

Research on the Path of Innovative Development in University Physical Education Driven by New Quality Productivity

Chen Mo, Wang Yaru, Sun Bin

Zaozhuang Vocational College of Science and Technology, Zaozhuang, Shandong, China, 277500

Abstract: In the current era where informatization and intelligentization are rapidly converging, new quality productivity, with innovation as its core driving force, leverages the distinctive traits of high technology, high efficiency, and high quality to bring fresh development opportunities to the reform of university physical education. At the same time, it also poses dual challenges at both conceptual and practical levels. This paper is grounded in the theoretical interpretation and practical characteristics of new quality productivity, delving into the intrinsic mechanisms of its interaction with the transformation of physical education in higher education institutions. It establishes a value-oriented direction for university physical education to pursue personalized, efficient, and intelligent development. Through five key dimensions—creating technology-enabled teaching spaces, constructing data-driven diversified evaluation mechanisms, building a multi-perspective modernized education framework, advancing green and sustainable development transitions, and cultivating interdisciplinary talent in sports and technology—the paper proposes actionable innovative strategies. These strategies provide a theoretical foundation and practical guidance for breaking through traditional constraints and achieving quality improvement in university physical education, ultimately fostering high-quality sports professionals aligned with the demands of the new era.

Keywords: New Quality Productivity; University Physical Education; Innovation Pathways; Technology Empowerment; Green Transformation

1. Introduction

In September 2023, General Secretary creatively proposed the important concept of "new quality productivity", defining it as an advanced form of productivity that goes beyond the traditional development model and is centered on technological innovation, providing a fundamental basis for the development of various industries in China. In the higher education system, physical education in universities is a key link in improving students' comprehensive literacy. The contradiction between its traditional teaching mode and the requirements of the new era's development is increasingly prominent. The unity of the existing curriculum design, the subjectivity of the evaluation system, and the singularity of teaching methods are no longer able to meet the social demand for high-quality and innovative composite talents. There is a deep internal fit between new quality productivity and the reform of physical education in universities. On the one hand, emerging technologies such as artificial intelligence and big data provide a breakthrough for physical education to break through the constraints of teaching time and space and achieve personalized training. Technical support, On the other hand, the innovative talents cultivated by physical education in universities can provide intellectual support for the transformation and upgrading of the sports industry^[1]. Therefore, exploring the path of reform in physical education in universities under the guidance of new quality productivity is not only an inevitable choice to implement the national education strategy, but also a fundamental requirement to promote the advancement of physical education in universities and achieve high-quality development.

2. The Scientific Connotation and Characteristics of the Era of New Quality Productivity

2.1 Scientific connotation

From a theoretical perspective, the new quality productivity represents a qualitative leap in the evolution of productivity, and its key feature is the fundamental transformation of production factors (human resources, capital, raw materials) led by scientific and technological innovation^[2]. According to

the classic interpretation of the category of productive forces in Marxist political economy, productive forces are essentially a systematic whole formed by the organic combination of various production factors. The new quality of productive forces has achieved a historic breakthrough in the structural dimension of this system: at the level of factor composition, it has broken through the limitations of traditional laborers and material carriers, turned to innovative talents with modern technological literacy as the main body, relied on digital intelligent tools as intermediary systems, and focused on cutting-edge industrial fields that combine reality and virtuality; At the level of development mechanism, a paradigm shift has been achieved from resource consumption to technological innovation. Through comprehensive innovation in technology system, production mode, and organizational management, the efficiency improvement and quality optimization of the productivity system have been promoted. For physical education teaching in universities, the scientific connotation of new quality productivity means that teaching needs to shift from "teacher centered" to "student-centered", from "experience led" to "data led", deeply integrate technological innovation into the entire teaching process, promote the transformation of physical education teaching from "single skill imparting" to "comprehensive quality cultivation", and ultimately achieve a dual improvement in teaching quality and talent cultivation efficiency.

2.2 Characteristics of the Era

The essential characteristics of new quality productivity are mainly manifested in the internal logic of "three highs and one integration", which includes high-tech content, high operational efficiency, high-quality requirements, and deep integration characteristics^[3]. These characteristics provide clear theoretical guidance for the reform of physical education models in higher education institutions. From a technological perspective, technological innovations represented by new energy technology, advanced materials science, and electronic information technology are profoundly transforming the tool system and implementation path of physical education. For example, virtual reality (VR) technology can create three-dimensional simulation environments for sports such as football and basketball, allowing students to optimize the process of acquiring sports skills through immersive interactive experiences; The Internet of Things technology can achieve real-time monitoring and collection of learners' physiological indicators, such as heart rate changes and exercise load, providing empirical support for the scientific adjustment of personalized teaching strategies. From the perspective of efficiency, the new quality productivity effectively achieves the educational benefit goal of "low input, high output" through systematic resource integration and optimization of allocation^[3]. In the field of physical education, the main feature of new productivity is the use of big data analysis technology to accurately identify students' weak links, thereby avoiding the repetition of teaching content and the unnecessary consumption of educational resources; The application of networked teaching platforms can effectively break through the limitations of time and space, promote a blended learning mode of online and offline, and thus improve the coverage and efficiency of teaching. In terms of high quality, the core goal of new quality productivity is to produce high-quality results. This concept is reflected in physical education teaching practice, which means that the teaching process should not only focus on students' sports performance, but also pay attention to cultivating their health literacy, innovative spirit, and sustainable development ability. Ultimately, the goal of high-quality talent cultivation is achieved by organically combining knowledge imparting, skill cultivation, and literacy improvement. In terms of strong integration characteristics, in the context of digital transformation, new quality productivity has broken through the boundaries of traditional disciplines and fields, promoting deep integration across disciplines and fields. This feature requires that physical education teaching in universities must strengthen the cross integration with related disciplines such as information technology, management, and environmental science, for example, applying big data analysis methods to teaching effectiveness evaluation, integrating ecological civilization concepts into curriculum design, and thus constructing a multi-dimensional teaching system.

3. The Value Orientation of Physical Education Teaching in Colleges and Universities from the Perspective of New Quality Productivity

Under the driving force of new quality productivity, physical education teaching in universities needs to reposition its value orientation to meet the new requirements of the times for talent cultivation. Based on the characteristics of new quality productivity and the actual needs of physical education teaching in universities, its value orientation can be summarized into three dimensions: personalization, efficiency, and intelligence.

3.1 Personalized Orientation

The demand for "innovative talents" in new quality productivity determines that physical education teaching in universities needs to break the traditional "unified" curriculum model and shift towards "personalized" teaching^[4]. Artificial intelligence and big data technology provide an implementation path for this orientation: by constructing a student behavior data analysis model, it can dynamically capture students' sports foundation, interest preferences, and physical function characteristics, and recommend personalized learning content and training plans for them. For students with poor physical fitness, a moderate intensity and gradually increasing sports activity plan can be designed; For ice and snow enthusiasts, virtual reality technology can be introduced to provide an immersive learning experience for related courses. The main purpose of personalized teaching mode is to "respect individual differences and implement precise docking". This method can not only prevent the decrease in participation enthusiasm caused by the mismatch between training content and students' actual abilities, but also effectively stimulate the physical potential of each student, thus achieving the refined education goal of "teaching according to talents" and laying the foundation for cultivating innovative specialized talents that adapt to the development needs of new quality productivity.

3.2 Efficient Orientation

The "high-efficiency" feature of new quality productivity requires physical education teaching in universities to shift from "resource intensive" to "efficiency oriented", and improve teaching and management efficiency through technological empowerment^[5]. The application of big data technology provides quantifiable data support for the teaching process, which can transform diverse information such as students' performance in classroom activities, physical fitness test results, and health monitoring into structured data that can be analyzed. This provides teachers with accurate diagnostic basis for problems and promotes scientific adjustment of teaching strategies^[6]; At the same time, the digital management platform can integrate cloud resources to achieve intelligent allocation and maximize the efficiency of sports facilities and equipment, effectively reducing resource waste; The integration of 5G communication technology has further expanded the practical path of remote teaching, enabling high-quality physical education resources to radiate to a wider range of student groups. This teaching philosophy that emphasizes efficiency is not simply about pursuing rapid progress in the teaching process, but rather about eliminating redundant teaching links through technological empowerment, optimizing the allocation of educational resources, and ensuring that teaching activities are closely centered around the core goal of improving students' physical fitness and innovation ability, ultimately achieving the optimal ratio of resource investment and teaching effectiveness.

3.3 Intelligent orientation

The "high-tech" characteristics of new quality productivity promote the transformation of physical education teaching in universities towards "intelligence", that is, to construct a closed-loop teaching system of "perception, analysis, decision-making, and optimization" through intelligent technology. The implementation of the concept of intelligence can be carried out from three dimensions: firstly, in terms of teaching decision-making, teachers abandon the traditional experience oriented judgment method and instead design teaching plans based on systematic analysis of learning data, such as dynamically adjusting training load based on students' exercise fatigue level data; Secondly, at the level of teaching methods, by introducing technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence coaches, a diversified teaching environment that combines immersion and interactivity can be constructed. For example, AR technology can be used to instantly correct students' shooting behavior norms; Finally, in the field of teaching management, a "smart sports venue" integrated system will be established to achieve real-time collection, deep analysis, and intelligent feedback of sports data. For example, the intelligent cameras deployed inside the venue can accurately recognize students' sports postures and provide real-time guidance. The core of the intelligent orientation is "empowering teaching with technology", upgrading intelligent technology from "auxiliary tools" to "core support", promoting the transformation of physical education teaching from "experience driven" to "data-driven", and enhancing the scientific and accurate nature of teaching.

4. The specific path of innovative development of physical education teaching in universities driven by new quality productivity

4.1 Building a Technology Empowered Physical Education Teaching Environment in Higher Education Institutions

The technology application environment is the "basic project" for driving the reform of physical education teaching with new quality productivity. It needs to be promoted from three levels: policy support, technology integration, and scenario implementation, and fully integrate high-tech elements into the entire teaching process.

4.1.1 Strengthen policy support and resource investment

Universities need to introduce special policies to clarify the application direction and guarantee measures of technology in physical education teaching: firstly, establish a "Sports Teaching Technology Innovation Fund" to purchase hardware and software such as VR devices, IoT sensors, and big data analysis platforms; The second is to establish cooperation with technology enterprises and sports industry institutions, introduce external technological resources and practical scenarios, such as jointly developing the "Sports Teaching AI Coach System" with artificial intelligence enterprises; The third is to develop a training plan for teachers' technology application abilities, regularly organize teachers to participate in technology training such as big data and artificial intelligence, and ensure that teachers have the ability to use technology to carry out teaching^[7].

4.1.2 Promote the integration and application of multiple technologies

Schools focus on the core components of physical education teaching and achieve targeted integration of various technical elements: First, build a "physical education teaching cloud platform" relying on a cloud computing environment, integrating online course resources, sports parameter collection databases, and teaching material libraries to support the implementation of ubiquitous learning models. Second, develop an intelligent teaching system using artificial intelligence technology, construct personalized recommendation algorithms based on learners' behavioral data, which can independently push adaptive course content and training plans, while realizing real-time evaluation and corrective guidance of motor movements through posture recognition technology; Finally, a sports data collection system based on the Internet of Things is constructed, and physiological parameter monitoring devices and motion trajectory capture devices are deployed in sports venues to form a multidimensional data collection network, providing data support for teachers to carry out precise teaching interventions.

4.1.3 Creating Immersive Teaching Scenarios

The school is committed to optimizing teaching effectiveness, improving teaching quality, and promoting the application of educational technology in practical teaching: firstly, virtual reality technology should be integrated into the skill development process, and simulated environments for sports such as football, basketball, and swimming should be constructed to enable students to repeatedly practice complex technical movements in virtual space, thereby reducing potential injuries during physical training; Secondly, in terms of theoretical teaching, augmented reality technology is adopted to concretize abstract concepts such as exercise physiology into three-dimensional animated demonstrations, such as using AR devices to visually present the physiological mechanisms of muscle activity; Finally, schools can organize competitive activities that integrate online and offline activities. Specifically, students are encouraged to participate in virtual ice and snow sports events, where immersive virtual environments enable them to experience the pleasure of competition while enhancing their sports proficiency.

4.2 Innovative data-driven multi-dimensional evaluation system

Traditional physical education teaching evaluation focuses on "sports performance" as the core, which has problems such as single evaluation dimensions and strong subjectivity, making it difficult to meet the demand of new quality productivity for "comprehensive talents". We need to build a multi-dimensional and multi-party evaluation system based on data, to achieve the transformation from result evaluation to process evaluation and from single evaluation to comprehensive evaluation.

4.2.1 Establish evaluation criteria and data collection methods

The evaluation system needs to shift from a single sports performance to a comprehensive evaluation, covering four levels: sports effectiveness, physical condition, innovation awareness, and activity

participation. At the level of exercise efficiency, IoT technology should be used to obtain quantitative information such as exercise load, movement standardization, and completion efficiency. At the level of physical condition, it is necessary to comprehensively analyze physiological indicators such as heart rate, body fat ratio, and sleep quality of students, in order to measure the effectiveness of physical education teaching in improving physical fitness. At the level of innovation consciousness, evaluation should be based on students' actual performance in sports technology practice activities such as "smart sports equipment research and development". At the level of activity participation, quantitative analysis should be conducted by collecting data on students' attendance at courses, frequency of classroom communication, and participation in extracurricular sports activities. The data collection should adopt a "diversified integration" mode, integrating objective records automatically collected by intelligent terminals, teachers' daily teaching observation notes, and practical reports submitted by students, to ensure the scientificity and completeness of the evaluation process.

4.2.2 Adopting Multi Subject Participation in Evaluation

To change the traditional evaluation method dominated solely by teachers, a multidimensional evaluation system including "teacher evaluation, student self-evaluation, peer evaluation, and enterprise feedback" should be constructed. Teacher evaluation should quantify the overall performance of students based on learning data, while student self-evaluation can encourage learners to examine their own performance against established goals and enhance their self-examination awareness. Peer evaluation through team competitions or collaborative projects can strengthen team collaboration and communication skills. Enterprise evaluation is targeted at students participating in industry practice, and cooperative units will provide professional evaluations based on their practical performance to enhance the practical value of evaluation.

4.2.3 Building a dynamic value-added evaluation mechanism

Using big data technology to establish a cyclic evaluation model of "real-time monitoring, continuous improvement, and optimization enhancement". Firstly, intelligent terminals capture real-time sports performance data to quickly generate evaluation reports to help students identify weak links in real time. Secondly, teachers regularly guide students to adjust teaching strategies and training arrangements in a timely manner based on evaluation data. Furthermore, developmental evaluation standards are adopted to focus on examining students' progress rather than a single result. Through longitudinal comparison of evaluation information at different stages, the actual promotion effect of teaching is measured to ensure that the evaluation always focuses on students' comprehensive development.

4.3 To build a comprehensive modern system for physical education teaching in universities

New quality productivity helps universities to innovate traditional decentralized courses and management models in physical education teaching, establish a modern system that covers multiple elements, dimensions, and the entire chain, and promote the efficient and coordinated operation of teaching, training, scientific research, and management.

4.3.1 Establish a curriculum system that integrates multiple elements

To cultivate comprehensive sports talents as the core system, we will integrate key elements such as curriculum resources, teaching models, and teaching staff. Specifically, we will integrate course content and offer cross disciplinary courses such as "Intersection of Sports and Technology," "Integration of Sports and Health," and "Linkage between Sports and Industry," such as "Sports Data Science," "Development of Intelligent Sports Equipment," and "Digital Transformation Management of Sports," For example, introducing teachers in the field of artificial intelligence to collaborate on smart sports courses and inviting sports industry executives to hold industry practice lectures^[8].

4.3.2 Building a Platform System for "Omnidirectional Linkage"

We need to establish a comprehensive collaborative support system and integrate the collaborative mechanism of the four functional modules of "teaching support, training support, scientific research support, and practical support". Specifically, in terms of teaching support, we need to use cloud technology to connect online and offline teaching channels to achieve flexible switching of course resources. In terms of training support, we need to build intelligent training bases and equip them with advanced training equipment and data evaluation tools to provide professional training guidance for students. In terms of scientific research support, we need to establish sports technology research and development centers to guide students to participate in the research of "emerging technology empowering the sports industry". In terms of practical support, we need to collaborate with sports industry

organizations and event units to build practical bases to promote students to transform theoretical achievements into practical abilities, such as participating in the daily operation and maintenance of smart sports venues.

4.3.3 Improve the management system covering the entire value chain

To create a "full cycle optimization" operation mode, a "curriculum planning, teaching implementation, effectiveness evaluation, and iterative improvement" full cycle operation mode should be constructed around the goal of "improving educational effectiveness". Firstly, in the curriculum planning stage, the training direction and curriculum architecture should be clarified by analyzing new industry needs. Secondly, in the teaching implementation stage, digital supervision tools should be used to track teaching dynamics in real time and make timely corrections. Then, in the effectiveness evaluation stage, a multi-dimensional evaluation mechanism should be adopted to widely collect opinions from all parties. Finally, in the iterative improvement stage, the curriculum system and teaching strategies should be continuously updated based on evaluation data, forming a virtuous cycle of "planning implementation evaluation improvement" to ensure the dynamic innovation and quality improvement of the teaching system.

4.4 Promote the green transformation and development of physical education teaching in universities

To promote the upgrading of physical education teaching in universities towards green direction, the new quality productivity regards high efficiency and sustainability as the core content, which is highly in line with the international environmental protection trend and China's "dual carbon" strategy. College physical education teaching needs to carry out green reform, and the concept of environmental protection should be integrated into all aspects of teaching to strengthen students' ecological literacy and sustainable development ability.

4.4.1 Building a Green Teaching Content System

Ecological concepts need to be integrated into curriculum design to achieve an organic fusion of environmental knowledge and sports skills. Specifically, a special topic on "Sports and Ecological Protection" should be added to theoretical courses, covering knowledge such as green venue design standards and energy-saving methods for sports activities; The second is to promote environmentally friendly sports projects in practical classes, such as holding zero waste events and advocating the use of sports equipment made from renewable materials; The third is to offer innovative practical courses to guide students in developing environmentally friendly sports equipment and planning sustainable sports activity plans, such as using waste to make simple sports equipment^[9].

4.4.2 Establish a mechanism for circular utilization of teaching resources

The school will optimize the allocation of teaching resources with a focus on efficient resource utilization. First, promote green venue operation by adopting energy-saving lighting and rainwater recycling technologies, thereby reducing energy consumption. Second, establish an equipment recycling mechanism: used sports equipment is refurbished through a systematic recycling, repair, and reuse process, and then allocated for public welfare donations or teaching demonstration purposes; The third is to build a teaching resource sharing platform, which enables the interconnection and sharing of course materials, teaching videos, and other resources through the cloud, reducing redundant construction and improving resource utilization efficiency.

4.4.3 Building a Green Transformation Sustainable System

Green transformation should be promoted through coordinated efforts in policy and funding supervision. Firstly, specialized green sports teaching policies should be formulated to refine the direction and implementation path of transformation, such as incorporating "environmental protection course coverage" into teaching assessment standards; Secondly, special financial funds should be allocated for key projects such as the construction of ecological sports venues and the research and development of low-carbon courses; Finally, a dynamic monitoring mechanism should be implemented to evaluate the transformation effectiveness and continuously optimize it through quantitative indicators such as venue energy consumption reduction and resource regeneration rate.

4.5 Building a highland for cultivating sports technology talents

The key to new quality productivity lies in the reserve of innovative talents. College physical education should focus on cultivating innovative sports forces that combine technological thinking and

international perspectives, and establish a multi-level talent incubation network through the dual wheel drive of "sports education integration+industry university research linkage".

4.5.1 Promote the innovation of teaching content and methods for the integration of sports and education

To promote the integration of sports disciplines and multiple disciplines, and deepen the organic combination of "sports+technology", specific measures include introducing technology related content into the curriculum system, such as teaching big data technology in the "Sports Training" course, exploring the specific application of artificial intelligence in training evaluation, and exploring practical cases of artificial intelligence in sports facility operation in the "Sports Management" course, implementing interdisciplinary thematic learning activities. For example, teachers can guide students to carry out practical projects such as "research and development of wearable sports monitoring devices" and "campus sports data mining". Through practical operations, their technical application level is effectively improved. The school has recruited professionals from the technology industry to join its teaching team, for instance, data analysts can be hired to impart sports data processing skills, assisting students in expanding their technological knowledge reserve.

4.5.2 Improve the integrated training mode of "industry university research application"

The school will strengthen its collaboration with sports technology enterprises and research institutes to build a "teaching research application" collaborative education system. First, jointly construct practical training platforms: intelligent sports equipment enterprises can co-establish internship bases, allowing students to engage in product development and performance verification. Second, implement an industry expert guidance mechanism, inviting enterprise engineers to act as practice mentors for students to guide the completion of innovative research projects and accelerate the transformation of scientific research achievements. Third, support students in transforming sports technology ideas into market-oriented products or solutions, such as assisting in the commercialization of the "Campus Sports Health Service Program," which helps cultivate their practical abilities in innovation and entrepreneurship^[7].

4.5.3 Cultivate students' international perspective and global competitiveness

In response to the global development trend of new quality productivity, we aim to enhance students' international communication and competitiveness. Firstly, we will offer courses on "International Sports Technology Frontiers" to showcase the latest developments in the global sports technology field. Secondly, we will organize international sports technology innovation related events, such as encouraging students to participate in the "International Intelligent Sports Design Competition" to compete with outstanding talents from around the world. We will further promote international exchange related projects, establish good cooperative relationships with foreign universities, select students to participate in sports technology research activities overseas, and learn from advanced technologies and concepts to create conditions for cultivating "sports innovation talents with a global perspective".

5. Conclusion

The rise of new quality productivity has created favorable conditions and brought new challenges to the reform of physical education in universities. Physical education teaching in universities should grasp the core essence and development trend of new quality productivity, take "personalization, efficiency, and intelligence" as the teaching orientation, and break through the limitations of traditional teaching models by building a technology empowered teaching environment, constructing a data-driven diversified evaluation mechanism, creating a comprehensive modern teaching system, implementing the concept of green and low-carbon development, and cultivating sports technology innovation talents through five measures. Looking ahead to the future, physical education teaching in universities still needs to keep pace with the development of new quality productivity, continuously improve teaching innovation strategies, such as researching the practical possibilities of metaverse technology in physical education teaching, and strengthening the deep integration between physical education and other disciplines. Only by doing so can we cultivate composite sports talents who meet the requirements of new quality productivity, with strong physical fitness, high technological literacy, and strong innovation ability, laying a talent foundation for the upgrading of China's sports industry and the implementation of the strategy of building a strong sports nation.

References

- [1] Jiang Chaohui, Jin Ziwei. *Empowering New Quality Productivity with Education: Theoretical Logic and Practical Path* [J]. *Chongqing Higher Education Research*, 2024, 12 (1): 108-117.
- [2] Wan Changsong, Xu Zhiyuan, Chai Yajie. *New Quality Productivity Theory* [J]. *Journal of Henan Normal University (Philosophy and Social Sciences Edition)*, 2024, 3 (11): 1-6.
- [3] Xiao Jing, Wang Qing. *The Logic and Path of New Quality Productivity Driving High Quality Development* [J]. *Journal of Xi'an University of Finance and Economics*, 2024, 37 (1): 12-20.
- [4] Zhang Tingrui. *Innovative Research on the Reform Path of Physical Education Teaching in Colleges and Universities under the Background of New Quality Productivity* [J]. *Innovation Research on Ice and Snow Sports*, 2025, 6 (8): 87-89.
- [5] Liu Bo, Li Chenxi, Wang Song, et al. *The connotation significance, internal mechanism, and implementation path of empowering high-quality development of university sports with new quality productivity*. *Journal of Wuhan Sport University*, 2024, 58 (9): 1-9.
- [6] Shi Cuiling. *The Value Orientation and Development Path of Teaching Reform in Universities Driven by Data* [J]. *Research and Practice of Innovation and Entrepreneurship Theory*, 2021, 4 (11): 87-89.
- [7] Huang Qian, Shi Haonan, Wang Qilong, et al. *The interactive promotion mechanism and practical path of new quality productivity and sports technology innovation* [J]. *Journal of Xi'an Sport University*, 2024, 41 (2): 150-158.
- [8] Zhang Wenjie, Qian Kaijuan. *Research on the Innovation Path of College Physical Education Teaching Reform from the Perspective of New Quality Productivity* [J]. *Contemporary Sports Technology*, 2024, 14 (17): 35-38.
- [9] Zhou Xianxian, Li Qidi. *Exploration of the High Quality Development Path of Physical Education Teaching under the Background of New Quality Productivity* [J]. *Physical Education Teaching*, 2024, 44 (8): 21-22.