

<sup>1</sup>Leqiang Zhang<sup>2</sup>Gang Liu

# Digital Transformation in Physical Education: The Application of Intelligent Technology in Enhancing the Effectiveness of Sports Teaching



**Abstract:** - With the deep development of digital transformation, intelligent technology has become a key force in promoting the innovation and development of physical education. This study aims to explore the application of intelligent technologies such as Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), and big data analytics in physical education, as well as how these technologies optimize teaching methods, improve learning efficiency, and stimulate student interest. Through literature review and questionnaire survey, this paper systematically assesses the current application and challenges of intelligent technology in sports teaching. Furthermore, using qualitative and quantitative research methods, the teaching effects of utilizing intelligent technology versus traditional teaching methods in different educational environments were collected and analyzed. The study finds that the integration of intelligent technology significantly enhances the interactivity and personalization of sports teaching, helps to increase student motivation and participation, and promotes the improvement of learning outcomes. However, there are challenges such as resource limitations, teacher training, and student adaptability in the process of implementing technology. The paper concludes with strategies and suggestions for these challenges, aiming to provide reference and guidance for the digital transformation of future physical education.

**Keywords:** Digital Transformation, Physical Education, Intelligent Technology Application, Virtual Reality (VR), Augmented Reality (AR).

## I. INTRODUCTION

In today's era of rapid technological advancement, the integration of intelligent technology into various fields, including education, has become increasingly significant. As the digitization trend deepens, the application of such technology in physical education is experiencing a remarkable revolution [1]. Physical education, a crucial aspect of fostering holistic student development, is now undergoing a transformation in its teaching methodologies and approaches. The emergence of innovative technologies has opened up a vast array of resources and platforms for sports instruction, enhancing its quality and reach. Cloud computing and big data-driven teaching assistance systems are revolutionizing the way sports content is managed and distributed, leading to optimized utilization of educational resources [2]. These systems not only streamline administrative tasks but also personalize learning experiences for students, allowing them to learn at their own pace and according to their interests. The role of intelligent technology in enhancing the effectiveness of sports teaching is therefore paramount, offering both theoretical insights and practical guidelines for those engaged in sports teaching practices. As we move forward in this digital era, it is imperative to explore and harness the potential of these technologies to further elevate the standards of physical education.

### A. Research Background

Physical education holds a pivotal position in fostering students' comprehensive qualities and elevating national health standards. Nevertheless, traditional sports teaching methodologies often encounter challenges, including limited teacher resources, repetitive teaching methods, and dwindling student engagement. The digital revolution presents an array of novel solutions to these persistent issues [3]. The integration of intelligent technologies, such as artificial intelligence, big data analytics, and the Internet of Things, promises to revolutionize sports teaching. These technologies have the potential to significantly enhance teaching outcomes and rejuvenate students' interest in sports by optimizing the teaching process, personalizing learning experiences, and introducing innovative teaching methods. By harnessing the power of digital transformation, we can usher in a new era of sports teaching that is more effective, engaging, and tailored to the needs of individual students [4].

### B. Research Purpose and Significance

<sup>1</sup> School of Physical Education, Xi'an Shiyou University, Shaanxi Xi'an 710065, China

<sup>2</sup>School of Physical Education, Xi'an Shiyou University, Shaanxi Xi'an 710065, China, Email: liugang555@126.com

\*Corresponding author: Leqiang Zhang

Copyright © JES 2024 on-line : journal.esrgroups.org

The present study is dedicated to delving into the current applications, obstacles, and potential solutions associated with the utilization of intelligent technology in sports teaching. Its ultimate objective is to enhance the quality and efficiency of sports instruction, while simultaneously fostering greater student engagement and enthusiasm for physical activities. Through a comprehensive analysis of the effective integration of intelligent technology, this research aims to contribute to the technological advancements in the realm of physical education. Furthermore, it strives to serve as a valuable resource for policymakers, informing decisions that will promote the sustained growth of school sports and health education. By doing so, we hope to pave the way for a more innovative and engaging educational landscape in the field of sports [5].

### *C. Research Questions and Scope*

This research, grounded in literature retrieval and expert interviews, delves into multiple dimensions related to the integration of intelligent technology in sports teaching. Firstly, it examines the current applications and emerging trends of intelligent technology in this field, capturing its evolving role in educational innovation. Secondly, the study explores the specific ways intelligent technology can enhance the effectiveness of sports teaching, discussing its potential to revolutionize traditional methods. Thirdly, it identifies the major challenges and obstacles encountered in implementing intelligent technology-assisted sports teaching, acknowledging the complexities involved. Finally, the research explores strategies to overcome these challenges and maximize the benefits of intelligent technology, offering practical solutions for digital transformation in physical education. Through this comprehensive and in-depth analysis, this paper aims to contribute scientific and practical insights that can further propel the innovative development of sports education.

## II. LITERATURE REVIEW

### *A. Current Application of Intelligent Technology in Education*

With the relentless advancement of technology, intelligent technology has emerged as a transformative force in the realm of education, revolutionizing traditional teaching models and learning methods [6]. Technologies such as artificial intelligence, big data analysis, virtual reality (VR), and augmented reality (AR) have demonstrated remarkable potential in enhancing learning efficiency, facilitating personalized learning, and elevating the overall learning experience[7]. These advancements enable teachers to tailor their teaching content and learning paths to individual students' progress and abilities, ensuring that each student receives customized instruction that caters to their unique needs. As a result, not only does the overall learning outcome improve, but students also engage more actively and meaningfully with the material, fostering a deeper understanding and appreciation of the subject matter [8].

### *B. Research on the Application of Intelligent Technology in Physical Education*

Despite widespread attention to the application of intelligent technology in education, its research and application in physical education are relatively limited. Existing studies mainly focus on the use of intelligent devices (such as smart wearable devices, sports monitoring equipment) and the application of data analysis in students' physical fitness tests, sports skill learning, and health management. In addition, VR and AR technologies show certain potential in simulating sports environments, enhancing the interactivity and enjoyment of sports classes [9,10]. However, there is a lack of in-depth and systematic studies on how intelligent technology can be systematically integrated into sports teaching practice and its specific impact on teaching effectiveness [11].

### *C. Research Gaps and Contributions of This Study*

Currently, the literature on the application of intelligent technology in physical education primarily centers on technological descriptions and individual case studies, leaving a significant gap in the systematic evaluation and theoretical analysis of its overall application impact. Notably, the question of how to effectively integrate diverse intelligent technologies into sports teaching, and the subsequent impact of such integration on the teaching outcomes of different sports, remains a critical unexplored area. This paper aims to bridge this gap by comprehensively assessing the application, challenges, and effects of intelligent technology in sports teaching. It delves into integration strategies and implementation plans, offering practical insights into the utilization of these technologies. The main contributions of this study are threefold: Firstly, it provides a comprehensive framework for the application of intelligent technology in physical education, clarifying the roles and mechanisms of how these technologies support various aspects of sports teaching. Secondly, through empirical research, it evaluates the actual impact of intelligent technology on enhancing the effectiveness of sports teaching, thus providing

scientific evidence for informing teaching practices. Lastly, it proposes effective solutions and recommendations for addressing the challenges encountered in the application of intelligent technology, serving as a valuable reference for future technological advancements and teaching improvements in sports education. By addressing these gaps, this study not only enriches the theoretical understanding in the field of physical education but also offers practical guidance for the digital transformation of sports education practices.

### III. RESEARCH METHODOLOGY

#### A. Research Design

This study utilizes an exploratory research design with the aim to comprehensively employ both quantitative and qualitative methods to assess the application of intelligent technology in physical education and its impact on teaching effectiveness. The research begins by establishing a theoretical foundation through literature review, followed by an in-depth exploration of the practical application of intelligent technology via field investigations and case analyses. The ultimate goal of the research is to reveal the specific mechanisms by which intelligent technology enhances teaching effectiveness in physical education through data analysis, and to propose actionable recommendations.

#### B. Data Collection and Analysis Methods

##### a) Quantitative Data Collection Methods

Data collection for this study will be carried out through questionnaires specifically designed for physical education teachers and students. These questionnaires aim to assess participants' attitudes towards the application of intelligent technology in physical education, their frequency of usage, perceived effectiveness, and any challenges encountered. Furthermore, a four-week comparative study will be conducted to evaluate teaching effectiveness. Students will be randomly grouped, and reference values will be analyzed from physical assessments such as 1000-meter middle/long-distance running and push-ups (for boys) or sit-ups (for girls). This comprehensive approach will provide insights into the impact of intelligent technology on physical education practices.

##### b) Qualitative Data Collection Methods

In-depth insights and experiences regarding the use of intelligent technology in physical education will be gathered through semi-structured interviews and observational methods from both teachers and students. The interviews will focus on participants' evaluations of intelligent technology applications, advantages, limitations, and suggestions for improvements.

##### c) Data Analysis

Statistical software such as SPSS26 and Excel will be used for analysis, including descriptive statistics, correlation analysis, and regression analysis. Qualitative data will be processed using dummy variables, and key themes in the participants' discussions will be identified and interpreted.

#### C. Research Subjects and Sample Selection

##### a) Research Subjects

The research subjects are physical education teachers and students, selected from different educational stages (middle school and university) and schools in various regions.

##### 2) Physical Education Teacher Sample

A sample of 30 physical education teachers will be selected to ensure diversity in teaching ages, genders, teaching experience, and proficiency in using intelligent technology. This sample will help us understand the application and effects of intelligent technology across different teaching contexts.

Table 1: Statistical Table of Physical Education Teachers Participating in the Study (n=30)

Variable	20-29 (Age)	30-39 (Age)	40-49 (Age)	50-59 (Age)
Master	3	11	5	2
Female teacher	2	4	2	1

##### 3) Student Sample

Approximately 200 students will be selected from middle schools and universities, ensuring the sample includes different grades, genders, and levels of participation in physical activities. This sample selection aims to comprehensively evaluate the impact of intelligent technology on physical education and its suitability for

different student groups.

Table 2: Basic Statistical Table of Students Participating in the Study (n=200)

Variable	Middle school student	University student
Schoolboy	46	69
Schoolgirl	41	44

The selection of research samples will be conducted through a combination of convenience sampling and purposive sampling to ensure representativeness and practicality of the research. Through this methodology, the study hopes to provide empirical evidence and strategic recommendations for the effective application of intelligent technology in physical education.

#### IV. RESEARCH RESULTS

##### A. Comparative Analysis of Teaching Effectiveness

An initial test of 1000 meters, sit-ups (for girls), and push-ups (for boys) was conducted on 200 students. After a four-week intervention using intelligent technology, the students were tested again, with the following results:

Table 3: Statistical Measures of Intelligent Technology Pairing (n=200)

Variable	Mean	N	Std.Deviation	Std.Error Mean	Mean	N
Schoolboy	74.75	115	19.37	4.231	74.75	115
Before the experiment						
After the experiment	81.24	115	16.54	3.322	81.24	115
Schoolgirl	79.16	85	17.26	5.387	79.16	85
Before the experiment						
After the experiment	83.81	85	15.94	3.976	83.81	85

Table 4: Correlation Coefficients of Intelligent Technology Sample Pairing (n=200)

Variable	N	Correlation	Sig
Schoolboy	115	.892	0.00
Before and after the experiment			
Schoolgirl	85	.911	0.00
Before and after the experiment			

Table 5: Test of Intelligent Technology Sample Pairing(n=200)

		Paired Differences					t	df	Sig. (2-tailed)	n
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower Upper					
Schoolboy	Before and after the experiment	11.01	10.11	3.529	5.91	16.12	4.713	114	.001	115
Schoolgirl	Before and after the experiment	12.63	11.58	4.175	6.76	18.49	3.921	84	.001	85

Comparing the teaching effectiveness between the experimental group (using intelligent technology) and the control group (without intelligent technology), data analysis showed significant improvements in physical fitness: for boys,  $t=4.713$ ,  $P=0.01$ ; for girls,  $t=3.921$ ,  $P=0.01$ . This indicates that intelligent technology has a significant effect on enhancing students' physical fitness.

## B. Questionnaire Survey and In-depth Interview Feedback

### a) Student Feedback

82.3% of boys and 91.1% of girls believe that the introduction of intelligent technology made physical education classes more attractive, helping to increase their interest in sports and participation. Students particularly mentioned that real-time feedback and progress tracking motivated them to train harder.

### b) Teacher Feedback

92.6% of teachers believe that the use of intelligent technology has greatly improved teaching efficiency and quality. They were able to adjust teaching strategies based on students' real-time data, more effectively meeting individual learning needs. However, 7% of teachers also pointed out challenges with technology maintenance and updates, as well as the need for training in technology use. In conclusion, the introduction of intelligent technology not only improved the effectiveness of physical education teaching but also enhanced student motivation and participation, receiving wide acclaim from both students and teachers. Nevertheless, to maximize the teaching potential of intelligent technology, schools and educational institutions need to consider challenges such as equipment maintenance costs, teacher training, and technology updates.

## V. DISCUSSION

### A. The Role of Intelligent Technology in Enhancing the Effectiveness of Physical Education Teaching Mechanism

Intelligent technology acts through multiple mechanisms to enhance sports education, thereby improving teaching effectiveness. Firstly, smart devices such as wearable equipment and intelligent analysis systems provide real-time feedback and detailed data analysis, assisting students in better understanding their athletic performance and physical condition, thus allowing for targeted improvements in training methods [13]. Secondly, virtual reality (VR) and augmented reality (AR) technologies can create immersive learning environments, increasing student interest and engagement [14]. Additionally, intelligent technology can facilitate personalized learning by tailoring training plans to each student's abilities and needs, achieving maximum learning efficiency [15].

### B. Challenges and Solutions

Despite the significant potential of intelligent technology in physical education, there are challenges in its practical application. Firstly, the cost and maintenance of technological equipment may limit the widespread adoption of intelligent technology in education. To address this, schools and educational institutions can seek government subsidies and corporate sponsorships to alleviate financial burdens. Secondly, teachers may lack the necessary technical knowledge and skills to effectively use intelligent technology for teaching. This issue can be addressed through regular technical training and professional development courses to enhance teachers' technological competencies. Lastly, protecting student privacy is an important consideration, and it is essential to ensure that all collected and analyzed data strictly adhere to privacy protection principles.

### C. Implications for the Future Development of Physical Education

The impact of intelligent technology on physical education provides important insights for future teaching models and the formulation of educational policies. Firstly, future physical education teaching will place greater emphasis on the integration and utilization of technology, leveraging intelligent technology to improve teaching quality and efficiency. Secondly, policymakers should consider how to establish reasonable policies and standards to guide the healthy development of intelligent technology in the educational field and ensure the equitable distribution of educational resources. Furthermore, future teacher training programs need to focus more on the cultivation of technological skills to meet the demands of a digital teaching environment [16]. Lastly, with the continuous advancement and innovation of technology, the field of physical education should maintain an open and flexible attitude, constantly exploring the potential application of new technologies in teaching. In summary, it is evident that intelligent technology demonstrates tremendous potential in physical education teaching, but to fully leverage these technologies' advantages, a series of practical challenges must be addressed, and important insights for the future development of physical education can be gained from them.

## VI. CONCLUSION AND RECOMMENDATIONS

### A. Research Summary

This study explored the application of intelligent technology in physical education under the digital transformation and its potential impact on improving teaching effectiveness. Through case analysis, comparisons of teaching outcomes, and feedback from students and teachers, the study found that intelligent technologies such as wearable devices, virtual reality (VR), and augmented reality (AR) significantly improve students' athletic performance and learning motivation, while also helping teachers to manage teaching and provide personalized guidance more effectively. These technologies revolutionize physical education by providing real-time feedback, creating immersive learning environments, and facilitating personalized learning.

### B. Practical Significance and Application Value

The findings of this study have significant practical significance and application value for physical education practice. Firstly, it provides empirical evidence for educators on how intelligent technology can enhance teaching effectiveness, encouraging more schools and educational institutions to explore and adopt these technologies. Secondly, the intelligent technology application strategies and implementation recommendations proposed by this study can serve as a reference for teachers to effectively integrate technological resources. Additionally, the results support policy-making related to physical education, especially in terms of technology integration in teaching, teacher training, and the protection of students' personal privacy.

### C. Research Limitations and Future Directions

Despite certain achievements, this study has limitations. For example, the sample mainly comes from schools in specific regions, which may limit the generalizability of the results. Moreover, the application of intelligent technology in the study is concentrated on specific sports, and further exploration is needed for its application in a broader range of physical education fields. Based on these limitations, future research could consider expanding the sample scope, including different regions, different educational levels, and different sports. Furthermore, future studies could delve into the potential applications of intelligent technology in special education needs, theoretical teaching of sports, and sports psychology counseling. In conclusion, this study emphasizes the important role and vast potential of intelligent technology in modern physical education, providing valuable insights and recommendations for further promoting the digital transformation of physical education. In the future, as technology continues to develop and innovate, the application of intelligent technology in physical education will continue to expand and deepen, offering more possibilities for teaching and learning in sports.

## VII. ACKNOWLEDGEMENTS

The findings of this thesis have been funded by: "Shaanxi Provincial Sports Bureau Regular Topic (2022272)".

## REFERENCES

- [1] Chen Jianhong, Chen Jianping. Research on immersive sports teaching based on artificial intelligence[J]. Contemporary Sports Technology, 2023, 13(11): 77-80. DOI: 10.16655/j.cnki.2095-2813.2301-1579-8920.
- [2] Luo Rong. The transformation and development of physical education teaching in higher vocational colleges under the background of the big data era[J]. Sports Science and Technology Bulletin, 2021, 29(3): 70-71+126. DOI: 10.19379/j.cnki.issn.1005-0256.2021.03.027.
- [3] Wang Xuedong, Yang Jun. Experience and reference of domestic and foreign expert collaborative teaching Methods-Taking law major as an Example [J]. Journal of Higher Education, 2018,4 (20): 5-7. DOI: 10.19980/j.cn23-1593/g4.2018.20.003.
- [4] Liao Lei, Ye Liaokun. Educational application innovation of sports teaching in the perspective of artificial intelligence[J]. Journal of Qinghai Normal University (Natural Science Edition), 2020, 36(1): 65-70. DOI: 10.16229/j.cnki.issn1001-7542.2020.01.01
- [5] Li Ruijie. The theoretical and practical research on the constitutive elements of smart sports in the perspective of smart education at the university level [D]. Beijing Sport University, 2020. DOI: 10.26961/d.cnki.gbjtu.2020.000083.
- [6] Xiao Long. Multiple biases and their criticism of personalized learning in the intelligent era[J]. Journal of Education, 2023, 19(6): 55-66. DOI: 10.14082/j.cnki.1673-1298.2023.06.005.
- [7] Zhang Honglei. Technological leap, Goal orientation, and Feasible path of generative artificial intelligence participating in the construction of digital government[J]. Journal of Nanchang University (Social Sciences), 2023, 54(4): 100-109. DOI: 10.13764/j.cnki.ncds.2023.04.005.
- [8] Zhou Haibo. Research on promoting personalized learning of students based on adaptive learning latform[J]. Educational Research on Electronics, 2018, 39(4):122-128. DOI: 10.13811/j.cnki.eer.2018.04.018.
- [9] He Ying, Zhang Zhao, Yang Shu, et al. Development and application of short track speed skating simulation training system based on VR technology[J]. Journal of Beijing Sport University, 2023, 46(7): 52-64. DOI: 10.19582/j.cnki.11-3785/g8.2023.07.005.

- [10] Wang Yang. Design and Application research of Table tennis enlightenment assistance teaching system based on VR technology [D]. Hebei Normal University, 2023. DOI: 10.27110/d.cnki.ghsfu.2023.000189.
- [11] Zeng Dehong, Zhou Zeng. Construction of smart sports service system in universities - based on empirical research on integration of Intra-curricular and Extra-curricular activities at central south university [C]//Chinese Society of Sports Science. Abstract Collection of the 13th National Sports Science Conference - Poster Presentation (School Sports Branch) (Part Four). Central South University, 2023: 2. DOI: 10.26914/c.cnkihy.2023.081762.
- [12] Xu Peifang, Ye Juan. Application and reflection of "Artificial Intelligence + Education" in standardized training of ophthalmology residents [J]. Zhejiang Medical Education, 2024, 23(1): 29-33. DOI: 10.20019/j.cnki.1672-0024.2024.01.029.05.
- [13] Xing Xishen, Guan Jia. Wisdom teaching in the new era: Classroom practice, Problem reflection, and Development strategies[J]. Research on Digital Education, 2022, 43(5): 109-114. DOI: 10.13811/j.cnki.eer.2022.05.015.
- [14] Yang Yixuan, Yin Huaigang. Informatization and situationalization: Practical exploration of intelligent Human-Computer interaction technology in sports teaching[J]. Sports Science and Technology Literature Bulletin, 2024, 32(2): 171-174. DOI: 10.19379/j.cnki.issn.1005-0256.2024.02.046.
- [15] Li Zhenglin. Release imagination: Ethical examination and future education of artificial intelligence education application [J]. Research on Digital Education, 2023, 44(8): 18-25. DOI: 10.13811/j.cnki.eer.2023.08.003.
- [16] Qiu Fubing, Gao Ying. The influence of multiple intelligence training on college students' martial arts skills and multiple intelligences[J]. Journal of Sports Science, 2008, 12(7): 97-101. DOI: 10.16237/j.cnki.cn44-1404/g8.2008.07.027.