and enhancing the overall effectiveness of physical education.

4.3 Improvement in Teaching Equity and Gender Awareness

Artificial intelligence technology enhances equity in physical education and gender awareness. It breaks the traditional teaching bias of being "male-centered" by using data-driven individual profiling and dynamic adjustments to match teaching content based on students' physical abilities, habits, and rhythms, avoiding teaching exclusion. Meanwhile, many AI platforms incorporate gender-friendly designs, such as displaying examples of diverse body types and maintaining gender balance in motivational voiceovers, enhancing female students' sense of identity and participation, promoting educational equity and gender equality.

4.4 Transformation of Teachers' Roles and Enhancement of Teaching Abilities

Artificial intelligence not only deeply empowers students' learning processes but also poses new requirements and directions for change in teachers' roles and teaching methods. With the assistance of AI technology, physical education teachers are gradually transitioning from traditional roles as "action demonstrators" and "training managers" to becoming "learning facilitators," "data analysts," and "individual supporters."

Firstly, the large amount of real-time data and learning analytics tools provided by intelligent platforms enable teachers to accurately grasp students' learning status and athletic performance, dynamically adjust teaching strategies based on data feedback, and enhance the scientific nature and relevance of classroom instruction. Teachers no longer need to repeatedly demonstrate actions, thus freeing up more time for personalized guidance and emotional support, effectively improving classroom efficiency.

Secondly, teachers can also utilize personalized resources recommended by AI systems to guide students in self-exploratory learning based on their interests and abilities, further stimulating students' initiative and creativity. For example, in Chen Hui et al.'s (2025) research on teacher transformation in the AI era, it was pointed out that the application of AI technology not only enhances teaching interactivity but also promotes teachers' comprehensive abilities in "resource integration, meticulous management, and precise intervention."

Interview results with teachers also indicate that the introduction of artificial intelligence has enhanced their professional capabilities in multiple dimensions such as "precise teaching," "performance evaluation," and "learning behavior analysis," becoming a new driving force for teacher professional development. This transformation not only improves the quality of physical education teaching but also promotes the paradigm shift of physical education from experience-driven to data-driven.

4.5 Existing Problems and Recommendations for Improvement

Although artificial intelligence technology has brought significant changes to women's physical education, there are still many challenges in practical applications that require systematic optimization to unleash its greater potential.

First, the human-computer interaction experience needs improvement. Some students, especially first-time users, face obvious operational barriers and "technological anxiety" when dealing with smart devices, reflecting the shortcomings of current AI platforms in interface design, operational convenience, and guidance mechanisms, making it difficult to meet the needs of users with different technical levels. In response, efforts should focus on optimizing interface interaction design by adopting intuitive and easy-to-understand operation interfaces and intelligent voice guidance to lower usage barriers and enhance system usability and user-friendliness.

Secondly, data privacy and security issues have become bottlenecks for development. In AI-driven physical education scenarios, the large-scale collection and analysis of sensitive data such as students' physiological indicators and movement trajectories have raised deep concerns among students and parents about privacy breaches. Current data management practices suffer from opaque terms and ambiguous authorization mechanisms, necessitating the establishment of robust ethical norms and privacy protection systems. It is recommended to introduce specific educational data management policies that clearly define data usage boundaries, storage periods, and access permissions to ensure that data processing is lawful, compliant, and transparent throughout.

Furthermore, regional disparities severely restrict technology adoption. Schools in remote and economically underdeveloped areas generally face shortages of smart devices, weak network infrastructure, and a lack of specialized technical talent, exacerbating the imbalance in urban and rural physical education resources. To address this, increased investment in information-based education for under-resourced areas is needed through fiscal subsidies, school-enterprise cooperation, and targeted talent cultivation initiatives to promote the application of AI technology in grassroots educational settings.

In response to the above issues, this study proposes an improved approach: First, strengthen teacher information literacy training through regular, specialized training programs to enhance physical education teachers' operational and application abilities with AI tools; Second, continuously optimize the user experience of intelligent systems with comprehensive human-centered upgrades from interface design, functionality layout to interaction methods; Third, improve the data security governance system by formulating specific regulations for data security in the education sector and clarifying the responsibilities and rights of all parties; Fourth, promote balanced development of regional educational resources, strengthen infrastructure construction in underdeveloped areas, narrow the urban-rural gap in AI educational applications, and help achieve a new ecosystem of inclusive, intelligent, and equitable physical education.

5. Discussion

Integrating AI technology into women's physical education provides a forward-looking path to enhance teaching inclusiveness, student engagement, and learning outcomes. Research findings indicate that AI tools can significantly promote personalized development in physical education, making teaching content more targeted and practical. Particularly in stimulating female students' interest in sports learning and improving skill levels, AI demonstrates unique advantages. With real-time feedback mechanisms and adaptive course designs, AI helps create a supportive, non-judgmental, and low-anxiety learning environment, thereby enhancing students' physical literacy, confidence, and physical initiative. This educational model not only addresses the often-neglected needs of female students in traditional physical education but also lays a positive foundation for their lifelong healthy development.

However, the study also points out that the effective implementation of AI in physical education requires high attention to contextual adaptability. Significant differences exist in educational culture, technological infrastructure, and teacher competence across different regions, which determines that AI tools are not "one-size-fits-all." Therefore, during the promotion process, dynamic adjustments must be made based on localized needs to ensure that the technology truly lands and produces expected benefits. Additionally, the role transformation of teachers in AI-assisted teaching cannot be overlooked—they are not only implementers of technology applications but also organizers of the learning process and interpreters of data feedback. Hence, systematic teacher training and continuous professional development support should be provided to enhance teachers' understanding and integration capabilities of AI technology.

It is worth noting that, despite the fact that artificial intelligence technology has enhanced the accessibility and engagement of education, it cannot, by itself, eradicate structural inequalities present within the educational field. For instance, issues like the implicit reproduction of gender stereotypes and uneven allocation of educational resources still need to be addressed through deeper systemic reforms. Therefore, artificial intelligence should be seen as a "booster" for promoting educational equity and gender equality, rather than an isolated solution. Only when integrated into a more systematic educational reform strategy can it achieve truly inclusive and sustainable development.

6. Conclusion

This study demonstrates that AI-enhanced physical education significantly improves student engagement, facilitates skill development, and enhances emotional investment, particularly showing positive educational empowerment effects among female students. Its personalized, data-driven characteristics make sports learning more scientific, precise, and equitable, helping to break down gender boundaries and participation barriers in traditional teaching, providing female students with broader opportunities for development in the sports domain.

However, the successful integration of artificial intelligence relies on systematic curriculum design, continuous enhancement of teachers' capabilities, and effective ethical safeguards. Only through collaborative efforts by policymakers, educators, and technology developers in building a diverse, inclusive, and sustainable educational ecosystem can the potential of AI technology be fully realized.

Looking ahead, as the intelligent transformation of educational systems accelerates, it is imperative to ensure these emerging technologies truly become tools for promoting educational equity, rather than catalysts for widening educational disparities. Future research should further conduct longitudinal tracking and cross-regional comparisons to explore the specific impacts of AI technology on female physical education across different social contexts and cultural environments, while also fostering interdisciplinary collaboration to broaden research perspectives, providing theoretical support and practical solutions for a fairer and

smarter educational future.

References

- [1] Manoj ti. (2021). Gender differences in physical education conceptual knowledge on physical education teacher education (PETE) students.
- [2] Yiliang Ding. (2023). Timely encouragement to stimulate students' potential. *Second Classroom (D)*, Issue 11, 2023.
- [3] Zhexiang Wang, Nanchang University, 330038. (2025). Analysis of gender differences in college physical education and optimization of teaching strategies. *New Wave* (02).
- [4] Cindy He, Tianyu Wu, Letian Zhou. (2023). Methods and applications of artificial intelligence in education. *Applied and Computational Engineering*.
- [5] Shiqing Wei, Puquan Huang, Rui Li, Zhiguo Liu, Yuepei Zou. (2021). Exploring the Application of Artificial Intelligence in Sports Training: A Case Study Approach. *Complexity*.
- [6] Jianbo Wang, Kai Qiu, Houwen Peng, Jianlong Fu, Jianke Zhu. (2019). AI Coach: Deep Human Pose Estimation and Analysis for Personalized Athletic Training Assistance. *Proceedings of the 27th ACM International Conference on Multimedia*.
- [7] Kevin Ma. (2020). Artificial Intelligence Aided Training in Ping Pong Sport Education.
- [8] Daniel Delgado Bellamy, Praminda Caleb-Solly. (2019). Collaborative HRI and Machine Learning to Build Personalized Physical Exercise Databases.
- [9] J. Borman, D. Ed, Tammi Kolski. (2022). Benefits of Video Feedback on Low Performing Female Cadets in Physical Education: An Action Research Study.
- [10] Shi Yuzhuo, Ma Xiaoyun. (2024). Research on Optimization Paths of University Physical Education Based on Artificial Intelligence. *Contemporary Sports Technology* (17).
- [11] Li Yuanbo. (2021). Design and Practice of Artificial Intelligence in Physical Education Systems. *"Journal of Mechanical Design"* (6).
- [12] Wang Ming. (2020). Design of University Physical Education Curriculum Teaching System Based on Artificial Intelligence Technology.
- [13] William Villegas-Ch, Joselin García-Ortiz, Santiago Sánchez-Viteri. (2024). Application of Artificial Intelligence in Online Education: Influence of Student Participation on Academic Retention in Virtual Courses. *IEEE Access*.