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Practical Confusion and Response Mechanism of Empowering Personalized Learning in Sports with Digital Technology

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Abstract: *The deep integration of digital technology and education provides important support for personalized learning in sports, which can break through the limitations of traditional sports teaching and meet the differentiated needs of students. However, in practice, it faces multidimensional confusion: at the technical level, there are problems such as inaccurate data collection, limited processing algorithms, and poor compatibility between technology and teaching integration; The traditional teaching mode in the education sector has strong inertia, and teachers' ability to apply digital technology is weak and the training system is not perfect; At the societal level, there is a bias in the understanding of physical education, with parents and students misunderstanding personalized learning, and insufficient policy support and uneven resource allocation. Regarding this, research proposes a three-dimensional response mechanism: optimizing data technology technically, strengthening security protection, and promoting deep integration; Innovate teaching models in education, improve teacher training and incentive mechanisms; Strengthen publicity, increase policy funding support, and improve standardized standards and resource sharing mechanisms in society, in order to solve practical problems and promote the high-quality development of physical education and the comprehensive growth of students.*

Keywords: *Intelligent Technology, Personalized Learning in Sports, Data Security, Innovation in Teaching Mode*

1. Introduction

With the rapid development of information technology, digital technologies represented by big data, artificial intelligence, cloud computing, etc. have widely penetrated into the field of education. Digitization of education has become an important form and future development direction of modern education. Digital technology is profoundly changing and reshaping the organizational form, methods, and governance models of education, becoming an innovative force driving the transformation and development of education. In terms of physical education, traditional teaching models have certain limitations in curriculum design, teaching methods, and other aspects, making it difficult to meet the personalized learning needs of students. The rapid development of digital technology has provided new opportunities for physical education[1]. Through artificial intelligence technology, personalized customization of physical education courses, optimization of teaching resources, and improvement of teaching effectiveness can be achieved.

In today's society, personalized learning for students has become an important direction of educational reform. In physical education, there are individual differences among students in terms of physical fitness, interests, and sports foundation. How to develop personalized learning paths based on these differences, improve students' learning interest and sports skills, has become an urgent problem to be solved. Digital technology empowers personalized learning in sports, helping to meet students' personalized needs, improve their physical literacy, and achieve individualized teaching.

This study has significant theoretical and practical implications. In theory, from multiple perspectives such as physical education, digital technology, and personalized learning for students, this paper explores the relevant theories of how digital technology empowers personalized learning in sports, providing new ideas and basis for related theoretical research, expanding and deepening the theories of physical education and the application of digital technology. In practice, the aim is to provide a personalized learning path and teaching method for physical education workers based on digital technology, improve

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the quality of physical education teaching, promote students' comprehensive development, promote physical education reform, enhance national physical fitness, and assist in the implementation of the Healthy China strategy.

2. The current application status of digital technology empowering personalized learning in sports

2.1 Application case presentation

In educational practice, many schools and sports institutions have actively explored the application of digital intelligence technology in personalized sports learning and have achieved certain results [2]. A certain middle school has introduced smart wristbands and integrated teaching platforms in physical education teaching, achieving the intelligence and personalization of physical education teaching. In daily physical education classes, students wear smart wristbands for sports activities. The wristbands can collect real-time exercise data from students, such as steps taken, heart rate changes, exercise distance, calorie consumption, etc. These data will be synchronously transmitted to the school's physical education teaching platform, and teachers can view students' exercise status and data changes at any time through the platform. In a long-distance running training class, the teacher discovered through the teaching platform that student Xiao Li's heart rate was too high, exceeding the normal training range. They promptly asked Xiao Li to reduce the intensity of exercise and switch to slow jogging to avoid damage to the body caused by excessive exercise.

With the help of the big data analysis function of the teaching platform, schools can also conduct comprehensive analysis of students' physical education learning situation. By mining long-term accumulated sports data and learning performance data, we can understand the characteristics of each student's physical fitness, sports ability, and interests, and develop personalized sports learning plans for students. For students with good physical fitness and strong endurance, teachers will add training content with certain intensity and competitiveness, such as long-distance running and basketball games, in the teaching plan to further enhance their physical fitness and sports skills; For students with relatively weak physical fitness and poor coordination, emphasis is placed on basic physical training and learning simple sports such as skipping rope, kicking shuttlecock, etc., gradually improving their physical fitness and athletic ability.

A certain sports training institution has also utilized digital technology to achieve personalized and precise teaching. The institution has developed a personalized training system based on digital intelligence technology for students of different age groups and sports levels. When students register, professional physical testing equipment and online questionnaires will be used to comprehensively collect their physical indicators data, including height, weight, body fat percentage, muscle strength, as well as their exercise goals, interests, and past exercise experiences. Based on this data, the system utilizes artificial intelligence algorithms to develop a personalized training plan for each student, specifying training objectives, content, intensity, and frequency.

During the training process, the institution utilizes intelligent training equipment to monitor and guide the trainees in real-time. The intelligent treadmill can automatically adjust the speed and slope according to the training plan of the students. The intelligent dumbbell can record the number of movements, strength, and other data of the students, and provide action guidance and training suggestions for them through voice prompts and display screens. When students' training movements are not standardized, the equipment will promptly issue reminders and display correct action demonstrations to help students correct errors and improve training effectiveness. The institution also utilizes virtual reality (VR) and augmented reality (AR) technologies to create immersive training scenarios for students, increasing the fun and challenge of training. During skiing training, students can immerse themselves in different ski slopes and conditions through VR devices, simulate training, and enhance their ability to cope with various situations.

2.2 Results achieved

The application of digital intelligence technology in personalized sports learning has achieved significant results in multiple aspects[3]. In terms of improving students' physical education performance, personalized teaching plans and precise training guidance enable students to engage in more targeted physical education learning and training, effectively enhancing their sports skills and physical fitness, thereby improving their physical education performance. After introducing digital technology into physical education teaching, a certain school has increased the students' physical education achievement

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rate from 70% to 85%, and the excellence rate from 20% to 35%. In the middle school entrance examination physical education, the average score of students in this school has increased by 5 points compared to the previous year, with particularly significant improvements in events such as long-distance running and long jump.

The application of digital technology has greatly enhanced students' interest in learning. Smart devices and diverse teaching resources have brought students a brand new learning experience, making physical education learning more interesting and attractive. The use of various intelligent sports devices enables students to have real-time access to their sports data and progress, stimulating their competitive awareness and desire to challenge themselves; The immersive training scenarios created by virtual reality and augmented reality technology make students feel as if they are in a real sports environment, increasing the fun and freshness of learning. A survey conducted by a certain middle school shows that after adopting digital technology teaching, students' love for physical education classes has increased from 60% to 80%, and the proportion of students actively participating in physical exercise has also increased from 40% to 60%.

Digital technology has also improved the efficiency of physical education teaching. Teachers can quickly access students' learning data and feedback information through teaching platforms and intelligent devices, adjust teaching strategies and methods in a timely manner, achieve precise teaching, save teaching time, and improve teaching effectiveness. At the same time, automated data collection and analysis functions reduce the workload of teachers, allowing them to devote more time and energy to teaching design and student guidance. After using digital technology, a certain sports training institution has improved teaching efficiency by 30%. Teachers are able to guide more students at the same time, and the learning effectiveness of students has also been significantly improved.

3. The practical confusion of empowering personalized learning in sports with digital technology

3.1 Technical challenges

When digital technology empowers personalized learning in sports, the accuracy and completeness of data collection face challenges. The multi-source data sources of sports, physiology, learning behavior, etc. are complex, and sensor accuracy and GPS positioning errors can easily cause deviations in sports data. Moreover, sports data is difficult to integrate synchronously with subjective data, which affects the analysis of learning situations. In data processing, existing algorithms are not well adapted to complex motion behaviors and emerging scenarios, and the analysis results are prone to deviate from reality; At the same time, data security and privacy protection risks are prominent, and improper platform protection or data abuse may leak students' privacy.

At the level of technological integration, compatibility issues are significant, and differences in interfaces and protocols between different devices and software hinder collaboration. Old facilities are also difficult to integrate with new technologies. The stability of equipment is greatly affected by the teaching environment, and factors such as temperature, humidity, and motion impact can easily cause equipment failures. In addition, digital technology updates quickly, and schools need to continue investing in upgrades. Those with limited funds are prone to technological backwardness and find it difficult to fully utilize the empowering role of digital technology.

3.2 Educational challenges

The traditional physical education teaching model has significant inertia and has long formed a paradigm centered on teachers and dominated by skill imparting, emphasizing the unity of teaching content, methods, and evaluation standards, ignoring individual differences among students, and difficult to meet personalized learning needs. In basketball teaching, teachers teach skills such as dribbling and passing according to a fixed syllabus, and all students receive homogeneous content and training intensity, without considering differences in students' foundations, interests, and abilities.

At the teacher level, insufficient innovation ability and willingness constrain the innovation of teaching models. Some teachers are constrained by traditional educational concepts, have low acceptance of new ideas and methods, and lack the spirit of exploration and innovation; Some teachers have a limited understanding of personalized teaching and are concerned that it may increase teaching difficulty and workload, affect teaching effectiveness, and adopt a wait-and-see attitude. They also lack relevant training support when innovating. At the same time, teachers generally have weak abilities in the

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application of digital technology, and have a shallow understanding of technologies such as big data and artificial intelligence. They are unable to proficiently use them for teaching data analysis, personalized program design, and intelligent tool operation. For example, using a physical education teaching platform can only complete basic operations, making it difficult to leverage the advantages of data analysis, intelligent recommendation, and other functions.

There are obvious deficiencies in the training system, with content that is disconnected from actual teaching needs. The emphasis is on technical theory explanation, lacking practical operation and case analysis. For example, digital technology training only introduces big data concepts and algorithms, without combining them with physical education teaching cases to guide application; The time arrangement is unreasonable, mostly focused on short-term training, making it difficult for teachers to digest the content, and lacking follow-up guidance and practical opportunities. The training effect is difficult to translate into actual teaching ability.

3.3 Social level difficulties

At the societal level, there is a cognitive bias towards physical education, with some subjects narrowing it down to a means of strengthening the body and neglecting its value in cultivating students' comprehensive qualities, physical and mental health development, willpower, and teamwork spirit. They focus more on academic performance, resulting in a lower status of physical education in school education, insufficient resource investment and attention, and restricting the application and promotion of digital technology in the field of physical education.

Parents and students have misconceptions about personalized learning: some parents equate it with students' free choice of learning content and methods, fearing that the lack of guidance and norms will cause students to deviate from their learning goals and affect their grades; Some students see it as "easy learning", with a vague understanding of its connotation and requirements, a lack of self-restraint and active learning awareness, and are prone to problems such as insufficient learning motivation and slow progress. Such misunderstandings lead parents and students to have doubts or resistance towards personalized sports learning based on digital technology, hindering its development.

There are obvious shortcomings in the policy and guarantee system: firstly, the policy support is insufficient. Although the national and local governments have introduced policies related to educational informatization, there is a lack of special policies for the application of digital technology in physical education. There is a lack of clear development goals, implementation paths, and guarantee measures, and the policy implementation is not in place. Some schools and education departments do not attach enough importance to it, and the implementation is perfunctory. The role of policy guidance and support is difficult to play. Secondly, there is a lack of standardized norms and standards for the application of digital technology in physical education, including equipment procurement, software development, data management, and teaching evaluation. For example, the lack of clear technical indicators and quality requirements for equipment procurement leads to uneven equipment quality, and the lack of scientific indicators and methods for teaching evaluation makes it difficult to evaluate application effects and hinder teaching feedback and improvement. Thirdly, there is an uneven distribution of resources. Developed regions and urban schools have significant advantages in the provision of digital technology equipment and teacher training, while underdeveloped regions and rural schools face problems such as equipment shortage, technological backwardness, and insufficient teaching staff, exacerbating educational inequality and limiting the comprehensive promotion of digital technology in personalized sports learning.

4. The response mechanism of empowering personalized learning in sports with digital technology

4.1 Technological innovation and optimization strategies

Improving data quality requires a dual approach. On the one hand, we need to increase research and development investment, promote cooperation between research institutions and enterprises, develop high-precision and anti-interference wearable devices, accurately collect data such as heart rate and exercise trajectory, and reduce environmental or operational errors; On the other hand, we establish scientific collection standards and processes, standardize sensor wearing locations and collection time nodes, and ensure data standardization. The research and development of data processing technology needs to strengthen resource investment and cooperation, attract technical talents and research teams, and develop specialized algorithm models for complex sports data, such as using deep learning to

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recognize sports actions and predict sports risks; We strengthen academic exchanges and project cooperation with universities and research institutions, overcome technical challenges, and promote innovation.

Data security protection requires the construction of a multi-layer system, using advanced encryption technology to protect student information and learning data, and setting up firewalls to resist intrusion; We establish a strict access permission system and clarify personnel operation permissions; Carry out security awareness education to enhance the awareness and prevention ability of data security among teachers and students. The integration of digital technology and physical education teaching needs to be promoted from multiple dimensions: in terms of teaching content, virtual scenes can be constructed using VR/AR technology, and personalized courses can be generated using artificial intelligence; In terms of teaching methods, we rely on intelligent platforms and mobile applications to provide ubiquitous learning support, and adjust teaching strategies through big data analysis; In terms of teaching evaluation, combining process data and attitude data, artificial intelligence is used to automatically evaluate sports performance and generate comprehensive and objective reports. In addition, it is necessary to encourage collaborative innovation between industry, academia, and research institutions: universities and research institutions conduct basic research, technology enterprises transform achievements into product services, physical education institutions practice and apply them, and provide feedback on needs, forming a collaborative mechanism to promote the deep integration of technology and teaching.

4.2 Education reform and development strategies

We need to actively explore new physical education teaching models based on digital intelligence technology: blended online and offline teaching integrates online convenience and offline interaction, students can learn independently through intelligent platforms, and offline teachers carry out skill training and on-site guidance, such as online learning skills and offline practical operations in football teaching; Project based teaching uses sports projects as a carrier, such as designing small-scale sports events, to cultivate students' comprehensive abilities and team spirit; Exploratory teaching guides students to conduct experimental exploration through inspiring questions, such as analyzing the impact of exercise on physical function, and enhancing innovation and problem-solving abilities.

Improving the teacher training system is the key to enhancing their ability to apply digital technology: the training content covers the theory, operational skills, and teaching cases of digital technology, and includes courses such as big data analysis, combined with case-based teaching; The training adopts a combination of online and offline methods, providing self-learning resources online and organizing centralized training and expert lectures offline; We provide practical opportunities, establish pilot classes, organize teaching competitions, and set up special awards; We establish incentive mechanisms, incorporate the ability to apply digital technology into performance evaluations, link it with professional titles and bonuses, set up special research funds, and stimulate teachers' enthusiasm and professional growth.

4.3 Social support and security strategies

We need to strengthen publicity through multiple channels to guide social awareness: using media such as television, radio, and the internet to promote the value of physical education for students' physical and mental health and comprehensive development, reporting on the application achievements and cases of digital technology in physical education, producing and playing promotional videos in schools and communities, and popularizing the application scenarios and effects of technology; We organize expert lectures, parent symposiums, and physical education open days to popularize knowledge of physical education and digital technology, answer questions, share experiences, invite the public to visit teaching facilities and technological achievements, and strengthen their understanding of technology empowering physical education teaching.

The government needs to strengthen policy support and resource investment: increase policy support, formulate special policies and regulations, clarify development goals, provide financial subsidies and tax incentives to schools and educational institutions, establish special funds to support scientific research, equipment procurement, and teacher training, and develop technical application standards and specifications; The joint school will increase funding investment, equip with smart sports wristbands, virtual reality devices and other digital technology hardware, build a high-speed campus network, develop and introduce high-quality physical education teaching software and platforms, and improve the teaching hardware and software environment.

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At the same time, we establish and improve standardized standards and resource sharing mechanisms: develop standards for equipment, data, teaching evaluation, etc., to ensure equipment compatibility and data consistency; We build a sports education resource sharing platform, integrate inter school, institutional, and social resources, promote the sharing of high-quality courseware, cases, etc., encourage social forces to participate in resource development, form a diversified supply pattern, and improve resource utilization efficiency.

5. Conclusion

This study focuses on empowering personalized learning in sports with digital intelligence technology. Through in-depth exploration from multiple dimensions, a comprehensive analysis is conducted on the application of digital intelligence technology in the field of sports education. Research has shown that digital intelligence technology, with its intelligent, data-driven, and highly integrated characteristics, has brought new development opportunities for personalized sports learning. In terms of application status, through the study of specific cases, it has been found that the application of digital technology in physical education teaching has achieved certain results, not only improving students' physical education grades and enhancing their learning interest, but also improving the efficiency of physical education teaching. A certain middle school has utilized smart wristbands and teaching platforms to achieve real-time monitoring and analysis of students' sports data, develop personalized learning plans for students, and significantly improve their physical fitness achievement rate.

However, the process of empowering personalized learning in sports with digital technology still faces many practical challenges. At the technical level, the accuracy and completeness of data collection are affected by factors such as sensor accuracy and data synchronization. Data processing algorithms need to be optimized, and data security and privacy protection also face challenges; The issues of technological compatibility and device stability have constrained the deep integration of digital technology and physical education teaching, and the rapid upgrading of technology has also brought cost pressure to educational institutions. At the educational level, the inertia of traditional physical education teaching models hinders innovation in teaching methods. Teachers lack the ability to apply digital technology, and the training system is incomplete, which cannot meet the needs of physical education teaching in the digital age. At the societal level, prejudice against physical education and misunderstanding of personalized learning have led to insufficient support for personalized learning in sports; Insufficient policy support, lack of norms and standards, and uneven resource allocation have limited the promotion and application of digital technology in personalized sports learning.

In response to these practical confusions, this study proposes corresponding coping mechanisms. In terms of technological innovation and optimization strategies, measures such as optimizing data collection methods and equipment, developing data processing technologies, and strengthening data security protection are taken to improve data quality and security; By promoting the deep integration of digital technology and physical education teaching in terms of teaching content, methods, and evaluation, we aim to promote the deep integration of technology. In terms of educational reform and development strategies, innovative physical education teaching models are being explored, including blended online and offline, project-based, and inquiry based teaching models; We continuously strengthen the professional development of teachers, improve the training system, provide practical opportunities, establish incentive mechanisms, and enhance teachers' ability to apply digital intelligence and technology. In terms of social support and security strategies, we strengthen publicity and transform social concepts; We will improve the policy guarantee system, increase policy support and funding investment, establish standardized standards and resource sharing mechanisms, and provide a favorable social environment for digital technology to empower personalized sports learning.

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