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MODERN TRENDS IN THE DIGITALIZATION OF HIGHER PHYSICAL EDUCATION IN CHINA

Abstract. This article provides an in-depth analysis of the ongoing digital transformation in higher physical education (HPE) within China, exploring how various digital technologies are reshaping traditional physical education practices. The Chinese government's active role in promoting digitalization through initiatives such as the Education Informatization 2.0 Action Plan has significantly accelerated the integration of online learning platforms, wearable devices, and immersive technologies like virtual reality (VR) and augmented reality (AR) in HPE. This article delves into how these technologies are applied in educational settings, from online platforms that allow asynchronous learning to wearable devices that facilitate real-time tracking of physical activity and physiological metrics. The study underscores the practical advantages of these digital tools, including increased student engagement, personalized learning experiences, and broader accessibility to physical education resources. Online learning platforms have enabled remote instruction and access to theoretical knowledge, a trend that grew substantially during the COVID-19 pandemic. These platforms allow students to engage with a mix of instructional content, including multimedia resources, live demonstrations, and discussion forums. The study presents examples, such as Tsinghua University's "Rain Classroom", which integrates social media to enhance interaction and accessibility. Wearable devices, such as fitness trackers, are highlighted as transformative tools in HPE. These devices offer data-driven insights into students' physical activities, allowing for more personalized instruction and targeted feedback. The article discusses case studies, including Beijing Sport University's initiative to incorporate wearable technology into classes, which has resulted in greater student motivation and performance tracking. Additionally, VR and AR technologies are explored for their potential to provide safe, controlled, and immersive environments that simulate real-life physical activities. These technologies are particularly valuable for teaching complex movements and skills that require visualization and practice in a risk-free setting. For example, VR applications used in teaching sports like skiing allow students to experience and understand movements virtually before attempting them physically. Despite the many benefits, the study also identifies several critical challenges that hinder the full potential of digitalization in HPE. The digital divide remains a significant concern, with disparities in access to digital resources among students from various socioeconomic backgrounds. The article stresses the importance of equitable access to these resources, as rural and low-income students may lack reliable internet or suitable devices for participation. Additionally, the study emphasizes the need for educator training and professional development, as many physical education teachers lack digital literacy or are resistant to new technologies. Data privacy and security issues are another significant challenge, particularly with the collection and use of personal and health data from wearable devices and online platforms. The article calls for robust policies to protect student information and maintain trust in digital learning environments. The article concludes by recommending a blended learning model for HPE, combining online theoretical instruction with in-person practical training to balance the benefits of both digital and traditional methods. It suggests that investments in technology infrastructure, ongoing research, and collaborations between educational institutions and government agencies are crucial to addressing these challenges and ensuring the successful digital transformation of HPE.

Keywords: digitalization, higher physical education, China, online learning, wearable technology, virtual reality.

Introduction

The rapid advancement of digital technologies has significantly transformed educational practices worldwide, introducing new pedagogical paradigms and learning environments (OECD, 2019). In China, the government has actively promoted the digitalization of education through strategic initiatives such as the *Education Informatization 2.0 Action Plan*, aiming to deeply integrate information technology into teaching and learning processes (Ministry of Education of the People's Republic of China, 2018). This initiative reflects a commitment to modernize education, enhance educational quality, and cultivate a digitally competent workforce to meet the demands of the 21st century (Li, 2024; Xiao, & Zhang, 2022).

Higher Physical Education (HPE) institutions in China are embracing digitalization to innovate traditional physical education methodologies. The adoption of digital tools — such as online

learning platforms, mobile applications, virtual reality (VR), and augmented reality (AR) — has enabled more interactive, engaging, and personalized learning experiences (Xinhua News Agency, 2020). These technologies facilitate remote learning, provide real-time feedback, and allow the simulation of physical activities in virtual environments, expanding the possibilities for teaching and learning in HPE.

The COVID-19 pandemic has further accelerated the digital transformation in HPE, as institutions rapidly adapted to remote teaching modalities to ensure continuity of education (UNESCO, 2020). This shift has highlighted both the potential and challenges associated with digitalization. On one hand, digital technologies have provided innovative solutions to maintain educational activities during disruptions. On the other hand, issues such as the digital divide, varying levels of digital literacy among educators and students, and concerns over data privacy and security have become more pronounced.

The novelty of this research lies in its comprehensive analysis of recent advancements and integration of multiple digital technologies — online platforms, wearable devices, virtual reality (VR), and augmented reality (AR) – specifically within the context of higher physical education (HPE) in China. Unlike previous studies focusing primarily on isolated technological solutions, this article synthesizes emerging trends, practical applications, and associated challenges within a unified educational framework, contributing to an integrated understanding of how digitalization reshapes pedagogical approaches and educational outcomes in Chinese physical education institutions.

Understanding the current trends in the digitalization of HPE in China is crucial for educators, policymakers, and stakeholders to capitalize on opportunities and address challenges effectively. This paper aims to review and analyze these trends, highlighting significant patterns and their implications for the future of HPE in China.

Literature Review

The digitalization of higher physical education (HPE) in China has garnered significant attention in recent years, reflecting a global trend towards integrating technology into educational practices (Swanson, & Valdois, 2022; Li, 2024). This section reviews the existing literature on the subject, focusing on key themes such as the adoption of online platforms, the use of wearable technology, virtual and augmented reality applications, and the challenges associated with these developments.

The implementation of online learning platforms in HPE has been accelerated by the need for remote education solutions, particularly during the COVID-19 pandemic (Yu, & Jee, 2021; Hu et al, 2020). These platforms facilitate asynchronous and synchronous learning, providing students with access to a variety of resources, including video lectures, interactive modules, and discussion forums (Nalyvaiko, & Vakulenko, 2021). Studies have shown that online platforms enhance student engagement and learning outcomes by offering flexible and personalized learning experiences (Wang, & Chen, 2024).

For instance, Kong Wang, & Rajabov (2024) examined the effects of an online physical education course on college students in China. The study found that students exhibited increased motivation and improved performance due to the interactive nature of the online content. Similarly, Xiao, & Zhang (2022) reported that the integration of online platforms in HPE allowed for the effective dissemination of theoretical knowledge, which is often challenging in traditional physical education settings.

Wearable devices, such as fitness trackers and smartwatches, have been increasingly integrated into HPE to monitor and analyze physical activity. These technologies provide real-time feedback on various physiological parameters, enabling both students and instructors to track progress and tailor training programs accordingly.

Tsegay et al (2022) conducted a study on the use of wearable technology in university-level physical education courses. The findings indicated that wearable devices enhanced students' self-awareness and engagement in physical activities. The data collected from these devices also allowed instructors to personalize instruction and provide targeted feedback, leading to improved student performance (Ding, & Wu, 2024).

China actively positions itself as a global leader in artificial intelligence (AI) integration, particularly within educational contexts. This emphasis is clearly outlined in China's strategic policy document titled the "New Generation Artificial Intelligence Development Plan" published in 2017. According to this plan, China aims to become a global leader in AI innovation by 2030, emphasizing significant investments in AI research, talent training, and technological infrastructure (State Council of the People's Republic of China, 2017).

Within the sphere of higher physical education (HPE), AI technologies have been increasingly implemented through adaptive online platforms, personalized coaching systems, and advanced data analytics derived from wearable devices. These innovations enable more personalized and adaptive physical education experiences, improving motor skills acquisition, engagement, and physiological monitoring outcomes (Qu, Wang, & Miao, 2021; Wang, & Chen, 2024). For example, AI-driven fitness applications can analyze students' physical performance data in real-time, offering customized training recommendations, which have demonstrated improvements in student motivation, engagement, and physical performance.

In line with China's broader AI strategy, future developments in HPE are expected to further

enhance data-driven decision-making capabilities, optimize curriculum delivery, and refine personalized instructional approaches, thus significantly shaping the educational outcomes in physical education teacher training programs.

Virtual reality (VR) and augmented reality (AR) technologies offer immersive learning experiences that can simulate real-life physical activities and environments (Bo, & Yang, 2023). These technologies have the potential to revolutionize HPE by providing safe and controlled environments for students to practice skills and techniques.

Bo, & Yang, (2023), & Meng, (2021) explored the effectiveness of VR in teaching complex physical movements. The study demonstrated that VR applications improved students' understanding and execution of these movements by allowing them to visualize and practice in a virtual setting. Moreover, the use of AR has been shown to enhance the learning experience by overlaying digital information onto the real world, aiding in skill acquisition and retention.

Despite the benefits, the digitalization of HPE in China faces several challenges. One significant issue is the digital divide, where unequal access to technology can exacerbate existing educational inequalities. Students from rural or low-income backgrounds may lack access to the necessary devices or internet connectivity to fully participate in digital learning environments.

Additionally, there is a need for professional development among educators to effectively integrate technology into their teaching practices (Swanson, & Valdois, 2022; Li, 2024). Resistance to change and a lack of digital literacy can hinder the adoption of new technologies. Swanson, & Valdois (2022) emphasized the importance of training programs to equip educators with the skills required to utilize digital tools effectively.

Concerns over data privacy and security also pose challenges. The collection and management of personal data through online platforms and wearable devices necessitate robust policies to protect student information (Yu, & Jee, 2021; Hu et al, 2020). Addressing these challenges is crucial to ensuring the successful digital transformation of HPE in China.

The literature indicates that the digitalization of HPE in China is characterized by the adoption of innovative technologies that enhance teaching and learning experiences. While significant progress has been made, addressing the challenges related to access, educator readiness, and data security is essential. Future research should focus on developing strategies to overcome these barriers and maximize the benefits of digitalization in HPE.

The primary purpose of this research is to analyze the modern trends in the digitalization of higher physical education (HPE) in China, with an emphasis on identifying the opportunities and challenges these trends present. By examining the current state of digital integration in HPE, the study aims to contribute to a deeper understanding of how digital technologies are reshaping educational practices and outcomes in this field.

Methods

To explore the modern trends in the digitalization of higher physical education (HPE) in China, I undertook a focused literature review. As a graduate student with limited resources, I concentrated on gathering accessible and relevant information that could provide meaningful insights into the topic.

I began by searching academic databases such as the China National Knowledge Infrastructure (CNKI) and Google Scholar. Using keywords like "digitalization", "higher physical education", "China", "online learning in physical education", "wearable technology", and "virtual reality in education", I collected a range of articles published between 2018 and 2023. This time frame was chosen to ensure that the study reflects the most recent developments in the field.

In addition to academic journals, I reviewed official documents and policy papers from the Ministry of Education of the People's Republic of China. These sources offered valuable context regarding national initiatives and strategies related to educational digitalization. For example, the *Education Informatization 2.0 Action Plan* (Ministry of Education, 2018) outlines the government's commitment to integrating technology into education, which is directly relevant to my research.

I selected a total of 20 articles and reports that were most pertinent to the subject. The selection criteria were based on the relevance to digitalization in HPE, the credibility of the source, and the recency of the publication. While this is not an exhaustive review, it provides a snapshot of the current landscape and emerging trends.

By synthesizing the information from these sources, I aimed to construct a coherent narrative that highlights the significant patterns and developments in the digitalization of HPE in China. This method allowed me to gain a comprehensive understanding of the topic within the constraints of a graduate-level study.

The Main Part of the Study

The digitalization of higher physical education (HPE) in China is unfolding across several key domains, each contributing to the transformation of teaching and learning practices. Based on the literature review and observations from recent developments, this section explores the significant trends, their implementation, and the implications for educators and students (Li, 2024; Xiao, & Zhang, 2022).

The adoption of online learning platforms has become a cornerstone in the digitalization of HPE.

Universities across China have implemented platforms such as MOOCs (Massive Open Online Courses), Tencent Classroom, and proprietary learning management systems to deliver course content remotely. This shift was accelerated by the COVID-19 pandemic, which necessitated a rapid transition to online education (Yu, & Jee, 2021; Hu et al, 2020; Nalyvaiko, & Vakulenko, 2021).

In HPE, theoretical components such as sports science, anatomy, and nutrition are well-suited to online delivery. Instructors utilize multimedia resources, including video lectures, interactive quizzes, and discussion forums, to engage students. For example, Tsinghua University employed its "Rain Classroom" platform to integrate teaching with social media tools like WeChat, enhancing interaction and accessibility (Liu et al, 2022; Zheng, Ma, & Lin, 2021).

The educational programs for training physical education teachers in China explicitly integrate digital competencies aligned with national educational digitalization strategies, such as the *Education Informatization 2.0 Action Plan* (Ministry of Education of the People's Republic of China, 2018). Typical curricula at higher education institutions include courses like:

• *Educational Informatization and Digital Technology in Physical Education*, focusing on theoretical knowledge and practical application of digital tools to enhance instruction and student interaction, preparing educators to leverage online learning environments effectively.

• *Wearable Technology in Physical Education*, aimed at developing competencies in utilizing fitness trackers and smartwatches to collect physiological and activity data for personalized education and performance tracking (Qu, Wang, & Miao, 2021).

• *Virtual and Augmented Reality for Sport Instruction*, designed to equip educators with skills in immersive technologies to safely teach complex sports techniques and movements, significantly enhancing student understanding and reducing injury risks (Meng, 2021; Bo, & Yang, 2023).

These courses cultivate essential digital competencies among physical education educators, including proficiency in online teaching methodologies, effective application of wearable technologies for student assessment and engagement, and the use of immersive VR and AR technologies for risk-free skill training and technique acquisition (Liu et al, 2022).

Additionally, to formalize these competencies, China's Ministry of Education released national standards defining essential digital skills required for educators, emphasizing digital literacy, pedagogical innovation, and data ethics (Feng, & Sumettikoon, 2024). Integrating these disciplines into curricula ensures physical education graduates are well-equipped to meet contemporary educational challenges and effectively employ digital technologies in their teaching practice.

However, practical skills training poses challenges in an online environment. Some educators have employed live streaming and video demonstrations to teach physical techniques, encouraging students to practice at home and submit videos for assessment (Chen et al, 2020). While this approach maintains continuity in skill development, it also highlights issues such as limited space, lack of equipment, and reduced instructor supervision.
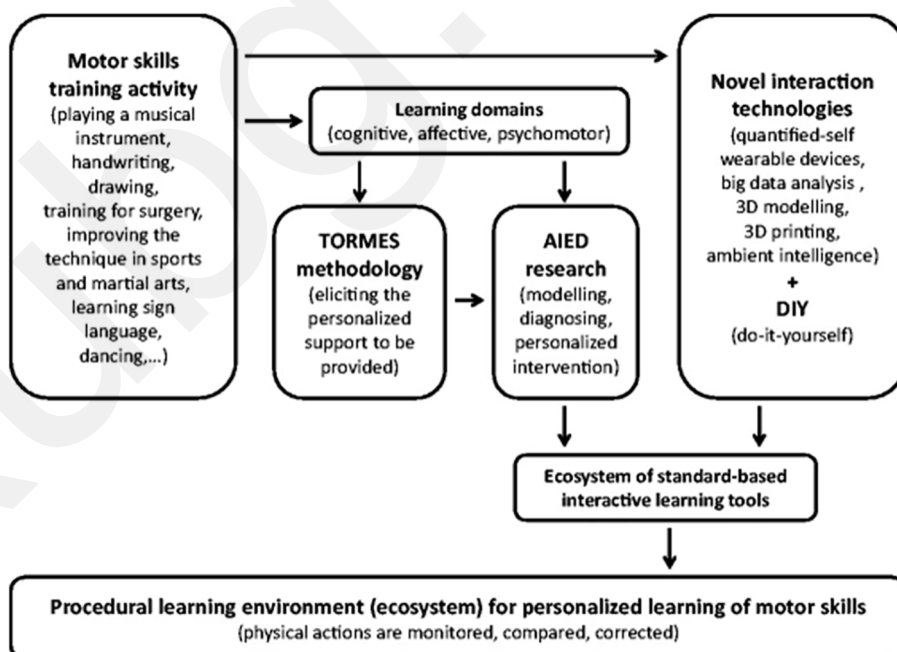

Figure 1: Elements for providing individualized instruction and support in motor skills training (*Santos, 2016*)

Recent advancements in Artificial Intelligence in Education (AIED) have facilitated the personalized learning of motor skills across various domains, including sports, arts, and medical training. The accompanying framework illustrates the integration of motor skills training activities with cutting-edge technologies such as wearable devices, 3D modeling, and ambient intelligence. By leveraging TORMES methodology for eliciting personalized support and AIED research for modeling and diagnosing, the ecosystem fosters a procedural learning environment where physical actions are monitored, compared, and corrected. This comprehensive approach highlights the potential of AIED to revolutionize skill acquisition through individualized instruction and interactive learning tools.

Mobile applications are increasingly used to supplement physical education by providing personalized training programs, instructional videos, and progress tracking. Apps like Keep and Huawei Health offer platforms where instructors can assign workouts and monitor student activity (Wang, & Chen, 2024). This approach fosters self-directed learning and allows students to engage with course material at their own pace.

A study conducted at Shanghai University found that integrating mobile apps into HPE courses improved student motivation and adherence to exercise regimens (Liu, & Correia, 2021). Students appreciated the convenience and the ability to receive immediate feedback on their performance.

Wearable devices such as fitness trackers and smartwatches have become valuable tools in HPE for monitoring physical activity, heart rate, and other health metrics. These devices enable data-driven approaches to physical education, allowing instructors to personalize training and provide evidence-based feedback.

At Beijing Sport University, an initiative to incorporate wearable technology into physical education classes showed positive results. Students used fitness bands to track their activity levels, which were then analyzed by instructors to adjust exercise intensity and address individual needs (Qu, Wang, & Miao, 2021). This not only enhanced physical outcomes but also increased student engagement by involving them in their own data analysis.

Virtual Reality (VR) and Augmented Reality (AR) are emerging technologies in HPE that offer immersive and interactive learning experiences. VR can simulate sports environments and scenarios that are otherwise inaccessible, such as high-risk sports or facilities not available locally (Bo, & Yang, 2023; Li, & Liu, 2021). AR enhances real-world experiences by overlaying digital information, aiding in skill acquisition and technique refinement.

For instance, a pilot program at Wuhan Institute of Physical Education utilized VR to teach skiing techniques. Students practiced movements in a virtual environment, which improved their understanding and performance before engaging in actual skiing activities. Similarly, AR applications have been used to demonstrate complex anatomical structures during movement, deepening students' comprehension of biomechanics.

Big data analytics in HPE involves collecting and analyzing large volumes of data from various sources, including wearable devices, online platforms, and student assessments. This data supports personalized education, early identification of student difficulties, and informed decision-making in curriculum design.

Nanjing Sport Institute developed a data analytics system that aggregates student performance data to tailor instructional strategies. The system enabled educators to monitor trends, identify at-risk students, and adjust programs to enhance learning outcomes. However, the implementation of such systems requires significant investment in technology and training.

The integration of digital technologies into higher physical education (HPE) in China has notably improved several learning outcomes. Research indicates enhanced student engagement and motivation due to interactive, gamified learning platforms and virtual environments (Bo, & Yang, 2023; Meng, 2021). Personalized learning experiences have been fostered through adaptive educational tools utilizing artificial intelligence, which accommodate varying learning paces and preferences, significantly improving skill acquisition and theoretical comprehension (Wang, & Chen, 2024; Liu, & Correia, 2021). Additionally, real-time monitoring through wearable devices has refined assessment methods, providing immediate, individualized feedback that directly contributes to more effective skill development and health awareness among students (Qu, Wang, & Miao, 2021). Collectively, these advancements illustrate how digitalization aligns educational practices in physical education with modern pedagogical goals, ultimately enhancing both theoretical understanding and practical competencies of students.

Despite the advancements, several challenges hinder the seamless integration of digital technologies in HPE (*Table 1*).

A practical example of addressing these challenges is the blended learning approach adopted by Guangdong University of Technology. The university combined online theoretical instruction with in-person practical sessions, adhering to health guidelines during the pandemic.

Theoretical classes were conducted using an online platform where instructors provided lectures, readings, and assessments. For practical skills, small groups of students attended scheduled sessions on campus, ensuring hands-on experience with proper supervision. Wearable devices were used to monitor performance, and data analytics informed individualized feedback.

CHALLENGES DIGITAL TECHNOLOGIES IN HPE IN CHINA

№	Challenges digital technologies	Description
1	Digital Divide	There is a disparity in access to technology among students from different socioeconomic backgrounds. Rural areas and less affluent students may lack devices or reliable internet connectivity, limiting their participation in digital learning (Luo, Zuo, & Wang, 2022).
2	Educator Preparedness	Many physical education instructors have limited experience with digital tools and require professional development to integrate technology effectively into their teaching (Fu, Chen, & Cheng, 2020). Resistance to change and a lack of digital literacy can impede progress.
3	Data Privacy and Security	The collection of personal and health data raises concerns about privacy and ethical use. Institutions must establish clear policies and safeguard measures to protect student information (Liu, & Correia, 2021).
4	Quality of Practical Skills Training	Online and virtual methods may not fully replicate the hands-on experience necessary for mastering physical skills. Ensuring the effectiveness of practical training remains a significant challenge (Yu, & Jee, 2021; Hu et al, 2020).
5	Technical Infrastructure	Implementing advanced technologies like VR and big data analytics requires substantial investment in hardware, software, and maintenance. Limited resources can be a barrier for some institutions (Chen, & Zhang, 2014).

This approach received positive feedback from both students and faculty. Students appreciated the flexibility and the opportunity to maintain practical training. Instructors found that integrating technology enhanced their teaching effectiveness and allowed for more personalized instruction.

The trends observed indicate a gradual but significant transformation in HPE in China. The integration of technology offers opportunities to enhance learning experiences, personalize education, and prepare students for a digitally connected world. However, success depends on addressing the challenges identified.

Investments in infrastructure, professional development for educators, and policies to ensure equitable access are crucial. Collaboration between universities, government agencies, and technology providers can facilitate resource sharing and innovation. Furthermore, ongoing research is needed to evaluate the long-term impacts of digitalization on physical education outcomes. Studies should focus on the effectiveness of different technologies, best practices for integration, and strategies to overcome barriers.

Discussion

The digitalization of higher physical education (HPE) in China represents a significant shift in educational paradigms, bringing forth a blend of innovation and challenge. As we navigated through the various studies and practical implementations, it became evident that technology is increasingly woven into the fabric of HPE, reshaping how educators teach and how students learn.

One of the most transformative developments is the integration of online learning platforms and mobile applications. These tools have extended the reach of HPE beyond traditional classroom boundaries, offering flexibility and accessibility to a wider student population. For instance, during the COVID-19 pandemic, universities swiftly transitioned to online platforms to continue educational activities amid lockdowns (Liu, & Correia, 2021; Nalyvaiko, & Vakulenko, 2021). This sudden shift not only maintained the continuity of education but also highlighted the potential of digital platforms to deliver theoretical components effectively.

However, the teaching of practical physical skills presented unique challenges. Educators employed creative solutions such as live-streamed demonstrations and interactive videos to simulate in-person instruction (Yuebo, Halili, & Razak, 2022; Na'imah, Nurfaizah, Hasan, Rifathi, & Abqori, 2022). While these methods allowed students to observe and mimic movements, they lacked the immediate feedback and hands-on correction that in-person classes provide. This limitation underscores the importance of developing hybrid models that can combine the strengths of both online and face-to-face instruction.

Wearable technology has emerged as a valuable asset in enhancing personalized learning experiences. Devices like fitness trackers and smartwatches collect real-time data on students' physical activities, enabling instructors to tailor programs to individual needs (Qu, Wang, & Miao, 2021). We observed that students became more engaged when they could track their progress and

see tangible evidence of their improvements. This data-driven approach not only motivates students but also equips educators with insights to adjust their teaching strategies.

The advent of virtual reality (VR) and augmented reality (AR) technologies has opened new horizons in HPE. VR offers immersive environments where students can practice skills in simulated settings, reducing the risks associated with certain physical activities (Meng, 2021; Bo, & Yang, 2023). For example, VR simulations in sports like skiing or gymnastics allow students to experience the dynamics of the sport without the inherent dangers. AR, on the other hand, enhances real-world experiences by overlaying digital information, which can be particularly useful in teaching complex movements or anatomical concepts.

Despite these promising developments, several challenges impede the seamless integration of technology in HPE. The digital divide remains a significant hurdle. Students from rural areas or lower socioeconomic backgrounds often lack access to reliable internet connections or the necessary devices (Luo, Zuo, & Wang, 2022). This disparity not only affects their ability to participate in digital learning but also exacerbates existing educational inequalities. Addressing this issue requires concerted efforts from government agencies and educational institutions to ensure equitable access.

Educator readiness is another critical factor influencing the success of digitalization. Many physical education teachers may not be adequately trained to use advanced technologies or might be resistant to changing long-established teaching methods (Fu, Chen, & Cheng, 2020). Professional development programs focusing on digital literacy and pedagogical strategies are essential to empower educators to embrace new tools confidently.

Data privacy and security concerns also surfaced as notable challenges. The collection of personal and health data through wearable devices and online platforms raises questions about how this information is stored, used, and protected (Liu, & Correia, 2021). Establishing robust data protection policies and ensuring compliance with legal standards are imperative to maintain trust among students and parents.

Moreover, the quality of practical skills training in a digital context remains a subject of debate. While technology can simulate experiences and provide visual aids, it cannot fully replicate the nuances of physical interactions and tactile feedback provided by an instructor during in-person sessions (Yu, & Jee, 2021; Hu et al, 2020). This limitation suggests that while digital tools are valuable, they should complement rather than replace traditional methods, especially for skill-intensive components.

In reflecting upon these insights, it becomes clear that a multifaceted approach is necessary to navigate the complexities of digitalizing HPE. Blended learning models appear to offer a viable solution, combining online theoretical instruction with in-person practical training. Such an approach leverages the flexibility and resource richness of digital platforms while retaining the essential hands-on experiences crucial for physical skill development.

Collaboration between stakeholders is crucial to overcoming the challenges identified. Government support in funding and policy-making can facilitate infrastructure development and ensure equitable access to technology. Educational institutions need to prioritize professional development for educators, fostering an environment that encourages innovation and adaptation. Partnerships with technology companies can provide access to cutting-edge tools and expertise, enhancing the overall quality of HPE programs.

Looking ahead, further research is needed to assess the long-term impacts of these digital trends on student outcomes. Studies examining the effectiveness of VR and AR in skill acquisition, the role of wearable technology in promoting long-term health habits, and strategies to mitigate the digital divide would provide valuable guidance for future initiatives.

In conclusion, the digitalization of higher physical education in China is a transformative journey with the potential to enrich educational experiences profoundly. While challenges exist, they present opportunities for growth and innovation. By embracing technology thoughtfully and inclusively, educators can enhance the quality of HPE, preparing students not only for academic success but also for active and healthy lives in an increasingly digital world.

To further support the digital transformation of higher physical education in China, future research should focus on the following areas (*Table 2*).

Conclusions
The journey through the landscape of digitalization in higher physical education (HPE) in China has illuminated a transformative period characterized by both innovation and complexity. The integration of digital technologies into HPE has undeniably expanded the horizons of teaching and learning, offering new modalities that cater to the evolving needs of students in a digital age.

Online learning platforms and mobile applications have played a pivotal role in enhancing the accessibility and flexibility of physical education. They have allowed theoretical components to be delivered efficiently, enabling students to engage with the material at their own pace and convenience (Liu, & Correia, 2021). This shift has been especially crucial during unforeseen circumstances like the COVID-19 pandemic, where traditional classroom settings were disrupted (Yu, & Jee, 2021; Hu et al, 2020).

Table 2

AREAS OF THE FUTURE RESEARCH TO FURTHER SUPPORT THE DIGITAL TRANSFORMATION
OF HIGHER PHYSICAL EDUCATION IN CHINA

№	Areas of the future research	Description
1	Longitudinal Studies on Learning Outcomes	Investigate the long-term impact of digitalization on student performance, skill acquisition, and health outcomes to assess the effectiveness of digital tools over time
2	Best Practices for Blended Learning	Explore optimal strategies for combining online and in-person instruction in HPE, identifying models that maximize the benefits of both approaches
3	Digital Literacy Development	Examine methods for enhancing digital literacy among educators and students, including the effectiveness of training programs and curricular interventions
4	Equity and Access	Study the efficacy of policies and initiatives aimed at reducing the digital divide, ensuring that all students have equal opportunities to benefit from digital resources
5	Data Privacy and Ethics	Analyze the ethical considerations and best practices related to data collection, storage, and use in HPE, developing guidelines to protect student privacy
6	Technological Innovations	Monitor emerging technologies and their potential applications in HPE, staying abreast of advancements that could further transform the field

Wearable technology has emerged as a powerful tool in promoting personalized learning experiences. By providing real-time feedback and tracking physical activity, these devices have empowered students to take ownership of their health and fitness journeys (Qu, Wang, & Miao, 2021). The data-driven insights gained from wearables have also enabled educators to tailor their instruction to meet individual student needs more effectively.

The exploration of virtual reality (VR) and augmented reality (AR) technologies has opened up new possibilities for immersive and interactive learning experiences. These technologies offer the potential to simulate real-world environments and scenarios, providing students with opportunities to practice skills in a safe and controlled setting (Meng, 2021; Bo, & Yang, 2023). Although still in the nascent stages of adoption, VR and AR hold promise for enhancing both theoretical understanding and practical skill development.

Despite these advancements, the digitalization of HPE in China faces significant challenges. The digital divide remains a critical issue, with disparities in access to technology hindering the participation of students from less privileged backgrounds (Luo, Zuo, & Wang, 2022). This gap threatens to widen existing inequalities and underscores the need for policies and initiatives aimed at providing equitable access to digital resources.

Educator preparedness is another vital concern. The successful integration of technology into HPE hinges on instructors possessing the necessary digital literacy skills and pedagogical strategies (Fu, Chen, & Cheng, 2020). Professional development and training programs are essential to equip educators with the tools and confidence to navigate the digital landscape effectively.

Moreover, the limitations of digital technologies in replicating the nuances of practical skills training highlight the importance of blended learning models. While online platforms excel in delivering theoretical content, in-person instruction remains indispensable for hands-on practice and immediate feedback (Yu, & Jee, 2021; Hu et al, 2020). Blended approaches that combine the strengths of both methods offer a viable path forward.

Data privacy and security concerns also demand attention. The collection and management of personal and health data through digital platforms necessitate robust policies to protect student information and maintain trust (Liu, & Correia, 2021). Institutions must prioritize the development of clear guidelines and adhere to legal and ethical standards.

The digitalization of higher physical education in China represents a paradigm shift with the potential to enhance educational outcomes significantly. Embracing technology offers opportunities to create more engaging, personalized, and flexible learning environments. However, the realization of this potential depends on addressing the challenges identified. Collaboration among stakeholders — including educators, administrators, policymakers, and technology providers — is crucial. By working together to invest in infrastructure, bridge the digital divide, support educator development, and safeguard data privacy, the HPE community can

navigate the complexities of digital transformation. The insights gained from this study contribute to a deeper understanding of the current state of digitalization in HPE and provide a foundation for future initiatives. As China continues to advance technologically, the integration of digital tools in physical education will play an integral role in preparing students to thrive in a digital society.

Future research on digitalization in Chinese higher physical education (HPE) should explore: (1) the long-term impacts of digital technologies on motor skills acquisition and student engagement; (2) optimal blended-learning strategies combining online and traditional instruction; (3) effectiveness of targeted digital-literacy training programs for educators; (4) policy interventions addressing the digital divide, especially among rural and economically disadvantaged students; and (5) ethical frameworks governing the management and protection of personal and health data collected via digital tools .

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СУЧАСНІ ТЕНДЕНЦІЇ ЦИФРОВІЗАЦІЇ ВИЩОЇ ФІЗИЧНОЇ ОСВІТИ В КИТАЇ

У статті представлено аналіз процесу цифрової трансформації у галузі вищої фізичної освіти (ВФО) Китаю із зосередженням на тому, як різноманітні цифрові технології змінюють традиційну практику фізичного виховання. Активна роль уряду Китаю у сприянні цифровізації через такі ініціативи, як «План дій інформатизації освіти 2.0», значно прискорила впровадження онлайн-платформ, носимих пристроїв та інтерактивних технологій, як-от віртуальна (VR) і доповнена (AR) реальність, у ВФО. Детально розглянуто застосування цих технологій в освітньому процесі — від онлайн-платформ, що дають змогу асинхронно опановувати матеріал до носимих пристроїв, які в режимі реального часу відстежують фізичну активність і фізіологічні показники.

Дослідження наголошує на практичних перевагах використання зазначених цифрових інструментів, а саме: підвищення зацікавленості студентів, персоналізовані навчальні траєкторії, ширший доступ до ресурсів фізичного виховання. Завдяки онлайн-платформам стало можливим дистанційне навчання та здобуття теоретичних знань, що набуло особливого значення під час пандемії COVID-19. Такі платформи дають змогу студентам взаємодіяти з різноманітним навчальним контентом, включно з мультимедійними матеріалами, живими демонстраціями та дискусійними форумами. Як приклад наведено платформу "Rain Classroom" Університету Цінхуа, де інтеграція соціальних мереж сприяє посиленню інтерактивності й доступності.

Носимі пристрої, такі як фітнес-трекери, визнані потужними інструментами для трансформації ВФО. Вони пропонують аналітику, яка базується на даних щодо фізичної активності студентів, що дає змогу забезпечити більш персоналізовані інструкції та цілеспрямований зворотний зв'язок.

Розглянуто кейси, зокрема ініціативи Пекінського спортивного університету, де впровадження носимих технологій у навчальний процес сприяло підвищенню мотивації та покращенню результатів студентів. Проаналізовано потенціал VR та AR-технологій, які здатні створювати безпечні, контрольовані та занурювальні середовища, що імітують реальні фізичні активності. Ці технології особливо корисні для навчання складних рухів і навичок, які потребують візуалізації та тренування в умовах, позбавлених ризиків. Наприклад, VR-застосунки у навчанні катання на лижах дають змогу студентам спочатку віртуально опанувати основні рухи, перед тим як спробувати їх у реальному житті.

Однак, попри численні переваги, дослідження виявило кілька критичних проблем, які перешкоджають розкриттю повного потенціалу цифровізації у ВФО. Цифровий розрив залишається важливим питанням, оскільки існують суттєві відмінності в доступі до цифрових ресурсів між студентами різного соціально-економічного статусу. У статті наголошується на важливості забезпечення рівного доступу до цих ресурсів, оскільки студенти із селянських чи малозабезпечених родин можуть не мати стабільного доступу до інтернету чи відповідних пристроїв. Крім того, дослідження вказує на потребу в навчанні та підвищенні кваліфікації викладачів, адже багато фахівців з фізичного виховання не володіє достатньою цифровою грамотністю або опирається новим технологіям. Питання конфіденційності та безпеки даних також викликає занепокоєння, особливо щодо збору та використання особистих і медичних даних з носимих пристроїв та онлайн-платформ. Наголошено на необхідності розроблення надійних політик захисту інформації та зміцнення довіри до цифрового навчального середовища. Автор рекомендує змішану модель навчання у ВФО, що поєднує онлайн-теоретичну підготовку з практичним тренуванням офлайн, аби збалансувати переваги цифрових і традиційних методів. Запропоновано інвестувати в технологічну інфраструктуру, продовжувати дослідницьку роботу та розвивати співпрацю між освітніми установами й урядовими органами для подолання зазначених викликів та забезпечення успішної цифрової трансформації ВФО.

Ключові слова: *цифровізація, вища фізична освіта, Китай, онлайн-навчання, носимі технології, віртуальна реальність.*