The Development Path of Digital Teaching in College Physical Education

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Abstract: Against the backdrop of the continuous deepening of digital transformation in the current education field and the comprehensive implementation of the "Healthy China 2030" strategy, there are still some practical problems in physical education teaching in universities, such as the traditional teaching mode relying too much on subjective evaluation and ignoring individual differences among students. However, the widespread application of digital technology has brought new opportunities for precision and personalization in physical education teaching. This article analyzes the development drivers and practical bottlenecks of digital sports teaching in universities, and proposes a targeted development path for digital sports teaching in universities. The ultimate goal is to promote the transformation of sports teaching from relying on experience to relying on data, thereby comprehensively enhancing students' health literacy.

1. Introduction

At present, physical education teaching in universities is in a critical stage of transformation, and its development model is gradually shifting from relying on experience to focusing on data-driven approaches; The teaching objectives have also expanded from simply imparting motor skills to paying comprehensive attention to students' full cycle health management. Now, with the continuous application of digital technologies such as the Internet of Things, big data, and artificial intelligence, physical education teaching scenarios can be reconstructed through technological means, promoting their development towards precision, personalization, and intelligence. However, the digitization of physical education in universities still faces many practical difficulties, including incomplete infrastructure, the need to improve teachers' digital literacy, and insufficient depth of data application. Therefore, there is an urgent need to find a development path that is both in line with the laws of higher education and suitable for the characteristics of physical education disciplines, in order to promote further deepening of the digital transformation of physical education teaching.

2. The development motivation and restrictive factors of digital teaching in college physical education

2.1. Development drivers driven by technological empowerment and demand upgrading

Firstly, the policy direction is clear: the Ministry of Education has issued multiple documents that

explicitly require the promotion of digital transformation in physical education teaching and the establishment of an intelligent sports evaluation system. In this way, clear support is provided for the digital construction of university sports from the top-level design.

Secondly, the technological foundation is mature: Currently, 5G networks have been widely covered in many university campuses, and the price of wearable devices is gradually decreasing. At the same time, the accuracy of artificial intelligence action recognition algorithms has greatly improved. For example, the OpenPose model has a recognition error of less than 3 °for human joint angles. These technological advancements have laid a solid foundation for real-time acquisition of motion data and accurate analysis of each person's motion performance.

Thirdly, changes in student demands: The new generation of students have been living in a digital environment since childhood, and they have a high acceptance of digital services such as online venue reservations, VR virtual training, and visual feedback of sports data. On the contrary, the traditional "unified model" of physical education teaching has become increasingly difficult to meet their growing personalized learning needs [1].

2.2. The main limiting factors of current development

Firstly, the infrastructure is not perfect: many sports venues in universities have not yet installed IoT sensing devices, such as heart rate monitoring cameras, smart equipment cabinets, etc., which have not been widely used. Only a few schools have just started building sports big data platforms, but most of these systems can only complete basic functions such as course selection management and score entry, and cannot fully collect various data of students during the sports process.

Secondly, teachers' digital literacy needs to be improved: Nowadays, many physical education teachers in universities can proficiently use multimedia courseware for classes, but only a few teachers can use Python data analysis or artificial intelligence teaching tools. When faced with key issues such as how to turn sports biomechanics data into specific teaching methods, most teachers lack systematic operational guidance.

Thirdly, the degree of data application is not deep enough: most existing systems can only record surface motion data, such as exercise time and steps; However, the deep level analysis functions have not been fully developed, such as evaluating whether the exercise load is reasonable, predicting skill learning progress, and warning health risks, resulting in the potential value in the data not being effectively utilized.

Fourthly, the evaluation system lags behind: Traditional physical education teaching evaluation still mainly takes the form of final skill tests, such as 1000 meter running, basketball dribbling and other project assessments, often ignoring students' daily exercise accumulation and personal progress. So far, digital tools have not been effectively integrated into the process evaluation system.

3. Development path of digital teaching in college physical education

3.1. Improve infrastructure and data standard system

To solidify the digital foundation, it is necessary to systematically improve the infrastructure and data standard system. In terms of infrastructure, it is necessary to build a "cloud edge end" collaborative hardware network architecture[2]. Specifically, sports venues should deploy various intelligent sensing terminals, such as heart rate bands for monitoring heart rate and 3D cameras for capturing motion details; Install facial recognition gates at the entrance and exit of the playground, as well as location sensors that can record personal movement trajectories; The equipment room is equipped with intelligent borrowing and returning cabinets to track the frequency of equipment usage. Relying on the campus 5G network and edge computing nodes, real-time transmission and

localization of motion data can be achieved, significantly reducing system latency.

At the level of data standards, it is necessary to collaborate with experts in sports disciplines and information technology departments to develop unified data collection and interface specifications. It is necessary to clarify the collection dimensions and accuracy requirements for three types of core data, including exercise load indicators, skill performance parameters, and health indicators. At the same time, by opening API interfaces, we can promote data integration between sports platforms, academic systems, logistics systems, and medical systems, facilitate the interconnection of diverse data such as schedule information, venue usage records, and physical examination reports, and completely eliminate the phenomenon of "data silos".

3.2. Enhancing teachers' digital literacy and technological application ability

Firstly, universities should establish a stratified training system: for new teachers, universities can systematically offer training courses on the application of basic digital tools, such as guiding them to master the method of releasing preview materials on the "Rain Classroom" platform or using applications to record and manage students' running data. For backbone teachers, advanced workshops with the theme of data analysis and teaching integration will be established, including the use of SPSS statistical software to analyze the impact of different teaching strategies on students' endurance levels, or the use of Python programming language to draw radar charts of students' sports abilities. For senior teachers, efforts should be made to promote their research and teaching practice, such as participating in system development or interdisciplinary research on the correlation between wearable device data and adolescent physical health.

Secondly, universities can establish a "dual teacher" teacher incentive mechanism: actively encourage physical education teachers to conduct collaborative research with disciplines such as computer science and public health. For example, the exercise load monitoring mini program independently developed by teachers, or the personalized training algorithm model constructed, can be recognized as effective digital teaching achievements in professional title evaluation [3]. In addition, technical experts from the front line of enterprises can also be hired as part-time mentors, such as technical consultants from Huawei Sports and Health Laboratory or course development experts from Keep platform. Regular technical salons and case study activities can be organized to promote the deep integration of industry, academia and research.

3.3. Refactoring teaching models in digital scenarios

Before class, teachers post "sports micro lessons" resources through online platforms, such as videos of the decomposition of basketball three-step layups, along with analysis of common errors. After completing the preview, students are required to submit a self-assessment questionnaire and answer questions such as "Can I complete 5 standard shots in a row. The system automatically analyzes students' knowledge blind spots, such as discovering that 80% of students have the problem of "too low a perspective", and then generates personalized preview reports to help teachers adjust subsequent lesson plans.

In the classroom, teachers can use smart bracelets to monitor students' heart rates in real time and keep them within the optimal range of 60% to 80% of their maximum heart rate. If a student's heart rate remains below 50% of the maximum heart rate, the system will send a prompt to the teacher, indicating that the student may not have sufficient exercise intensity; If it consistently exceeds 90%, it indicates a possible risk of overexertion. In addition, through 3D motion capture technology, the system compares students' shooting movements with standard templates, evaluates parameters such as wrist pressure angle and elbow angle, and immediately marks errors such as "arms not extended" or "footsteps moving too fast" to help students adjust their movements on their own.

After class, the system pushes different assignments based on individual classroom performance. For example, students with poor physical fitness need to complete tasks such as "jogging and stretching", while students who need to strengthen their skills need to do training such as "100 fixed-point shooting". After students upload videos of exercising at home, the system automatically scores them based on the regularity of their movements and the number of times they complete them. The system records the exercise frequency, intensity, and physical fitness test results of each person for a long time, generates a "healthy growth curve", provides feedback on students' specific progress, encourages students to persist in exercise with actual data, and enhances their sense of achievement in sports[3].

3.4. Building a multidimensional dynamic sports literacy evaluation model

To build a multidimensional and dynamic sports literacy evaluation model, it is necessary to change the traditional evaluation method that only relies on final grades and establish a more comprehensive evaluation system. The system should include three main aspects: firstly, process data, such as the frequency of daily physical exercise, heart rate compliance rate, and other indicators; The second is the level of skill development, with a focus on the progress of students from the beginning to the present; The third is health outcomes, including changes in physical indicators such as total score and body fat percentage in physical fitness tests. In addition, numerical indicators related to "sports ethics" should be included, such as the number of times they cooperate in team collaboration or the behavior record of actively helping classmates after class. By utilizing these specific behavioral data, such as the number of passes during group training, quantitative evaluation of non skill literacy can be achieved [4].

3.5. Strengthen organizational collaboration and institutional innovation

At the school level, it is necessary to strengthen cross departmental cooperation and promote institutional innovation. It is suggested that the school establish a "Sports Digital Teaching Leadership Group", with the Vice President in charge as the group leader, and collaborate with various resources such as the Academic Affairs Office, Information Center, School of Physical Education, and the school hospital. The Academic Affairs Office is responsible for course arrangement, the Information Center provides technical support, the School of Physical Education is responsible for teaching implementation, and the school hospital is responsible for the docking of health data[5]. At the same time, special funds should be established, which are recommended to account for 15% to 20% of the total annual sports budget, with a focus on infrastructure construction, teacher training, and technological development. In addition, it is necessary to develop a security management method for digital sports teaching data, clarify the scope and usage rights of student sports privacy data, stipulate that these data can only be used for teaching improvement and health management, strictly prohibit illegal use, and prevent information leakage risks from a systemic perspective.

4. Conclusion

The digital transformation of physical education teaching in universities is not simply the application of technology, its fundamental purpose is to promote the comprehensive development of students' physical and mental health. To achieve this goal, it is necessary to systematically promote the following aspects: upgrading infrastructure, rebuilding teachers' professional abilities, innovating teaching organizational models, and improving evaluation mechanisms. Through these measures, we can truly shift towards an education direction centered on health, helping students establish a lifelong awareness of sports and cultivate their ability to exercise independently, thus laying a solid foundation

for cultivating well-rounded future talents.

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