

Physical Education Teaching Reform in the Era of Artificial Intelligence

Ruxu Zhang*

Beijing Sport University, Beijing 100091, China

**Author to whom correspondence should be addressed.*

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Abstract: With the rapid advancement of artificial intelligence and digital-intelligent technologies, physical education is undergoing an in-depth transformation from the traditional experience-oriented model to a data-driven smart model. The intervention of digital-intelligent technologies in physical education is not a simple accumulation of tools, but triggers systematic reforms covering teaching objectives, teaching procedures, teachers' roles and the educational ecosystem. Adopting the literature-research method, this study interprets the major values of digital-intelligent technologies for physical education from three dimensions: personalized instruction, precise assessment and full-process collaboration, and thoroughly reveals practical difficulties encountered in the current digital-intelligent transformation of physical education. Finally, it proposes coordinated promotion from three aspects: technology application, talent cultivation and institutional guarantee, so as to build a brand-new physical-education ecosystem empowered by technology and underpinned by humanistic care, and provide theoretical references and practical inspirations for the high-quality development of physical education in the digital-intelligent era.

Keywords: Artificial intelligence; Digital-intelligence; Physical education; Paradigm transformation; Smart physical education

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1. Introduction

The rapid progress of artificial intelligence and digital-intelligent technologies is profoundly reshaping the education sector. Building a powerful country in education serves as a fundamental project for the rejuvenation of the Chinese nation. Promoting educational digitalization and strengthening school physical education constitute dual strategic supports for educational reform and innovation in the new era, and digital physical education has become a new trend for college physical education^[1].

General Secretary clearly pointed out: Educational digitalization is an important breakthrough point for China to open up new tracks and foster new advantages for educational development. In January 2025, the Central Committee of the Communist Party of China and the State Council issued the *Outline for the Construction of a Powerful Country Through Education (2024-2035)*, which clearly puts forward promoting

the transformation of education enabled by artificial intelligence. In April of the same year, nine ministries and commissions, including the Ministry of Education, jointly released *Opinions on Accelerating Educational Digitalization*, marking that China's educational digitalization has entered a new stage featuring all-round breakthroughs. Guided by such policies, as a major component of school education, the digital-intelligent transformation of physical education has become a key measure to open up new tracks and foster new advantages for educational development.

Nevertheless, current AI application in physical education mostly stays at the level of simple technological empowerment, lacking macro consideration and systematic construction for the paradigm transformation of physical education. Although the application of AI in physical education has achieved certain results, systematic summaries of research status and development trends are still insufficient^[2]. As the core force leading profound changes in “teaching, learning, administration, assessment and research” in physical education, generative artificial intelligence is in urgent need of improvement in terms of its operating mechanism, technical risks and preventive measures^[3].

The intervention of artificial intelligence and digital-intelligent technologies in physical education is driving a paradigm shift from experience-led to data-driven, and from extensive teaching toward precise talent cultivation. This transformation concerns not only the change of teaching tools, but also profound reforms of value orientation for physical education, teaching modes, teacher-student relations and assessment forms.

2. Policy environment for digital-intelligence-driven development of physical education: From top-level planning to practical implementation

The application of artificial intelligence and digital-intelligent technologies in physical education first benefits from national policy-driven forces. The *Education Informatization 2.0 Action Plan* advocates the in-depth integration of information technology with education and teaching; *China's Education Modernization 2035* further requires the enhancement of education informatization construction. In April 2026, five ministries and commissions, including the Ministry of Education, issued the *Artificial Intelligence + Education Action Plan*, pointing out that effective approaches for artificial-intelligence-empowered physical education shall be explored. This series of policy documents forms a complete policy chain ranging from macro strategies to concrete measures, and provides institutional support and action guidelines for the digital and intelligent transformation of physical education.

3. Value manifestation and core characteristics of physical education empowered by digital-intelligent technologies

3.1. Personalized learning: From “One-Size-Fits-All” to “One-Strategy-Per-Individual”

Traditional physical education often adopts a one-size-fits-all mode and can hardly take individual differences into account. Artificial-intelligence technologies provide solutions to this problem. Through data analysis and processing, AI can accurately grasp each student's physical fitness foundation, motor-skill status and learning characteristics, and offer beneficial schemes for personalized-learning planning.

The value of digital-intelligent technologies in physical education is mainly reflected in three aspects. First, precise measurement: AI can collect students' sports information. For example, through smart wearable devices or other AI means, students' physical-fitness conditions and skill proficiency can be accurately

evaluated. Second, intelligent planning: based on measured data, AI can generate personalized training plans and learning paths, realizing the shift from one-size-fits-all to one-strategy-per-individual. Third, dynamic adjustment: AI can continuously track students' sports performance and physiological indicators, and timely adjust training intensity and teaching content to guarantee the suitability and safety of teaching.

One major value of integrating artificial intelligence into physical education lies in providing personalized-learning approaches and digital-analytical guidance ^[4]. Relying on experience, traditional physical education suffers from low precision and insufficient personalization, and the integration of digital-intelligent technologies fundamentally changes such conditions.

3.2. Precise assessment: From “Vague Judgment” to “Data-Driven”

Physical-education assessment has long been experience-dominated. Teachers judge students' movement postures through naked-eye observation. Such judgment is highly subjective, often lacks objective data support, and has low precision and fairness. The integration of digital-intelligent technologies is profoundly changing this situation.

Through AI-empowered physical education assessment, full-process precise assessment covering pre-class, in-class, and post-class phases can be realized. Smart wearable devices can continuously monitor data such as heart rate to guarantee sports safety. Big-data platforms conduct integrated analysis of multi-source data and provide data support for teaching assessment and personalized tutoring.

Artificial intelligence can build a multi-dimensional and diversified comprehensive-assessment system to realize precise evaluation and effectively boost students' all-round development ^[5]. Assessment is not the terminal of teaching, but a navigator running through the whole teaching process, which includes instant feedback, continuous optimization and dynamic adjustment.

3.3. Full-process collaboration: From “Separation of Learning and Training” to “Integration of Learning, Training, Competition and Assessment”

Conventional physical education often separates the four links of learning, training, competition and assessment: learning takes place in class, training after class, examinations serve as competitions, and assessment is conducted at the end of semesters. The lack of organic connection among all links leads to low overall quality of physical education and unsatisfactory outcomes.

Adopting the AI-empowered integrated mode of learning, training, competition and assessment, smart systems, via the integration of online-offline and in-class-after-class approaches, build a smart physical-education scheme integrating learning, training, competition and assessment, and realize the in-depth integration of precise teaching, personalized training and situational competitions ^[6].

The major value of this mode lies in breaking the separation among various links of traditional physical education and establishing a closed-loop optimized teaching system.

4. Practical framework and teaching modes of AI-empowered physical education teaching

4.1. Construction of smart physical-education classrooms

Smart physical-education classrooms constitute the major scenario for physical-education teaching empowered by digital-intelligent technologies. Through three application modules: smart classrooms,

smart physical-education teaching administration and smart self-service physical education, scenarios for university-level smart physical education are reconstructed.

At primary and secondary school stages, applying AI technologies to assist physical-education teaching is gradually becoming the major practical trend for smart physical-education classrooms. Traditional classrooms face two major challenges. First, demonstration viewing angles are limited; restricted by observation positions, students can hardly clearly perceive movement details. Second, stratified teaching is difficult. In large-size classes, teachers cannot rapidly capture individual differences among students. The participation of artificial-intelligence technologies effectively solves these problems. Through multi-directional video collection and motion analysis, every student can obtain motion demonstrations and feedback from exclusive viewing perspectives^[7].

The Huixiaoti Smart Physical-Education Campus Management System of Xiamen Renmin Primary School demonstrates practical approaches for the in-depth integration of artificial intelligence with basic physical education. Via intelligent perception, data collection, and analytical feedback, this platform realizes the precision and personalization of physical-education teaching, and provides a referable experience for the wide promotion of smart physical-education classrooms^[8].

4.2. Pre-class-in-class-post-class full-process teaching mode

The application of digital-intelligent technologies in physical-education teaching is not confined to single links of classrooms, but covers the whole teaching procedure, namely the pre-class, in-class and post-class three-in-one teaching mode empowered by intelligent technologies^[9].

Before classes, AI can accurately determine teaching starting points for teachers according to historical data and formulate personalized warm-up plans for students. During classes, AI visual-recognition technology analyzes students' movement postures in real time and instantly generates feedback information and guiding suggestions. Smart wearable devices continuously monitor physiological data such as heart rate and exercise load, and provide data support for teachers to adjust teaching intensity. After classes, big-data platforms conduct comprehensive analysis of students' sports performance, generate personalized post-class training suggestions and health-management plans, and provide data support for subsequent teaching^[10].

The core of this full-process mode is building a teaching cycle consisting of data collection, intelligent analysis, instant feedback and continuous optimization, transforming physical education from experience-driven to data-driven.

4.3. Typical practical case: Digital physical-education ecosystem of Peking University

Peking University's digital-physical-education ecosystem under its "Ten-One Project" is representative and referential^[11]. The digital-physical-education courses offered by Peking University integrate physical-education science, artificial intelligence, data analysis and health management. Based on sports activities, they provide assistance in data form through specific devices, furnish sports exercises with data support and offer decision-making references for health management.

Built by Peking University, the digital-physical-education ecosystem enhances students' sports interest and cultivates comprehensive qualities through smart devices in simulated competitions. Peking University's digital-physical-education ecosystem fully demonstrates the theoretical significance, practical experience and action directions for constructing university-level digital-physical-education ecosystems, and points out that digital technologies promote all-round reforms of physical-education situational experience,

monitoring-assessment and data management.

Digital physical education is not meant to replace traditional physical education; instead, it represents the return and improvement of the essence of physical education under new-technology conditions.

5. Role transformation and literacy reconstruction of physical-education teachers in the digital-intelligent era

5.1. From “Skill Instructors” to “Growth Guides”

The in-depth integration of digital-intelligent technologies into physical education will inevitably redefine the roles of physical-education teachers. In previous physical-education teaching, teachers’ primary duty was skill instruction. When AI reaches or even surpasses teachers’ teaching proficiency, the traditional positioning of teachers as skill instructors faces fundamental challenges.

The digital-intelligent transformation is pushing physical-education teachers to evolve from skill instructors into growth guides ^[12]. Teachers shall not merely mechanically teach motor skills, but develop themselves into guides for students’ growth and progress. Under the new context of human-machine collaboration, university physical-education teachers shall pursue lifelong learning and actively adapt to physical-education teaching modes of the new era.

5.2. Leap of digital-intelligent literacy

Role transformation is inevitably accompanied by competence reconstruction. In the digital-intelligent era, physical-education teachers are required to elevate their digital-intelligent literacy from basic technical-operation proficiency to high-level intelligent-decision-making capabilities ^[13]. Such a leap includes three dimensions. At the basic level: technical-operation competence, i.e., being proficient in operating smart physical-education equipment and teaching platforms. At the intermediate level: data-analysis competence, i.e. being capable of analyzing sports data, diagnosing learning conditions and optimizing teaching schemes. At the advanced level: intelligent-decision-making competence, i.e. making professional judgments in human-machine collaboration rather than mechanically accepting analytical outputs from AI.

The digital-transformation of education puts forward brand-new requirements for professional competence of university physical-education teachers. Systematically improving digital-intelligent literacy has become an inevitable choice. Nevertheless, physical-education teachers’ digital-literacy levels remain uneven, which has become a major bottleneck restricting the digital-intelligent transformation of physical education. How to improve physical-education teachers’ digital-intelligent literacy has become an urgent subject for the professional development of physical-education teachers in the digital-intelligent era.

6. Practical dilemmas and breakthrough approaches

6.1. Three-fold dilemmas

Digital-intelligent technologies have significantly boosted the development of physical education, yet multiple practical problems still exist. Current dilemmas for the digital transformation of physical education mainly lie in the following three aspects.

First, poor adaptability between technology application and teaching demands, especially for digital-intelligent university physical-education teaching. Many smart physical-education facilities and

teaching systems introduced by schools either feature overly complicated functions and high operational difficulty for teachers, or fail to match practical physical-education teaching needs, becoming display exhibits rather than teaching tools. Technologies are separated from teaching and cannot be truly integrated into physical education.

Second, structural deficiency in teachers' digital literacy. Physical-education teachers have uneven digital-literacy levels, and many lack the competence and awareness to apply digital-intelligent technologies in physical-education teaching. This problem can be summarized as talent incapacity. Insufficient literacy undermines the practical effectiveness of school physical-education transformation. Poor digital literacy among physical-education teachers will not only affect technology-application outcomes, but may also lead to declining teaching quality due to improper operations.

Third, growing data-ethics risks and humanistic deficiencies. The widespread application of digital-intelligent technologies in physical-education teaching inevitably involves the collection, storage and analysis of students' sports data. Ethical challenges arise in AI-aided physical-education teaching, including data risks, unfairness and humanistic shortages. If technologies occupy an excessively dominant position in teaching procedures, physical-education elements such as bodily perception, emotional communication and humanistic care may be eliminated by data-oriented logics ^[14].

6.2. Breakthrough approaches

To get rid of the above-mentioned dilemmas, joint efforts shall be made from the dimensions of technology, personnel and institutions.

Technologically, promote the shift of technologies from high-cost and high-threshold to low-cost and low-threshold. Select appropriate technical schemes in light of actual school conditions instead of blindly pursuing sophisticated high-end products. Clearly define the positioning of AI as a teaching-aid tool, and prevent technologies from gaining dominance and weakening the core educational essence of physical education ^[15].

From the personnel perspective, establish a hierarchical training system for physical-education teachers' digital-intelligent literacy. Through practical human-machine-collaborative-teaching activities, encourage teachers to explore effective integration approaches for digital-intelligent technologies and physical-education teaching in real-classroom contexts. Implement hierarchical and targeted training plans to deliver differentiated training programs for teachers of varying proficiency levels.

From the institutional perspective, improve ethical norms and data-governance mechanisms for educational applications of digital-intelligent technologies. Formulate ethical rules for the collection and application of students' sports data, build multi-subject collaborative data-supervision systems, and establish human-machine-integrated physical-education ethical standards. Only when guaranteed by institutions can the digital-intelligent transformation of physical education move forward steadily.

7. Conclusion

The integration of artificial intelligence and digital-intelligent technologies into physical education is more than simple technological accumulation. It represents a paradigm transformation touching the fundamentals of physical education. This transformation is driving physical education to evolve from the traditional experience-driven mode toward the data-driven smart mode. Teaching objectives shift from unified patterns

toward personalized customization; teaching procedures change from extensive approaches toward precise control; teaching assessment evolves from vague judgment toward data support; teachers' roles transform from skill instructors toward growth guides. The current digital-intelligent transformation of physical education encounters practical difficulties including poor technological adaptability, insufficient teacher literacy and data-ethics risks. To resolve these problems, joint efforts shall be exerted in technology application, talent cultivation and institutional support to build a new physical-education teaching environment empowered by technology and underpinned by humanistic care.

Tracing back to the source, the ultimate goal of empowering physical education with digital-intelligent technologies is to strengthen the educational attributes of physical education. Supported by technologies, every student can receive sports guidance matching individual characteristics, develop lifelong-learning capabilities, form healthy habits benefiting a lifetime, and experience physical and mental joy brought by sports.

Disclosure statement

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References

- [1] Li Y, 2023, Give Full Play to the Role of Educational Digitalization as an Important Breakthrough Point. People's Daily, visited on July 29, 2026, <https://edu.people.com.cn/n1/2023/1013/c100640094267.html>.
- [2] 2025, Bibliometric Analysis of Artificial Intelligence Applied in Physical Education: Research Status and Future Trends. Proceedings of Academic Achievements of the 14th National Sports Science Congress.
- [3] Wang J, Zhao F, 2025, Technical Risks and Preventive Strategies of Generative Artificial Intelligence Embedded in Physical Education. *Journal of Shenyang Sport University*, 44(5): 30–37.
- [4] Zhao Z, Liu H, 2025, Value Application, Practical Dilemma and Path Optimization of Digital-Intelligent Development of University Physical Education Under the Background of Artificial Intelligence. *Sports World*, (10): 77–80.
- [5] Ren Y, Zhou S, Chen Y, 2026, Values, Challenges and Strategies of Artificial-Intelligence-Driven Teaching Reform of Public Physical-Education Courses in Universities. *Sports World*, (4): 100–102.
- [6] He Y, Liu J, Chen D, 2025, Research on the Application of the Integration of “Learning, Training, Competition and Assessment” in University Physical Education Under the Background of “Artificial Intelligence +”. *Innovation and Entrepreneurship Theory Research and Practice*, 8(20): 1–4.
- [7] Tao L, Sun Y, 2026, Practical Effects and Reflections on AI-Empowered Physical-Education Classroom Teaching. *China School Physical Education*, 45(1): 40–43.
- [8] Chen J, 2026, Practical Exploration on Dual Empowerment of National Smart Education Platform and AI for Primary-and-Secondary-School Physical-Education Teaching. *Education and Equipment Research*, (2): 54–58.
- [9] Anonymous, 2025, Full-Process Precise-Evaluation Strategy of “Pre-Class-In-Class-Post-Class” Empowered by AI. *China School Physical Education*, (8); 8.
- [10] Zhu Y, 2025, Research on Artificial-Intelligence-Empowered High-Quality Development of School Physical Education. *Sichuan Sports Science*, 44(5): 11–17.
- [11] Niu J, Xu W, Qian J, 2025, Digital Physical-Education Ecosystem: A New Path for University Physical-Education Development in the Era of Artificial Intelligence — A Case Study of Peking University. *Journal of Beijing Sport*

University, 48(9): 12–25.

- [12] Zhu X, Shang L, Wang G, 2026, Remolding Roles and Authority of University Physical-Education Teachers Under Human-Machine Collaboration. Chongqing Science and Technology News, 002.
- [13] Wang J, Ji L, Yang N, 2026, From “Technical Operation” to “Intelligent Decision-Making”: Cultivation Path and Mechanism Innovation of Digital-Intelligent Literacy for University Physical-Education Teachers Driven by New-Quality Productive Forces. Abstract Proceedings of the 3rd Shaanxi Provincial Sports Science Congress — Special Reports (Supplement), 2026: 122–128.
- [14] Wu L, 2026, Digital-Intelligent Technologies: Application Risks and Mitigation Strategies in School Physical Education. Proceedings of the Symposium “Educational Innovation and High-Quality Development in the Digital-Intelligent Era” of the 2026 Annual Conference on Educational Theory and Management (Volume I), 2026: 411–415.
- [15] Zhang J, 2025, Artificial-Intelligence-Empowered School Physical Education: Connotation, Practical Dilemmas and Practical Paths. Proceedings of the 1st China Smart Sports Science Congress 2025 (Volume II), 2025: 272–277.

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