International Journal of Education and Humanities
ISSN: 2770-6702 | Vol. 21, No. 3, 2025

The Coupled Development of Smart Sports and School Sports: Mechanisms, Practical Dilemmas, and Implementation Paths

Xin Hu*

Department of Physical Education, Southwest University, Chongqing, China
* **Corresponding author:** 1178016573@qq.com

Abstract: Supported by technologies such as the Internet of Things, big data, and artificial intelligence, smart sports provides a new path to solve the problems of traditional school sports through mechanisms including technological empowerment of teaching scenarios, driving the transformation of teaching models, and promoting ecological collaboration. This paper sorts out the concept and evolution of smart sports, analyzes the operational mechanism of their coupled development, deconstructs practical dilemmas such as unbalanced infrastructure, insufficient technological integration, digital literacy gaps, lack of data governance, and absence of standard systems, and proposes implementation paths from five dimensions: resource allocation, teaching integration, literacy improvement, data governance, and standard construction. It aims to provide theoretical reference and practical guidance for the intelligent upgrading of school sports.

Keywords: Smart Sports, School Sports, High-quality Development, Coupled Development.

1. Introduction

As an important component of China's physical education system, school sports is not only the core carrier for implementing the "Healthy China 2030" Strategy but also a key path for cultivating students' core competencies, promoting all-round development, and fulfilling the fundamental task of fostering virtue through education. In the process of educational modernization in the new era, the functional boundary of school sports has expanded from a single focus on physical fitness training to a multi-dimensional coordinated development pattern encompassing value shaping, motor skill acquisition, healthy behavior development, and social responsibility cultivation. However, the current practice of school sports in China still faces many structural contradictions: the spatial distribution of educational resources is unbalanced, with significant gaps in physical education teaching conditions between urban and rural areas as well as among schools; teaching models are homogenized, making it difficult to adapt to students' personalized sports needs; students' internal motivation for sports participation is insufficient, and the sustainability and effectiveness of physical exercise need to be improved; the evaluation system lags behind the times, failing to fully reflect the development level of students' physical literacy. These issues seriously restrict the achievement of the high-quality development goal of school sports.

The national " 14th Five-Year Plan for Sports Development" clearly proposes to empower the upgrading of the entire sports industry chain with digitalization and intelligence, and build a comprehensive smart sports service system for all people[1], pointing out the direction for the transformation and development of school sports. In this context, smart sports, as a new educational form driven by technology, provides theoretical possibilities and practical tools to solve the problems of traditional school sports through data-driven perception, intelligent decision-making, and precise services. Practices such as the "Sports Portrait" system of Shanghai Jiao Tong University's Physical Education Department and the adaptive learning system of East China Normal University have verified the feasibility of technological empowerment, but the promotion still faces multiple obstacles: backward infrastructure, inadequate adaptation between technology and teaching, and imperfect data governance, which restrict the effectiveness of coupled development.

Based on this, from the core perspective of the theory of technology-education integration, this paper clarifies the conceptual connotation and essential characteristics of smart sports, deeply analyzes the operational mechanism of the coupled development of smart sports and school sports, systematically deconstructs the formation logic of its practical dilemmas, and proposes systematic implementation paths combined with China's educational context and the practical characteristics of school sports. It aims to provide useful reference for promoting the in-depth integration of the two and realizing the high-quality development of school sports.

2. Conceptual Interpretation and Development Evolution of Smart Sports

2.1. Conceptual Interpretation

Smart sports is the latest achievement of applying new-generation information technologies such as the Internet of Things, cloud computing, and big data in the sports field. It is a systematic project integrating "sports +" cross-border resources. By building a digital, networked, and intelligent sports space, sports model, and sports ecology, it comprehensively improves the quality of sports services, promotes the transformation and upgrading of the sports industry, and responds more quickly, flexibly, and accurately to people's more personalized and diversified sports needs[2]. Rooted in IBM's "Smarter Planet" concept, this concept emphasizes realizing full-factor perception, full-process interconnection, and full-scenario intelligent decision-making

through technological empowerment.

Compared with traditional sports, smart sports is not a simple superposition of technologies but forms a closed-loop system of "perception-analysis-decision-service" through the in-depth coupling of technology clusters and sports elements, ultimately achieving the intelligent reconstruction of the sports ecology[3]. Its essential characteristics are reflected in three aspects: first, dataization, which builds an overall data chain of "human-machine-environment" relying on technologies such as sensors and biometrics; second, intelligence, which analyzes data rules through artificial intelligence technologies to achieve a leap from "experience-based guidance" to "algorithm-based decision-making"; third, servitization, which integrates cross-border resources to build an intelligent service ecology and promotes sports participation towards full-life-cycle health promotion[4]. In neuromotor rehabilitation, virtual reality technology has been used to improve patients' motor functions and cognitive abilities[5].

2.2. Development Evolution

The development of smart sports is closely related to the iteration of information technology, mainly going through three stages: the first stage is the information sports stage, focusing on digital resource storage and basic information management to improve sports management efficiency; the second stage is the digital sports stage, relying on big data to realize in-depth mining of sports data and support the precision of teaching and training; the third stage is the intelligent sports stage, integrating technologies such as artificial intelligence and virtual reality to realize the intelligent reconstruction of sports scenarios and personalized service supply. Finally, an intelligent operation system integrating data collection, intelligent analysis, and dynamic response is formed, promoting the transformation of sports from experience-driven to data-driven, and forming a new development model different from traditional sports[6].

3. Operational Mechanism of the Coupled Development of Smart Sports and School Sports

The coupled development of smart sports and school sports is essentially a process of in-depth interembedding of technical logic and educational laws. This process jointly drives the systematic reconstruction and quality improvement of the school sports ecology through three core mechanisms: technological empowerment, model reshaping, and ecological collaboration.

3.1. Technological Empowerment: Reconstructing Teaching Scenarios and Realizing Data-driven Development

By embedding into the entire teaching process, smart sports technologies upgrade traditional experience-dominated physical education to a new data-driven and precision-intervention teaching form[7].

3.1.1. Implementing Data Monitoring and Precision Intervention

Through Internet of Things technologies such as wearable devices and intelligent sensors, the system can real-time collect students' physiological and behavioral data including exercise heart rate, speed, and movement trajectory. Artificial intelligence algorithms conduct real-time analysis of the data, which can not only evaluate students' instantaneous exercise load and movement standardization but also identify potential sports risks. This enables teachers to transcend subjective experience and make evidence-based precise decisions and personalized training guidance[8]

3.1.2. Providing Immersive Teaching Experience

Technologies such as virtual reality (VR) and augmented reality (AR) break through the limitations of physical space and safety conditions, enabling the simulation of high-cost or high-risk sports scenarios such as skiing and rock climbing. This not only greatly reduces the safety risks and equipment costs of teaching but also stimulates students' curiosity and internal motivation through immersive and gamified experiences, helping to explore students' sports potential and expand the project boundaries of school sports. For example, metaverse technology provides participants with a new sports experience through the construction of virtual scenarios, resources, and interaction systems, effectively breaking the time and space constraints of sports participation[9].

3.1.3. Intelligent Decision-making and Process Optimization

Teaching management platforms based on big data analysis can integrate historical teaching data and real-time classroom feedback to provide macro insights for teaching management. The platform can assist teachers in optimizing curriculum design, scientifically arranging teaching progress, and automatically completing routine work such as attendance and score analysis, thereby freeing teachers from heavy transactional work and allowing them to focus more on teaching interaction itself, promoting the development of physical education teaching management towards scientization and refinement[10].

3.2. Transformation of Teaching Models: From Standardization to Personalization

The next stage of technological empowerment is to drive a fundamental transformation of teaching models, that is, from "one-size-fits-all" standardized teaching to student-centered personalized teaching.

3.2.1. Building a Data-driven Precision Teaching Decision-making System

By continuously capturing and analyzing multi-dimensional data such as students' sports abilities, health indicators, and interest preferences, the smart sports platform constructs refined "digital portraits" of individual students and student groups. This enables teachers to accurately evaluate students' learning progress and effects, and divide students into different ability levels accordingly, matching differentiated teaching content and training intensity for each level or even each individual[11].

3.2.2. Promoting Gamified and Inquiry-based Teaching Strategies

With the help of technologies such as AR somatosensory games and interactive fitness screens, physical education teaching can be deeply integrated with gamified elements, transforming physical exercise into an interesting exploration process. This model not only significantly improves students' immediate participation but also aims to cultivate students' long-term interest in sports activities and the habit of persisting in exercise, realizing the transformation from "passive participation" to "active investment"[12].

3.2.3. Realizing Multi-modal Comprehensive Teaching Evaluation

Smart sports goes beyond the traditional evaluation model of single skill assessment. By integrating multi-source data such as classroom performance, physical fitness tests, and extracurricular activities, it constructs a comprehensive evaluation model covering multiple dimensions including skills, physical fitness, healthy behaviors, and sports morality. Researchers have used computer vision technology to analyze emotional and interactive dynamics in classrooms, realizing the perception of teachers' and students' states during the teaching process.

3.3. Ecological Collaboration: Breaking Organizational Barriers and Optimizing Resource Allocation

3.3.1. Promoting Resource Integration and Educational Equity

Information technology enables the digitization and networking of high-quality sports resources. Famous teachers' teaching videos, virtual sports courses, and other resources can be shared across regions through cloud platforms, effectively narrowing the gap in physical education quality between urban and rural areas and among schools. At the same time, Internet of Things technology helps the intelligent scheduling and management of sports venues and facilities. For example, the "School Sports Facilities Sharing Platform" established in Shanghai has significantly improved the efficiency of venue utilization and alleviated the structural contradiction of coexisting resource idleness and shortage.

3.3.2. Building a Closed-loop of Home-School-Community Collaborative Education

The profound impact of smart sports lies in breaking the organizational barriers between "home, school, community, and enterprise" through digital platforms, and building an open, interconnected, and collaborative new ecology of physical education. Through intelligent terminals and data platforms, students' sports data and health reports can be synchronized in real-time between families and schools, promoting the close connection between family supervision and school teaching[13].In many regions, such as Dongcheng District of Beijing and Futian District of Shenzhen, physical education has been successfully extended to extracurricular and family scenarios by developing family fitness programs and organizing online challenge activities, forming a positive interaction of home-school co-education. In addition, cooperation between universities, technology enterprises, and schools to develop customized solutions will effectively promote the in-depth integration of industry, university, and research.

4. Practical Dilemmas of the Coupled Development of Smart Sports and School Sports

Despite the great potential of smart sports, its nationwide promotion still faces multi-dimensional structural challenges, restricting the full release of empowerment efficiency.

4.1. Systematic Imbalance in Infrastructure and Resource Allocation

4.1.1. Systematic Deficiencies in Intelligent Infrastructure

The effective operation of smart sports relies on a full-scenario perception network. However, many schools have problems such as insufficient deployment density and inconsistent models of intelligent equipment (such as heart rate armbands and AI cameras), leading to fragmented data collection, which is difficult to support comprehensive analysis of students' exercise load. A deeper problem is that the interoperability between equipment and platforms from different manufacturers is poor, and data interfaces are not open, forming many "data silos" that prevent the integration of physical education teaching data, physical health data, and academic management data, hindering personalized teaching decisions based on big data[14].

4.1.2. Structural Contradictions in Resource Allocation

The spatial allocation of educational resources shows a significant imbalance. Under the urban-rural dual structure, the distribution density and advancement of intelligent sports equipment form a gradient gap, and rural schools have obvious gaps in new infrastructure such as sports data analysis systems and virtual reality teaching equipment. At the regional level, the Matthew effect has emerged in the investment in digital infrastructure such as 5G network coverage and cloud computing platform access between economically developed and underdeveloped regions, further exacerbating the differentiation of regional physical education quality.

4.2. Adaptability Crisis between Technological Application and Teaching Integration

If technical tools cannot be deeply integrated with educational laws, it is difficult to generate real teaching value and may even trigger new problems.

4.2.1. Technological Application "Focuses on Form rather than Core"

The functions of technical tools have not been maximally integrated with the core needs of teaching objectives, and technological empowerment remains superficial. Intelligent facilities collect students' physiological data, but front-line teachers face the problem of transforming data into personalized teaching strategies, which easily leads to technology becoming a "data collector" rather than a "teaching optimization tool"[15]. Secondly, physical education teaching content needs to match technological applications, which requires teachers not only to be proficient in physical education knowledge but also to master information technology proficiently to design courses that can fully utilize smart sports technologies. However, such interdisciplinary teaching design and innovative requirements often exceed the comfort zone of traditional teachers and require additional training and support.

4.2.2. Risk of Weakening the Humanistic Value of Physical Education

Physical education is not only the cultivation of physical fitness and skills but also a carrier for teamwork, willpower, and emotional communication. Over-reliance on technology, such as allowing students to immerse themselves in virtual sports for a long time, may weaken interpersonal interaction and emotional experiences in reality. Scholars point out that

the implementation of smart sports needs to guard against the erosion of "educational humanism" by "technical rationality", and avoid treating students as pure data objects while ignoring their emotional and social development[16].

4.2.3. Structural Gaps in Teachers' and Students' Digital Literacy

The effective implementation of smart sports places high demands on teachers' and students' ability to accept and apply technology. On the one hand, some older teachers face technical adaptation barriers. On the other hand, there are differences in students' cognition and mastery of digital technology due to family background, personal interests, and other factors. This literacy gap may lead to differences in the effect of technology use, affecting the inclusiveness of smart sports[17].

4.3. Institutional Absence in Data Governance and Service Quality

As data becomes a core production factor, the lack of corresponding governance frameworks and service standards constitutes a deep-seated obstacle to the sustainable development of smart sports.

4.3.1. Weak Mechanisms for Data Privacy and Security Protection

Students' sports trajectories, physiological indicators, and other data collected by smart sports are all sensitive personal information. However, in the links of data storage and transmission, the imperfection of encryption technologies and access control measures constitutes a continuous leakage risk[18]. The "Personal Information Protection Law of the People's Republic of China" has put forward clear requirements for such processing activities, but the construction of compliance capabilities in technology and management is still lagging behind.

4.3.2. Structural Absence of Service Quality Management Systems

Smart sports still lacks unified national or industry standards to regulate its hardware performance, data accuracy, and service processes, resulting in difficulties in recognizing evaluation results between different systems and uneven product quality. At the same time, the continuous service mechanism from equipment operation and maintenance to curriculum resource update is generally absent. Many projects fall into the dilemma of "valuing construction over operation" after initial construction, making it difficult to form a closed-loop of long-term improvement[19].

5. Implementation Paths for the Coupled Development of Smart Sports and School Sports

To address the above practical dilemmas and promote the in-depth integration of smart sports and school sports, it is necessary to build a multi-party collaborative and systematically promoted implementation path system, making joint efforts from five dimensions: infrastructure, teaching integration, literacy improvement, data governance, and standard construction.

5.1. Strengthen Top-level Design and Diversified Investment to Optimize Infrastructure Resource Allocation

At the national level, it is necessary to strengthen strategic planning and inclusive investment. Relying on the guidance of the "Guiding Opinions on Building a High-quality Education Support System through the Construction of New Educational Infrastructure", integrate smart sports infrastructure into the layout of new educational infrastructure, formulate special guidelines and standards, establish special funds, increase policy inclination towards underdeveloped areas, and narrow the "digital divide"[20].

At the social level, stimulate the vitality of social forces, innovate diversified investment mechanisms, build a "government-led, social participation, and school-independent" model, broaden funding channels, and encourage enterprises to participate in smart sports construction through various forms. It is necessary to follow the principle of "interconnection, co-construction, and sharing", promote platform interconnection and data sharing, break "data chimneys" and "functional silos", and lay the foundation for cross-platform and cross-scenario data integration and business collaboration.

5.2. Deepen the In-depth Integration of Information Technology and Physical Education to Promote Model Innovation

To solve the problem of "two skins" between technology and teaching, the focus of technological application must shift from "the tool itself" to the improvement of "teaching efficiency"[21].

First, develop intelligent teaching content closely coupled with curriculum standards. Guided by the "Compulsory Education Physical Education and Health Curriculum Standards (2022 Edition)", build a diversified resource library and promote the co-construction and sharing of high-quality resources. Second, promote student-centered smart teaching models. Actively learn from local successful experiences, organically embed intelligent technologies into the teaching closed-loop of "data-driven decision-making - personalized task setting - process evaluation and feedback", and truly realize teaching students in accordance with their aptitude. Third, use technology to enrich teaching methods and scenarios. On the premise of ensuring safety, VR/AR technology can be reasonably used to simulate high-risk or scarce sports projects, thereby expanding teaching boundaries and stimulating students' interest. However, attention should be paid to balancing with offline physical activities to avoid the abuse of technology.

5.3. Implement a Hierarchical and Classified Training System to Comprehensively Improve Teachers' and Students' Digital Literacy

Improving teachers' and students' digital literacy and technological application capabilities is crucial for adapting to the development of education in the digital age[22]. First, institutionalize and regularize teachers' digital literacy training. Incorporate the application ability of smart sports into the training and assessment system of the "Standards for Information Technology Application Capabilities of Primary and Secondary School Teachers". The training content should go beyond simple equipment operation and focus on data interpretation, teaching strategy adjustment based on data, and teaching design empowered by technology. At the same time, schools should encourage knowledge sharing and experience exchange among teachers to promote common

progress. Second, offer general digital literacy courses for students, including digital skills, data security, and privacy protection common sense, to cultivate students' sense of social responsibility and ethical awareness in the information society.

5.4. Build a Clear Data Governance System with Defined Powers and Responsibilities to Strengthen the Safety and Ethical Defense Line

Establishing mechanisms for data sharing and privacy protection requires comprehensive consideration and practice at multiple levels including legal construction, policy formulation, and technological application to ensure the effective collection and use of sports data under the premise of protecting personal privacy. First, strictly regulate the entire processing process in accordance with the law. As data processors, schools must strictly implement the "Data Security Law of the People's Republic of China" and the "Personal Information Protection Law of the People's Republic of China", ensure explicit informed consent before collecting students' sensitive information such as biometrics, and take technical and management measures to ensure the full-life-cycle security of data.

Second, establish an algorithmic fairness review and accountability mechanism. The "Guidelines for the Construction of a National Integrated Government Affairs Big Data System" issued by the General Office of the State Council mentions the need to improve data security system specifications, enhance platform technical protection capabilities, and strengthen data security operation management. Third, strengthen technical support, equip safety protection equipment, adopt technologies such as data desensitization and blockchain, and set up a professional data security management team.

5.5. Accelerate the Systematic Construction of Standards and Evaluation Systems to Guide High-quality Development

Formulating unified standards and evaluation systems is an important guarantee for regulating the coupled development of smart sports and school sports. First, accelerate the development of special standards in the field of smart sports, and introduce industry or group standards for data interfaces, service quality, and evaluation accuracy of smart sports equipment applicable to school scenarios, establishing a dynamic update mechanism. Second, a comprehensive evaluation system integrating processes and results should be established. As the key to the implementation of smart sports, teachers need to improve their ability to use intelligent sports equipment and operate data analysis systems through specific training programs and standards, such as establishing corresponding operational qualification tests. The evaluation of students should follow the spirit of the new curriculum standards, and use the process data generated by the smart sports platform to build a comprehensive evaluation model covering multiple dimensions such as sports ability, healthy behavior, and sports morality. At the same time, strengthen the application and feedback of evaluation results, guide schools and teachers to optimize their work, and establish an open mechanism to accept social supervision.

In general, education departments should formulate a comprehensive, scientific, and operable set of standards and evaluation systems considering teaching content, facility configuration, teacher training, student assessment, etc., to guide and promote the coupled development of smart sports and school sports[23].

6. Summary

The coupled development of smart sports and school sports is a systematic project of in-depth interembedding of technical logic and educational laws, and it is also the core starting point for promoting the transformation of school sports from experience-driven to data-driven and from standardized supply to personalized service. By sorting out its operational mechanism of "technological empowerment - model reshaping - ecological collaboration", deconstructing practical dilemmas in infrastructure, teaching adaptation, digital literacy, data governance, and other aspects, this paper constructs a multi-dimensional and coordinated implementation path system. This coupled development not only responds to the requirements of national strategies but also meets the fundamental task of fostering virtue through education and the needs of students' all-round development. In the future, it is necessary to continuously strengthen top-level design and multi-party collaboration, seek a balance between technological innovation and the essence of education, avoid "technological alienation", fully release the empowerment potential of smart sports, promote the high-quality development of school sports, and lay a solid foundation for cultivating new-era youth with healthy physiques and sound personalities.

References

[1] People's Network. Digital Sports Has Great Potential (Sports Pen Sketches)[EB/OL]. (2024-02-20)[2024-02-20]. http://sports.people.com.cn/n1/2023/0615/c22176-32593858.html.

[2] Zheng Fang, Xu Weikang. Intelligent Sports in China: Rise, Development and Countermeasure Research[J]. China Sport Science, 2019, 39(12): 14-24.

[3] Wu Jian, Yuan Shengmin. Overall Thinking and Construction of the Smart System for School Sports in China[J]. Sports Science Research, 2020, 34(3): 40-46+94.

[4] Wang Lei, Wu Bo. Connotation, Significance and Prospect of Smart Sports - A Review of "Research on the Innovation of Smart Sports Services in Colleges and Universities under the Background of Modernization"[J]. Journal of The Chinese Society of Education, 2023(3): 158.

[5] Shi Min, Wu Qingchao, Wu Lei. How to Bridge the Digital Divide in Smart Healthcare? - From the Perspective of "Agile Governance"[J]. Health Economics Research, 2023, 40(1): 61-64.

[6] Ye Qiang, Wei Ning. Smart Sports - An Inevitable Trend of Sports Informatization[J]. Journal of Nanjing Sport Institute (Natural Science Edition), 2011, 10(5): 117-119.

[7] Li Zaijun, Li Zhengxin. Smart Sports: Characteristics, Development Dilemmas and Promotion Paths[J]. Journal of Shenyang Sport University, 2022, 41(4): 64-70.

[8] iFLYTEK Smart Education. Smart Sports - Empowering the Improvement of Students' Sports Ability and Physical Health Level with AI[EB/OL]. (2024-05-10)[2024-05-10]. https://www.iflytek.com/education/smart-sports.html.

[9] Huang Chengyin, Qu Qinqin, Zhang Zhenyuan, et al. Structural Barriers and Mitigation Paths for the Integrated Development

of Metaverse and Sports[J]. China Sport Science, 2023, 43(3): 14-25.

[10] Jiang Lilei, Huang Qian, Hou Yuyang, et al. The Operational Mechanism, Application Fields and Implementation Paths of Digital Intelligence Technology Empowering the Modernization of School Sports[J]. Sports Science Research, 2023, 37(4): 67-78.

[11] Yin Zhihua, Guo Mingming, Jia Chenyu, et al. The Demand Mechanism, Key Dimensions and Implementation Strategies of Artificial Intelligence Boosting the Development of School Sports[J]. Journal of Chengdu Sport University, 2023, 49(2): 73-81.

[12] Shao Huijin, Huang Haiyan. The Value and Application of Artificial Intelligence Empowering Sports - 2022 World Artificial Intelligence Conference Smart Sports Summit Forum[J]. Sports Science Research, 2023, 44(1): 24-29.

[13] General Administration of Sport of China. Smart PE Classes Are Coming![EB/OL]. (2024-03-15)[2024-03-15]. http://www.sport.gov.cn/n2000158/n2000166/c10072174/content.html.

[14] Fu Gangqiang, Wei Xinmei, Liu Dongfeng. The Intelligent Transformation of Sports Venues in China in the Digital Age: Motivation, Effect, Risk and Strategy[J]. Journal of Shandong Sport University, 2022, 38(6): 92-99.

[15] Huo Bo, Li Yanfeng, Gao Teng, et al. Research Status and Development Direction of Key Technologies in the Field of Sports Artificial Intelligence[J]. Journal of Capital University of Physical Education and Sports, 2023, 35(3): 233-256.

[16] Sun Guobao. Smart Physical Education Teaching: Functional Value, Risk Reflection and Future Direction[J]. Sports Culture Guide, 2023(8): 96-103.

[17] Hu Xiaoyong, Li Wanyi, Zhou Yanni. Research on Teachers' Digital Literacy Training: International Policies, Focus Issues and Development Strategies[J]. Journal of National Academy of Education Administration, 2023(4): 47-56.

[18] Song Yaxin, Liang Wei. Challenges and Governance of Personal Information Protection in the Era of Smart Sports - Taking Public Smart Sports Facilities as an Example[J]. China Sport Science, 2021, 41(10): 51-59.

[19] Xu Guochong, Zhang Mingyue. Practical Dilemmas and Solutions of Intelligent Supply of Public Sports Services - A Case Study of the Construction of Smart Sports Platform in City X[J]. Journal of Shanghai University of Sport, 2024, 48(7): 56-65.

[20] Wang Jian. Implementation Framework and Development Ideas of Smart Physical Education Teaching[J]. Sports Culture Guide, 2023(5): 103-110.

[21] Huang Qian, Wang Huanqing, Li Shaopeng. Logical Reconstruction and Practical Prospect of the Future Development of Sports - Starting from the Concept of Metaverse[J]. Journal of Xi'an Physical Education University, 2022, 39(2): 129-135.

[22] Jiang Xiaohan, Zhang Zhibin. The Value, Practical Dilemmas and Optimization Paths of Smart Physical Education Teaching in Primary and Secondary Schools[J]. Sports Teacher and Friend, 2024, 47(4): 71-74.

[23] Guo Jianghao, Hu Ti. Towards "Metaverse Physical Education Teaching": Conceptual Characteristics, Functional Perspective and Scenario Application[J]. Modern Educational Technology, 2023, 33(3): 27-35.