

Research on Inheritance and Development of Lotus Lantern Dance in Changge Old City, Henan Province

Yangyang Lyu*, Rita Mee Mee Wong

Faculty of Social Sciences, Arts, and Humanities, Lincoln University College (LUC), Petaling Jaya 47301, Selangor, Malaysia

**Corresponding author: Yangyang Lyu, 394173263@qq.com*

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

Henan, with its strategic location in the middle and lower reaches of the Yellow River, is one of the cradles of Chinese culture, rich in history and vibrant cultural and artistic life. As time has passed, Henan's cultural and artistic development has rapidly advanced, reaching the pinnacle of Chinese cultural development. Thanks to its convenient transportation and vast resources, Henan has become a hub for various cultural and artistic activities across the country. The lotus lantern dance in Changge, Henan, a branch of cultural arts, holds significant importance.

Keywords:

Changge old city lotus lantern dance
Historical origin
Artistic characteristics
Inheritance and development

Online publication: April 26, 2025

1. Cultural environment and historical origin of the lotus lantern dance in the old city

Changge City, located in central Henan Province, borders the ancient capital of Xuchang to the south, the provincial capital Zhengzhou to the north, Kaifeng to the east, and Luoyang to the west. Since ancient times, it has been a strategic location, as the saying goes, He who controls the Central Plains controls Changge. According to the Changge County Annals, Changge is the site of the ancient Ge Tian clan. Archaeological findings show that Changge has multiple sites of the Peiligang culture, where

ancestors lived and thrived as early as 7,000 years ago during the early Neolithic period, engaging in activities such as animal husbandry and farming. The name Changge first appeared in the Spring and Autumn Annals, specifically in the fifth year of Duke Yin of Lu (718 BC), when the people of Song attacked Zheng and besieged Changge. During the Warring States period, the State of Wei built the city of Changshe to the south, and the Qin Dynasty established Changshe County. In the sixth year of the Kaihuang era of the Sui Dynasty (586 AD), Changge County was established, with its county seat in today's Laotown. Throughout the Tang, Song, Yuan,

Ming, Qing, and Republic of China periods, Changge's administrative structure remained unchanged. In 1960, the county seat was moved to Shangheqiao Town.

The Lotus Lantern Dance, also known as the Jumping Lantern Dance or the Lotus Flower Lantern Dance, is a typical children's collective dance from Changge, Henan Province. It originated in Changge City during the Qing Dynasty and has been popular in Changge and its surrounding areas for three centuries. The dance was created by Zhang Heng and his descendants in Ping Street, Laocheng Town, during the Kangxi period of the Qing Dynasty. Over 300 years of performance, it has evolved into a unique form of dance art distinct from other folk dances. In June 2009, it was listed as an intangible cultural heritage project of Henan Province. The Laocheng Lotus Lantern Dance is characterized by its strong folk social fire features and incorporates elements of traditional Chinese opera. Unlike other folk performers, the dancers are all teenagers, giving the dance a distinctive artistic style. During its performance, the dance incorporates elements of the formations and compositions of Central Plains folk dances, developing its own unique artistic features. The dances return to tradition and exploration of the richness of folk art are of great significance. By incorporating various elements of folk culture, opera culture, and folk music, the dance enhances the performance skills of the children and promotes their overall development and mental health. The inheritance and promotion of this dance are essential. The Lotus Lantern Dance of the old city, with its educational value for children, is a testament to the wisdom and labor of the people of Changge, Henan. This dance, a product of the Central Plains people's life and labor, embodies their aspirations and dreams for a better life, driving the continuous development of social culture ^[1].

2. Artistic characteristics of the lotus lantern dance in the old city

The Lianhuadeng Dance of the old city originated as a children's collective dance to celebrate the harvest in Changge County during the Qing Dynasty. Over 300 years, it has developed distinct artistic features. According to surveys, besides the grand Lianhuadeng Festival held annually, which often includes lion, dragon,

bamboo horse, and land boat performances, the dance is also performed at ancient temple gatherings in multiple villages. The dancers in the Lianhuadeng Dance include the commander and the light bearers. The commander stands at the front of the dance team, holding a small flag and directing the performance with flag signals. Regardless of the size of the dance team, there is always one commander. The light bearers are typically young girls and boys aged nine to twelve, with more girls than boys. The dance team usually consists of more than twelve people, sometimes up to twenty or thirty, all holding delicate lotus lanterns and wearing bright dance costumes. They follow the commander, dancing to the rhythmic beats of gongs and drums ^[2].

The performers of the Lianhuadeng Dance in the old city are mainly children, who vividly embody the innocence and purity of childhood. Their movements are lively and dynamic, full of childlike fun, with a cheerful music rhythm, simple props, and lively performance techniques. This dance is performed day and night in Changge and its surrounding areas. During the day, the dance is characterized by its vibrant and enthusiastic movements; at night, from a distance, the lotus lanterns in the hands shine like stars in the sky, and the dance formations continuously change, lively and dynamic, forming characters and various shapes, such as Peace Under Heaven, National Peace and People's Safety, and People-Oriented. The Lianhuadeng Dance in the old city has a rich cultural heritage and unique folk customs, making it a typical children's dance. Its style is filled with childlike fun, lively movements, a brisk rhythm, simple props, and simple yet refined steps, showcasing a distinct local flavor and vitality.

3. The survival status and inheritance of the lotus lantern dance in the old city

The Lianhuadeng Dance of the old city, a children's dance with Central Plains folk customs, holds significant historical, social, and artistic value. Since the reform and opening up, China has been influenced by various cultures, leading to fundamental changes in people's lifestyles and aesthetic tastes ^[3]. The trend of urban-rural integration has further exacerbated the aging of the Lianhuadeng Dance of the old city's inheritors and

reduced its popularity, placing it at risk of extinction. In today's rapidly evolving modern civilization, researching and protecting traditional folk culture has become a crucial aspect of national cultural development. Henan, a region that has played a significant role in the history of Chinese dance, places particular emphasis on the preservation and inheritance of intangible cultural heritage, especially the folk dance art.

According to interviews and family records, the lotus lantern tradition was initially passed down within the Zhang family. The fifth generation of the Zhang family, Zhang Heng, introduced the lotus lantern, which was further promoted by his sixth-generation descendant, Zhang Xi. By the eighth generation, Bao Guang, Jian Yi, and En Tong (a student at the Imperial Academy) had perfected the tradition. In the ninth generation, Xian Zhi (a student at the Imperial Academy, awarded a sixth-rank title), Yuan Di (a student at the Imperial Academy, also awarded a sixth-rank title), and Zhen Zai continued the tradition. In the tenth generation, Dong Tai, You Jiang, Wen Yuan, Xin Jing (a student at the Imperial Academy), Chang Tian, Yun Tong, and Tong Ju further developed the tradition.

Among these inheritors, Zhang Xi, Zhang Tingshu, and Zhang Yingzhou are the most representative. Born on December 30, 1876, and passing away in February 1966, Zhang Xi (whose academic name is Zhang Qingfu) was primarily a businessman. His family ran a general store, and he was widely respected for his honest goods and sincere, kind treatment of people. Not only was he a successful businessman, but he also had profound accomplishments in medicine and the arts, bringing endless joy to the community through his artistic talents. During festivals, he would join other art enthusiasts in playing music and singing, adding to the festive atmosphere. Due to his passion for the arts and the fact that his father and grandfather were prominent figures in politics and passionate about art, he organized and promoted this cultural activity. He gathered children aged nine to thirteen from the village, who created their own routines and designs, made their own props, and bought costumes. They practiced tirelessly, performing in the streets and alleys during festivals, significantly contributing to the development of the lotus lantern dance in the old city^[4].

4. The predicament of the inheritance of the lotus lantern dance in the old city

The protection of intangible cultural heritage in our country is a significant undertaking for today's society, bearing the responsibility of inheriting and developing history. Promoting traditional Chinese folk arts has become a top priority in the goals of inheritance and development. Therefore, attention and participation from all sectors of society are essential. Currently, the challenges faced by the Laocheng Lotus Lantern Dance in its inheritance process include the fact that the protection efforts remain largely led by relevant government departments, organized by cultural centers, with inheritors engaging in activities independently, and lacking a systematic approach. To address these challenges, the Laocheng Lotus Lantern Dance must take necessary measures to change the current situation. First, it should strengthen cooperation with the media to make this traditional folk dance more widely known and interesting^[5]. Second, it should collaborate with various sectors of society, such as enterprises and schools, to promote the Laocheng Lotus Lantern Dance through publicity, thereby increasing public awareness. Through teaching, research, and visits to experts and scholars, we can enhance societal understanding of the protection of intangible cultural heritage, encouraging greater attention and participation in the activities of protecting and inheriting the dance, thus involving more people. With the rapid development of China's market economy, cultural development has expanded from enterprises and institutions to schools and society at large. In a new stage of development, the development of intangible culture and these cultures are mutually reinforcing and inseparable^[6].

School is an important place for cultural inheritance, and school education is an important way of cultural inheritance in modern society. In today's society, where traditional methods of family and community inheritance are gradually declining, establishing a method for the inheritance of school education can help preserve the Lianhuadeng Dance in the old city. Nowadays, the state is increasingly focusing on the inheritance and protection of intangible cultural heritage, announcing several batches of key protection projects and providing substantial financial support. However, there are still some issues. While this has sparked a heritage application fever, the government needs to mature in its approach to development and

protection during implementation. Currently, the Lianhuadeng Dance in the old city faces the challenge of insufficient publicity^[7].

This phenomenon highlights the severe lack of school-based educational inheritance for the Lianhuadeng Dance in the old city. Since the performers are primarily children, schools are the ideal venue for this form of cultural transmission. Not only does it allow students to appreciate and engage with China's rich folk dance culture, but it also contributes to the preservation and development of this intangible cultural heritage. School-based inheritance is not only sustainable but also beneficial for students' physical and mental growth. However, current school dance education focuses more on modern dances, with few opportunities to perform traditional dances, leading to a significant gap in the inheritance of traditional dance. Today, the school-based inheritance model is considered a crucial method for ensuring the long-term development of the Lianhuadeng Dance in Changge Old City.

Due to the lack of promotion and education in schools and insufficient government funding, the school-based education of the Lianhuadeng Dance in the old city remains a gap. To establish a method for inheriting this dance through schools, we can extend it beyond local primary and secondary schools within the province to include students from other ethnic groups outside the province who are interested in learning about the Lianhuadeng Dance culture. Therefore, relevant government departments should enhance their awareness of inheritance and development, actively promote and develop intangible cultural heritage projects, increase financial support, provide economic assistance, and offer additional training courses. These measures aim to gradually instill a sense of responsibility and mission among inheritors towards the preservation of intangible cultural heritage. Through these efforts, the Lianhuadeng Dance in the old city can be better protected, ensuring its continuation and development as an intangible cultural heritage project.

5. Thoughts and suggestions on the inheritance of the lotus lantern dance in the old city

Nowadays, every minute, intangible cultural heritage

bearers in our country are disappearing, and folk cultural projects are vanishing. The Lianhuadeng Dance in the old city mainly relies on the skills and arts of the bearers who have been passed down from generation to generation. Most of the older bearers are now elderly and have difficulty moving around. Therefore, the cultivation of new bearers has become more urgent than ever. Protecting intangible cultural heritage means protecting its bearers. Government departments should gradually improve their protection mechanisms. The Changge City government should provide fixed rehearsal venues and financial support to the bearers to conduct inheritance and dissemination activities. Government departments should actively implement national policies supporting bearers, providing them with better living and development opportunities. For bearers with poor living conditions, necessary living subsidies should be provided to meet their basic needs. For those with better economic conditions, social recognition and awards should be given based on their performance in various activities, enhancing their enthusiasm and sense of responsibility for inheritance. It is essential to ensure that funds reach each bearer, providing them with strong support to focus on inheritance and research, avoiding the risk of them being abandoned due to financial difficulties.

Nowadays, school education is a vital channel for the transmission of modern social culture. We advocate that school education should not only keep pace with the times and impart advanced cultural knowledge but also take on the responsibility of promoting and preserving the traditional national culture that has been passed down in China for centuries. Due to natural and historical reasons, the Lianhuadeng Dance in the old city can only be passed down through traditional methods of oral and physical instruction within families and communities. The relatively backward economic development at that time hindered the educational level of the Lianhuadeng Dance community, and historically, there has been no formal school-based education for the Lianhuadeng Dance. To ensure the continuous transmission of traditional culture, especially intangible cultural heritage, it is essential to fully leverage the role of school education. A new method of school-based inheritance should be established, starting with the education of Lianhuadeng Dance culture in local primary and secondary schools in

Changge. Government departments need to intervene, and the education department of Changge City should integrate the education of Lianhuadeng Dance culture into the regular education system, making it part of students' extracurricular activities and incorporating it into regular art program rehearsals. This not only nurtures new forces for cultural inheritance but also strengthens the close collaboration between the government and schools. Excellent folk arts and cultures should be integrated into the education curriculum of all levels and types of schools, and based on actual conditions, additional courses on Lianhuadeng Dance should be added. The specialized classes and training programs for lantern dance aim to find new breakthroughs in the inheritance of this ancient traditional art. As times evolve, while preserving traditional folk arts, they can also incorporate new elements, making the art form more vibrant and diverse. By bringing intangible cultural heritage into schools, this nearly lost art of lotus lantern dance can be popularized, ensuring its legacy is passed down through generations, continuing without end.

Since the reform and opening up, China has been influenced by a variety of cultures, leading to fundamental changes in people's lifestyles and aesthetic

tastes. As the socialist market economy rapidly develops, research on the inheritance and development of the traditional folk dance of Changge Lotus Lantern Dance in Henan has become scarce. Furthermore, with the rise of urban-rural integration, the aging of the traditional lotus lantern dance inheritors in the old city and the decline in its popularity have put it at risk. In light of this situation, today's society should pay more attention to and support the traditional lotus lantern dance of the old city. Protecting and inheriting the traditional lotus lantern dance is essential for preserving its historical legacy. Like all ancient national arts, protecting traditional ethnic folk arts is an urgent task for contemporary society. In the development of national cultural undertakings, it is not only necessary to study traditional folk dances but also to protect them. Henan stands out in the history of Chinese dance, facing the risk of traditional dances being lost. Therefore, protecting the existing living folk dances is crucial. The traditional lotus lantern dance of the old city is the crystallization of the labor and wisdom of the people of Changge, Henan. It is a product of the life and labor of the people of Central Plains, reflecting their aspirations and dreams for a better life. The dream drives the continuous development of social culture.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Xiao Tong of Liang Dynasty (Southern Dynasties), 1977, Wen Xuan, Zhonghua Book Company, Beijing.
- [2] Lotus Lantern Dance, Xuchang Volume, Henan Ethnic and Folk Dance Collection, 2005, Xuelin Publishing House, Xuchang.
- [3] Liang J, 2003, New Introduction to Art, Southwest University Press, Chongqing.
- [4] Wang J, Dong Y, 2007, National Cultural Heritage and Education, Central University for Nationalities Press, Beijing.
- [5] An X, 2008, Research on Intangible Cultural Heritage of Ethnic Minorities, Central Nationalities Publishing House, Beijing.
- [6] Chen J, 2005, Geographical Characteristics of Chinese Folk Dance and Tourism Development. Fujian Geography, (10).
- [7] Wang Y, 2009, Characteristics and Forms of Expression of Folk Dance in Chinas Intangible Cultural Heritage. National Chinese Core Journal Art 100, (8).

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

The Integration and Innovation of Virtual Reality Technology in Film Production

Jingwen Zhang

Communication University of China Nanjing, Nanjing 211172, Jiangsu, China

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

The widespread application of virtual reality (VR) technology in the film production industry has become a significant development trend in recent years. This technology has not only revolutionized the creative model of filmmaking but also provided audiences with a brand-new immersive viewing experience. Strengthening the integration and innovation of VR technology in film production has become a necessary path for upgrading the film technology industry, requiring in-depth exploration from multiple dimensions, including technological R&D, content creation, virtual production, talent development, policy support, and ethical balance.

Keywords:

Virtual reality technology
Film production
Integration
Innovation

Online publication: April 26, 2025

1. Introduction

On March 21, 2025, the National Film Administration officially issued the Notice on Promoting the Orderly Development of Virtual Reality Films, explicitly incorporating virtual reality (VR/AR/MR) films into China's film industry system. The goal is to standardize the management of "virtual reality films," expand film formats, promote technology-industry integration, and support the construction of a "film power." The integration and innovation of VR technology in film production have become a vital force driving transformation in the film industry. From immersive viewing to the innovation of narrative spaces, VR technology has not only brought a new cinematic experience to audiences but also provided

creators with broader creative horizons. However, the widespread application of this technology also faces numerous challenges, requiring policy support, technological innovation, and industry collaboration to achieve deeper integration and optimization^[1].

2. Applications of virtual reality technology in film production

As a cutting-edge field of deep integration between artificial intelligence and digital technology, virtual reality technology is reconstructing the artistic form and industrial ecology of cinema. "Virtual reality films" not only create a 360-degree immersive aesthetic experience

but also open up new narrative dimensions through human-computer interaction and the coexistence of virtual and real elements. This not only enriches the cinematic experience and cultivates new film cultural consumption models but also provides a broad imaginative space for exploring new expressions of film content. “Virtual reality films” are not a substitute for traditional films but a historical opportunity to expand the boundaries of the silver screen. Specific applications include the following.

2.1. Enhanced immersive experience and narrative innovation

From sound films to color films, and then to the development of 3D and 4D films, the integration of virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies with cinema is an inevitable result of the evolution of this comprehensive art form. The core function of film lies in conveying emotions and ideas through audio-visual information while continuously attempting to break through traditional two-dimensional perceptual dimensions to provide audiences with more diverse viewing atmospheres and immersive experiences. The introduction of virtual technology has reconstructed the narrative logic of film, transforming audiences from passive “bystanders” into “participants” in the story ^[2]. For example, in the 2016 VR short film *Gnomes & Goblins*, audiences can freely choose their focus, obtaining a personalized narrative experience; in the 2017 VR documentary *Notes on Blindness: Into Darkness*, audiences trigger scene changes through head movements, directly influencing the development of the plot. This interactivity not only enhances immersion but also promotes the shift in film narrative from a “director-centered” to an “audience-centered” model. The integration of virtual technology and film marks the leap of cinema from a single audio-visual medium to a multi-dimensional immersive experience, redefining narrative logic and providing audiences with unprecedented participation and personalized experiences, indicating the future direction of film’s transformation from “storytelling” to “experience creation.”

2.2. Realization of virtual production and real-time rendering

As the core driving force of film industrialization, virtual

production technology constructs a more efficient hybrid production model by integrating the interdisciplinary advantages of virtual reality, augmented reality, and computer graphics (CGI). Its core technical approach is reflected in: using UE5’s virtual geometry system to achieve real-time asset rendering, combined with the sub-millimeter precision tracking of the OptiTrack motion capture system, enabling seamless stitching of virtual scenes and live-action elements at the frame level ^[3]. For example, during the filming of *The Mandalorian Season 2* in 2021, a 270° curved LED volume stage combined with Unreal Engine 5.0 was used to seamlessly integrate dynamic sky boxes with physical reflections in real time, allowing the director to adjust lighting curves and depth-of-field parameters in real time through the NVIDIA Omniverse platform during filming, compressing the traditional green screen post-production timeline of 6–8 weeks into the same day of shooting ^[4,5].

2.3. Enhancement of visual effects and creative realization

The application of virtual reality technology in film special effects production has promoted the transformation of the film industry toward real-time and interactive production models. By simulating real-world environments, VR technology can create surreal scenes such as the universe, underwater worlds, or monsters at low cost and high efficiency, bringing immersive visual experiences to audiences. For example, the *Avatar* series used VR technology to build the dynamic ecosystem of Pandora, seamlessly integrating virtual scenes with live-action elements. Additionally, virtual production technology supports directors in completing scene design and character motion capture in virtual environments through motion capture systems and real-time rendering technology, breaking through the limitations of physical shooting. This “what you see is what you get” workflow not only reduces production costs but also brings about a new model of creative iteration, laying the technical foundation for the transformation of film from “post-production special effects” to “pre-production special effects.” The introduction of VR technology has enhanced the possibilities of creative realization, providing core support for the construction of future film metaverses.

2.4. Promotion of interactive films and audience participation

The breakthrough progress of VR technology has completely subverted the traditional film narrative model, allowing audiences to immerse themselves in the narrative space from a first-person perspective and directly shape the plot through voice commands, gesture operations, or key node selections ^[6,7]. For example, *Black Mirror: Bandersnatch* grants audiences decision-making power through a branching narrative structure, with plot forks appearing every 15 minutes on average, ultimately forming a complex narrative network. This multi-path narrative model not only enriches storytelling but also shortens the distance between audiences and works, indicating that film art will evolve from a one-way communication medium to a multi-dimensional perceptual community.

3. Impacts of virtual reality technology on the film industry

3.1. Collaborative development of industrial ecology

The introduction of virtual reality technology has promoted the collaborative development of the film industry chain. For example, cooperation with fields such as gaming and animation has provided new opportunities for film and television creation while also promoting the research, development, and popularization of related hardware devices (such as VR headsets and gloves). This cross-industry integration not only enriches the expressive forms of film but also enhances its market competitiveness.

3.2. Transformation of film narrative language

The immersive nature of VR technology has brought new possibilities to film narrative language. Directors can achieve non-linear and multi-perspective narratives through virtual environments, thereby breaking the narrative framework of traditional films. Works such as *Brave New Films* and *Michea Reno* demonstrate how VR technology is changing film creation methods.

3.3. Optimization of cost and efficiency

The application of virtual reality technology has significantly reduced the cost and time of film production. For example, virtual sets have replaced traditional green screen shooting, making scene construction more efficient. Additionally, real-time rendering and motion capture technologies have reduced post-production workload, further improving production efficiency.

4. Challenges in the application of virtual reality technology in film production

While virtual reality technology has brought new possibilities for immersion and creative expression to film production, it also faces numerous challenges, primarily in technical, narrative, user experience, and cultural aspects.

4.1. Technical challenges

Film production using VR technology must overcome several technical difficulties. First, the weight and portability of hardware devices significantly affect the audience's viewing experience. Meanwhile, panoramic camera equipment is costly and difficult to popularize, and synchronized shooting and post-processing between devices increase production complexity ^[8]. In content production, VR films require high-frame-rate and high-resolution images to provide smooth viewing experiences, placing extremely high demands on networks and servers. Furthermore, the post-production process for virtual reality films is complex, requiring stitching and adjustment of footage from multiple cameras to ensure visual coherence and consistency.

4.2. Narrative challenges

Traditional film narrative relies on linear structures, while VR films require creators to build entirely new audio-visual expression systems. As audiences can freely move their perspectives, traditional narrative logic may be disrupted, requiring directors to redesign story structures to guide audience attention and maintain plot coherence. For example, VR films need to attract audience attention through elements such as sound, light, and moving objects, increasing narrative complexity. Additionally, screenwriting for VR films is far more challenging than

for traditional films, as scripts must account for audience choices and interactivity. This non-linear narrative approach places higher demands on directors and screenwriters and may affect audience comprehension and acceptance of the story.

4.3. User experience issues

Although VR technology provides immersive viewing experiences, its limitations are evident. For example, prolonged use of VR headsets may cause discomfort, dizziness, or nausea in users. Additionally, while the interactivity of VR films enhances audience participation, it may also distract viewers and affect the viewing experience. In cinema environments, audiences need to wear VR devices for extended periods, posing significant physical challenges. Therefore, VR devices developed for cinemas need breakthroughs in portability, lightweight design, and display quality ^[9,10].

4.4. Cultural and industrial adaptation issues

As an emerging medium, the cultural attributes and industrial adaptability of virtual reality films still require further exploration. The traditional film industry has established mature production processes and technical standards, while VR film production processes and technical requirements are entirely different. For example, VR film shooting requires coordination between multiple cameras and cannot use traditional recording equipment. The business models and profit mechanisms for VR films are unclear, making promotion and commercialization difficult for industry practitioners. Despite their enormous potential, the popularization and development of VR films are still constrained by technology, costs, and user acceptance.

Virtual reality technology has revolutionized film aesthetics and creative logic, but its integration into film production faces multiple constraints, including insufficient hardware performance, complex narrative logic, unintuitive interaction design, and cross-cultural adaptation issues. These challenges require industry professionals to continuously explore and develop solutions to break through obstacles and promote the collaborative innovation of VR and the entire film industry chain.

5. Strategies for integration and innovation of virtual reality technology in film production

5.1. Strengthening policy support to ensure industry standardization

Government departments can promote the application of virtual reality technology in film production through policy support. For example, the Notice on Promoting the Orderly Development of Virtual Reality Films issued by the National Film Administration clarifies the definition and standards for virtual reality films and encourages technological innovation. Such policy support helps standardize industry development and inspires more creators to experiment with new technologies. Meanwhile, promoting high-quality VR content and establishing sound distribution channels can expand the market influence of virtual reality films.

5.2. Enhancing technical R&D and cultivating professional and applied talent

Virtual reality and augmented reality technologies are essential tools in film production, offering immersive experiences and interactivity. For example, VR technology can be used to construct virtual scenes, allowing directors and cinematographers to optimize scene design through immersive previews before shooting, thereby improving production efficiency and quality. Additionally, advancements in real-time rendering technology have made virtual scene generation smoother, providing creators with greater creative freedom. Combined with artificial intelligence (AI) and machine learning (ML), script analysis, character design, and special effects production can be further optimized to enhance creative decision-making capabilities. Films like *Avatar* have achieved unprecedented visual effects through virtual reality and CGI technologies, demonstrating that technological innovation is crucial for enhancing film artistry.

The application of virtual reality technology requires professional talent. Film and television production institutions should collaborate with universities to offer relevant courses and cultivate professionals with VR technology application capabilities. These talents must not only master traditional film and television production skills but also be familiar with the operation

and characteristics of VR technology. Furthermore, cross-industry collaboration within the industry is an important pathway to drive technological innovation. For example, the integration of VR technology with gaming and animation can bring more inspiration and possibilities to film creation.

5.3. Carrying out interdisciplinary collaboration to achieve resource optimization and integration

Filmmakers should collaborate with technology developers, artists, and experts from other fields to jointly explore new applications of VR technology in film. Non-linear and immersive narratives are becoming mainstream trends. Through VR technology, creators can break free from traditional narrative structures, allowing audiences to explore stories from multiple perspectives and enriching narrative layers. For example, integrating artificial intelligence and machine learning technologies can optimize functions such as script analysis and facial recognition.

5.4. Strengthening market promotion and further optimizing user experience

VR technology has brought new possibilities to film narratives. Audiences can deepen their engagement with stories by choosing different perspectives and interaction methods, enhancing their sense of participation and immersion. For example, interactive films allow audiences to advance the plot based on their choices, blurring the lines between film and gaming and providing more personalized viewing experiences. Production teams should focus on audience needs, design user-friendly interaction methods, and regularly conduct user testing and feedback collection. Additionally, promoting VR films through crowdfunding platforms and social media can attract more audience attention and participation.

5.5. Improving scene effects and scientifically applying virtual production and virtual sets

Virtual production technologies (such as LED walls and virtual cameras) are reshaping film and television production processes, gradually replacing green screen shooting with core advantages such as real-time rendering and dynamic light interaction. This technology enables

shooting cycle compression, post-production cost reduction, and accelerated creative iteration through real-time monitoring and special effects previews of virtual scenes. Streaming works represented by *The Mandalorian* have used this technology to build an immersive Star Wars universe, reducing the time and space costs of traditional on-location shooting to zero. Furthermore, virtual reality-assisted digital asset creation allows creators to directly manipulate virtual sets and character animations in a holographic workflow, reducing time and space constraints during actual shooting.

5.6. Enhancing user experience and strengthening the balance between ethics and user experience

While advancing technology, creators need to pay attention to ethical issues and user experience. For example, virtual reality technology may trigger ethical controversies such as privacy leaks and data manipulation. Therefore, creators must embed privacy protection mechanisms in the creative process to ensure that technological applications always serve content expression. At the same time, they should focus on content ethics and diversity, optimizing interaction design through regular user testing and feedback iteration to achieve a dynamic balance between experience innovation and value orientation while ensuring data security.

6. Challenges and future prospects

Although VR technology has demonstrated significant application potential in film production, its development still faces multiple challenges. From the perspectives of technical costs and popularization, the high investment in advanced VR equipment and technologies significantly restricts the application feasibility for small and medium-sized production companies. In terms of user experience and content quality, balancing technological innovation with artistic expression is a critical issue. Producers must ensure that new technologies do not overshadow the core focus on storytelling. Additionally, the application of VR technology has raised new issues such as privacy protection and data ethics, requiring industry professionals to construct a creative framework that covers content

ethical compliance and cultural diversity adaptation while exploring technological innovation, ultimately forming a sustainable development path that integrates technological drive with humanistic values.

The most fundamental challenge lies at the cultural attribute level. Since its inception, film has carried the function of collective social interaction, and the current consumption pattern of China's film market, which is dominated by family viewing, has further strengthened this feature. When audiences wear VR devices, the public space attribute of cinemas will be deconstructed, and the emotional interaction derived from collective viewing will disappear. The essential difference between this personalized viewing model and family/social viewing may undermine the sociocultural foundation of film art.

In the future, with upgrades in hardware devices, improvements in software development capabilities, and the perfection of relevant laws and regulations, virtual reality technology will play a more significant role in the film industry. For example, policy documents issued by the National Film Administration clearly support the development of virtual reality films and encourage

localities to actively promote the application of related technologies. Additionally, the rise of extended reality (XR) technology will further integrate VR, AR, and mixed reality, bringing more possibilities to film production.

7. Conclusion

Although the development path of “virtual reality films” is fraught with challenges, every technological revolution is accompanied by the pain of transformation. Film art will ultimately open up a broader dream space for humanity in the new dimension of interwoven virtual and real worlds. The integration and innovation of virtual reality technology in film production have not only brought new viewing experiences to audiences but also provided creators with broader creative horizons. To achieve the widespread application and deep integration of this technology, joint efforts in policy support, technological innovation, and industry collaboration are still required.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Lin J, 2024, Application of Virtual Reality Technology in Contemporary Film Production in the Digital Age. *Sound and Screen World*, 2024(21).
- [2] Wu M, 2024, Research on the Application of Virtual Reality Technology in Animation Design. *Toy World*, 2024(06).
- [3] Zhang Q, 2022, Exploration of the Integration of Virtual Reality Technology and Chinese Opera Performance—Taking the “R&D of a Simulation Performance System for Chinese Traditional Opera Adapted to Real Humans” as an Example. *Performance Technology*, 2022(04).
- [4] Zhang W, 2023, Analysis of the Application and Development of Virtual Reality Technology in Film and Television Production. *Journalism and Communication*, 2023(01).
- [5] Li Y, 2023, Presentation and Value Shaping of Virtual Reality Technology in Film-Game Integrated Films. *Film Literature*, 2023(03).
- [6] Wu G, 2023, “Seeing is Believing” in a Luminous World—Virtual Reality Technology and Film Ontology. *Film Art*, 2023(03).
- [7] Miao K, 2023, Application of Virtual Reality Technology in Film and Television Production in the Converged Media Era. *Television Technology*, 2023(08).

- [8] Wang Y, 2023, Application Strategies of Virtual Reality Technology in Traditional Theatrical Stages. Art Education, 2023(09).
- [9] Xu Z, 2022, Research on the Application of Virtual Reality Technology in Animation. Art Observation, 2022(05).
- [10] Cheng X, 2021, Application and Development Prospects of Virtual Reality Technology in the Film and Television Field. Yangtze Information & Communications, 2021(09).

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Barriers to Effective Inclusive Education in Primary School in China: Perspectives from Teaching Practice

Danyang Sun

Tongren Preschool Education College, Tongren 554300, Guizhou, China

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

Inclusive education is steadily developing and has achieved some results in China, but there are also many barriers, such as insufficient teacher capacity for inclusive education, insufficient school resource support, and difficulties in communicating with parents. These barriers are particularly evident in underdeveloped provinces, which constrain the development level of inclusive education in the local area and are detrimental to educational equity. This study conducted interviews with 15 teachers from 3 ordinary schools in Guizhou Province in China. Through thematic analysis, the results were obtained from three aspects: teaching practice, barriers faced, and solutions. In terms of teaching practice and the obstacles faced, there are significant problems such as insufficient level of inclusive education, insufficient personalized education, communication difficulties, inadequate management of behavioral norms, and lack of resources for teachers. Teachers overcome these obstacles through self-improvement, diversified teaching methods, emotional communication, and seeking external help, with good results.

Keywords:

Inclusive education
Teaching practice
Primary school
Interviews

Online publication: April 26, 2025

1. Introduction

In 1994, UNESCO first proposed inclusive education at the World Conference on Special Needs Education, which is a new educational trend advocated by the international community. Inclusive education requires that any school has an obligation to enroll any child in its jurisdiction and provide them with education suitable for their physical and mental health development^[1]. Based on this, through unremitting efforts and development, China has made significant improvements in the development level, teaching conditions, and teaching efficiency of inclusive

education^[1]. To promote the high-quality development of special education, China has provided sufficient support for the cultivation and development of inclusive education for teachers.

At the same time, there are theoretical and practical gaps in relevant research both domestically and internationally. For example, the existing inclusive education program system is not perfect. In terms of practical gaps, many ordinary teachers lack sufficient understanding of the relevant theories of inclusive education teaching due to various reasons, resulting in a

lack of knowledge on how to deal with various problems arising from special needs children in teaching practice. Especially for ordinary schoolteachers in remote areas, their understanding of educational theory and teaching practice are disconnected under limited conditions ^[2].

This study investigated the problems of inclusive education in China from the perspective of teaching practice and proposed corresponding solutions. Three research questions were answered: “What are the current teaching practices of primary school teachers in handling inclusive education?”; “What are the barriers faced of the primary school teachers in handling inclusive education?”; “How do primary school teachers overcome the barriers in inclusive education?”. The conclusions of this study offer practical guidance for primary school teachers by presenting specific, actionable strategies to improve their teaching methods. These strategies can help teachers better address the diverse learning needs of their students, enhance teaching effectiveness, and strengthen their professional competence in the field of inclusive education. This may make them more competitive in terms of career advancement or professional recognition. Special students can receive more appropriate support, and ordinary students can also cultivate a sense of tolerance and cooperation in a more inclusive learning environment, which also helps to improve students’ learning efficiency ^[3].

2. Methods

This study adopted a qualitative research method. Based on the research aids of this study, the main tasks were to understand the current teaching practices of primary school teachers, the barriers faced of primary teachers and the strategies of primary school teachers overcome the barriers. Since these tasks do not involve quantitative relationships or assumptions, interviews are the most appropriate method to accomplish them. Therefore, a qualitative research approach is more suitable ^[4].

Interviews have been conducted in 3 public ordinary primary schools in Guizhou Province of China. The core criteria for selecting schools include three. One is the geographical coverage and level of economic development. Regions with different levels of economic development were selected to reflect the impact of urban-rural differences on the allocation of inclusive education resources. The

second is the type of school ^[5]. All three schools are ordinary public primary schools, not special education schools or key prestigious schools, with a moderate scale, and schools that have accepted special students. Students with special needs have been enrolled in these schools, and teachers have attached importance to inclusive education and have gained some teaching experience. In the three schools, 15 teachers have been selected using random sampling techniques to conduct interviews, which means 5 teachers have been selected in each school. The teachers as participants met three conditions: having a bachelor’s degree or above, having teaching experience of inclusive education for more than 1 year, and participated in teacher training of inclusive education, but not having an education background in major of special education ^[6].

The interview instrument adopted a self-designed “Lived experiences of primary school teachers handling children with special needs” as the outline, which includes 4 parts. The first part is personal information, including sex, age, educational background, etc., for statistical analysis. The second part is current teaching practices in inclusive education. The third part is the barriers faced by primary school teachers in inclusive education. The fourth part is about overcoming barriers by primary school teachers in inclusive education. The interview outline is semi-structured, and the questions listed above are only intended to prompt researchers to moderately limit the scope of the conversation during the interview process and are not intended to limit or prompt the participants’ speech content. Interview data is in textual form, so this study used thematic analysis to analyze them ^[7].

3. Results

In the interviews, four questions were used to discuss the current teaching practices of primary school teachers. According to the teaching practice theory, the quality of teaching practice can be divided into classroom culture, instruction, and socioemotional skills ^[8]. So, there are a total of 60 answers from 15 participants, themed as follows in **Table 1**.

There are a total of 45 answers discuss the barriers faced of the primary school teachers can be themed as follows in **Table 2**.

There are a total of 60 answers discussing strategies to overcome barriers can be themed as follows, in **Table 3**.

Table 1. Themes of current teaching practices

| Theme | Sub-theme | Participant | Example |
|--|--------------------------------------|-------------|--|
| Creation of classroom culture | Creating an inclusive environment | T7 | Creating an inclusive atmosphere is very important. Organizing class meetings and other methods can guide students to accept special students. |
| | | T12 | Select educational partners for special needs children, who can provide guidance and assistance in their academic studies. |
| | Behavior management | T2 | Provide appropriate rewards to special students to encourage their good behavior, which can be material or spiritual, such as snacks or verbal praise. |
| | | T8 | Use specific and direct guidance methods to help them understand classroom rules. |
| Conduction of instruction | Adjustment of teaching | T1 | Simplifying or enriching teaching content to better meet the cognitive level of special students can also help enhance their confidence in learning. |
| | | T7 | We developed an IEP based on the different needs and characteristics of students, to provide them with more targeted teaching support. |
| | Auxiliary teaching methods | T14 | Involve all students in the classroom, such as using gamified and cooperative learning, to ensure that every child can learn knowledge. |
| | | T8 | Utilize assistive technology and teaching aids to help students better understand and master knowledge. |
| | Communication and feedback | T6 | Communicate with students, parents, and superiors to understand feedback on teaching and learn from others' good practices and obtain more resources. |
| | | T13 | Observe classroom reactions after classes to identify my shortcomings and then make progress by searching for information with colleagues. |
| The promotion of socioemotional skills | Emotional management | T4 | Create a harmonious classroom atmosphere that respects, appreciates, and encourages special students. |
| | | T15 | Teach special students simple emotional regulation methods. When they feel anxious or nervous, guide them to calm their body and emotions. |
| | Improvement of socioemotional skills | T2 | Encourage students not to be afraid and encourage them to boldly try to participate in the class. |
| | | T12 | Praise special children based on their situation to enhance their self-esteem and desire for expression. |

Table 2. Themes of barriers faced of the primary school teachers

| Theme | Sub-theme | Participant | Example |
|-----------------------------------|---|-------------|--|
| The barriers in classroom culture | Teachers lack professional knowledge | T1 | The differences between students with different backgrounds and abilities are significant and difficult to balance. |
| | | T3 | The lack of professional knowledge and skills makes me feel helpless when facing many special students. |
| | Insufficient external support | T7 | Implementing inclusive education requires sufficient teacher resources and teaching support, but there is often a shortage of teachers and resources. |
| | | T8 | Parents of ordinary students do not agree, fearing that the presence of special students may affect their children's learning. |
| | Communication difficulties | T6 | The difficulty in communication is very high, especially for children with cognitive impairments, who I cannot communicate smoothly with. |
| The barriers in instruction | Limited teaching level in inclusive education | T4 | Special students have different types and levels of disabilities, so their educational needs are also different, and sometimes it is impossible to balance them. |
| | | T7 | Due to the personalized and diverse needs of special students, it is difficult to find customized educational methods that are suitable for them. |
| | Insufficient resources and support | T1 | Developing a suitable teaching plan for each special student requires time and professional knowledge, but the workload is heavy. |
| | | T8 | Not all parents support teachers using new educational methods due to parental obstruction. |
| | Inefficient communication | T2 | Because these students are quite special, they also believe that they are different from others, so they dare not express their inner thoughts. |
| | | T3 | Establishing effective communication channels with students with language, hearing, or cognitive impairments is a major challenge. |

Table 2 (Continued)

| Theme | Sub-theme | Participant | Example |
|---|--|-------------|--|
| The barriers in the socioemotional skills | Insufficient professional competence of teachers | T1 | It is very difficult for me to accurately identify and understand the emotional needs and trigger points of special students. |
| | | T5 | The barriers in supporting the emotional well-being of special needs students include understanding their unique needs, building trust relationships... |
| | Communicative disorders | T3 | For example, students with autism have very limited and simple language, making it difficult to understand their true thoughts. |
| | | T8 | The lack of communication among students is a great challenge, and special students rarely express their emotions to the outside world. |
| | Time and energy are limited | T4 | The workload is heavy, and there is no energy to take care of the emotions of special students. |
| | | T6 | Special students require more patience and careful care than ordinary students, but because of the lack of time, I am unable to pay attention to their emotions. |

Table 3. Themes of strategies overcome barriers

| Theme | Sub-theme | Participant | Example |
|---|------------------------------------|-------------|---|
| The strategies in creation of classroom culture | Self-improvement and encouragement | T1 | Continuously learning and researching the best practices for integrating educational classroom culture and applying them to my teaching. |
| | | T3 | Build confidence in myself and continuously improve my abilities through learning. |
| | Seeking support | T12 | Inquire with parents about the basic situation of special needs children, search for information to fully understand their needs, and comfort parents' concerns about their children. |
| | | T11 | ...collaborating with colleagues, gradually creating an inclusive classroom culture that is suitable for all students. |
| The strategies in conduction of instruction | Teaching adjustments | T1 | By providing learning activities of different difficulty levels and levels, ensure that each student can make progress at their own level of ability. |
| | | T11 | I have found that...providing multiple learning paths are particularly effective, as these strategies help students with different abilities to participate and progress. |
| | Auxiliary teaching methods | T2 | Encouraging students to form small groups, sharing weal and woe, and helping each other can fully stimulate their learning enthusiasm. |
| | | T6 | Develop special reward and punishment mechanisms and strictly enforce them. |
| The strategies in socioemotional skills | Organize collective activities | T5 | I organized group cooperative games, role-playing, and peer assistance to help children establish friendships and improve social skills through interaction. |
| | | T7 | Create common interests, form interest groups, and cultivate a sense of mutual assistance within the group. |
| | Daily interaction | T10 | Encourage ordinary students to help special needs students and encourage them to bravely express themselves. |
| | | T6 | Treat students without discrimination, communicate patiently with them, observe their behavior, and only give fair judgments when problems arise. |

4. Discussion

According to the results of interviews, the current teaching practices of primary school teachers in inclusive education can be discussed as follows: Firstly, understanding special students is an important prerequisite. The participants repeatedly answered the importance of understanding special children in every

domain of the questions. Without understanding special children, it is impossible to create a suitable classroom culture. Secondly, the quality of individualized teaching is not good enough. From the responses of the participants, it was found that the teacher adjusted the teaching content, pace, and format for special students to better adapt their learning abilities^[9]. In addition, peer assistance

and collaboration are widely adopted by teachers. Participants all expressed that they have adopted methods such as “peer support,” “cooperative learning,” “group activity,” and “encouraging cooperation” to complete teaching practices of inclusive education. Furthermore, there is a lack of rules for emotional and behavioral management. The participants have a consistent approach to creating classroom rules for special students and strategies for managing their emotional issues, with a focus on attention, encouragement, and praise. As well, homeschool communication is an important way to obtain support. Parents of students are both supervisors and supporters of education ^[10]. Some participants chose to obtain support from parents of special students by maintaining communication. Moreover, there is a serious lack of school resource support. As an important teaching resource, assistive devices can bring a lot of convenience to the learning and life of special students, as well as teaching aids, toys, and training equipment specially designed for special children’s deficiencies.

Barriers faced of primary school teachers can be discussed as follows: Firstly, insufficient ability of teachers to provide inclusive education. Secondly, difficulty communicating with special students and student’s parents. Thirdly, insufficient resource support from schools. Participants in the interviews generally expressed that schools provide insufficient resource support for inclusive education ^[11].

Strategies to overcome barriers can be discussed as follows: First, self-improvement. Self-improvement is the answer given by most participants, and it is also the fundamental strategy to address the insufficient capacity of teachers in inclusive education ^[12]. Second, adopting diverse teaching methods. Adopting diverse teaching methods is also a form of self-improvement, but it is

more focused on overcoming the challenges faced at present, and self-improvement is long-term and slow. Third, engage in emotional communication with students’ parents. Communication is an art and one of the essential skills for a teacher. In inclusive education, teachers need to maintain close communication with students’ parents and obtain the necessary information. Fourth, seek help from leaders and colleagues. One person’s power is limited, and inclusive education should not be the task of teachers alone. As an inclusive teacher, it is essential to learn how to seek help from leaders and colleagues and actively engage in teamwork ^[13].

5. Conclusion

On current teaching practices in inclusive education, the creation of classroom culture, the accessible environment, and the diverse assistance provided by teachers for special students are important elements. The insufficient professional knowledge and skills of teachers, inadequate support from ordinary students and parents, insufficient educational resources, and difficulties in communicating with special needs students are the main barriers faced in inclusive education ^[14]. In overcoming the barriers, classroom culture creation, the improvement of teachers’ own abilities, encouragement of ordinary students by teachers, communication between teachers and parents, and seeking help from leaders and peers are all effective strategies. According to the interview results, the use of strategies provided guidance for teachers and allowed students to make significant progress. At the same time, it is also necessary to continuously improve in maintaining learning, seeking support, and adjusting individualized education and teaching plans ^[15].

Disclosure statement

The author declares no conflict of interest.

References

- [1] UNESCO, 1994, Salamanca Declaration. Salamanca Declaration, 1994: 1–15.
- [2] Marton F, 1986, Phenomenography—A Research Approach to Investigating Different Understandings of Reality. *Journal of Thought*, 21(3): 28–49.

- [3] Chen J, Jiao J, 2020, A Review on the Current Situation of Special Education Teachers. *Educational Observation*, 9(37): 137–140.
- [4] Galkiene A, Monkeviciene O, 2021, Improving Inclusive Education Through Universal Design for Learning. *Springer Nature*, 5: 1–333.
- [5] Molina E, Pushparatnam A, Rimm-Kaufman S, 2018, Evidence-Based Teaching: Effective Teaching Practices in Primary School Classrooms. *World Bank Policy Research Working Paper*, 2018(8656): 1–65.
- [6] Qin GM, 2023, Research on the Application of Information Technology in Inclusive Education and Teaching. *China Information Technology Education*, 24: 84–87.
- [7] Braun V, Clarke V, 2006, Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3(2): 77–101.
- [8] Chen HX, Zhou Y, Lin JR, 2023, Research on the Application of Inclusive Education Classroom Teaching Strategies for Hearing-Impaired Students From the Perspective of Deep Learning. *Chinese Journal of Hearing and Language Rehabilitation Science*, 6: 572–574, 617.
- [9] Hu YC, Wu YY, Liu XW, 2021, Research on the Professional Competence and Assistance Needs of Teachers in Guangdong Special Education Schools in Developing Individualized Education Program. *Modern Special Education*, (24): 12–21.
- [10] Kozikoglu I, Albayrak EN, 2022, Teachers' Attitudes and the Challenges They Experience Concerning Individualized Education Program (IEP): A Mixed Method Study. *Participatory Educational Research*, 9(1): 98–115.
- [11] Li X, 2024, Investigation and Research on the Implementation Status of Individualized Education Program for Special Students in Ordinary Schools in Sichuan Province. *Journal of Leshan Normal University*, 39(10): 127–134.
- [12] Liu X, 2024, Exploration of Teaching Strategies for Special Needs Children in Inclusive Education Perspective. *Read, Write and Calculate*, 17: 146–148.
- [13] Meng SC, 2023, A Study on the Quality of Inclusive Classroom Practices and Its Related Factors in Shanghai Preschools—Based on Inclusive Classroom Profile, thesis, East China Normal University.
- [14] Wang H, 2024, Reflection and Practice on the Effective Application of Individualized Education Programs in Inclusive Education. *Modern Special Education*, 17: 19–21.
- [15] Zhang HW, Zhao B, 2022, Research on the Development of Inclusive Education in China From a Policy Driven Perspective. *Modern Special Education*, 2: 7–14.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Research on the Innovative Path of Art Education Integration Empowered by Artificial Intelligence

Xingyang Wang, Yutong Zhu

Geely University of China, School of Education, Chengdu 641423, Sichuan, China

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

With the rapid development of artificial intelligence technology, especially in the field of education, the application of intelligent technology is redefining the traditional education model, particularly in art education. Intelligent empowerment not only enriches teaching methods, but also promotes the innovation of educational content and methods. This paper explores the integrated and innovative paths of intelligent AI technology in art education, analyzes the applications in aspects such as intelligent assisted design, creative expression and personalized learning, proposes optimization strategies for art education models based on intelligent AI, and discusses the application and challenges of intelligent AI in combination with practical cases. Research shows that the integration of intelligent AI not only enhances teaching efficiency and learning experience but also promotes the improvement of students' creativity and individualized development, providing new ideas for the modernization of art education.

Keywords:

Artificial intelligence
Art education
Innovation path
Educational model
Personalized learning

Online publication: April 26, 2025

1. Introduction

With the rapid development of AI technology, especially in the field of education, intelligent AI offers tremendous opportunities for the innovation of teaching models. In art education, intelligent AI technology has broken through the limitations of traditional teaching, providing personalized plans for students through data analysis and offering immediate feedback to promote creation and innovation. By integrating virtual reality and augmented reality technologies, students can immerse themselves in

artistic creation, stimulating their potential and creativity. Therefore, how to deeply integrate intelligent AI into art education and form an efficient educational model has become a key issue at present. This article aims to explore how intelligent AI can empower art education and provide theoretical and practical support.

2. The background and current situation of Artificial Intelligence empowering art education

2.1. The predicament and reform demands of traditional art education

Art education, as an important component of quality-oriented education, shoulders the task of cultivating aesthetic ability and innovative thinking. However, the traditional classroom content is monotonous and the evaluation is ambiguous. The teaching mainly focuses on lecturing and imitation, lacking space for individual expression and critical thinking. The uneven distribution of resources between urban and rural areas, the shortage of teachers, and the lagging equipment also restrict educational equity and the development of students' potential.

Furthermore, traditional teaching has slow feedback and weak interaction, making it difficult to meet the diverse needs of students in the new era. Under the background of the "Double Reduction" policy, art education urgently needs to transform, shifting from the indoctrination of techniques to the guidance of thinking and the cultivation of qualities. The current evaluation mechanism focuses more on results and neglects the process, and students lack the motivation to explore. The concepts and methods of teaching staff are updated slowly, and the teaching methods are conservative^[1]. Therefore, reshaping the art education ecosystem with the aid of new technologies and enhancing interactivity and innovation have become the key directions of current reform.

2.2. The trend of artificial intelligence driving educational transformation

In recent years, artificial intelligence technology has made considerable progress in fields such as speech recognition, image processing, and data modeling, and has widely permeated multiple industries, including education, healthcare, and finance. In the field of education, intelligent AI has been applied to key links such as intelligent assessment, personalized push, and learning behavior analysis, becoming an important tool for promoting the precision and efficiency of education. Its advantage lies in the in-depth mining of big data and the immediate feedback mechanism, which can provide

more flexible and individualized teaching support for teachers and students^[2].

In art education, the introduction of intelligent AI technology not only enriches teaching resources but also breaks the limitations of time and space, making art teaching more open and widespread. For instance, through image recognition and style transfer technologies, intelligent AI can analyze the structure, color, and composition of artworks, providing students with immediate aesthetic references. With the help of the intelligent recommendation system, students can automatically obtain appropriate learning content based on their interests and levels, thus truly achieving teaching in accordance with individual aptitude. More importantly, intelligent AI provides a feasible path for the transformation of education from "standardized teaching" to "personalized growth". Teachers can use AI to analyze data, understand each student's learning habits, creative tendencies, and psychological characteristics, and thereby precisely implement teaching intervention and creative stimulation to enhance classroom effectiveness^[3].

Meanwhile, intelligent AI technology is gradually changing the form of teaching organization. By building an intelligent learning platform, students can engage in independent creation, display their works and peer evaluation, broadening the communication dimensions and expression channels of learning. In addition, intelligent AI can also provide targeted improvement suggestions based on students' work styles and performance levels, assisting teachers in conducting more scientific teaching evaluations. For educational administrators, the big data analysis capabilities brought by intelligent AI help them grasp the overall picture of teaching, optimize resource allocation and teaching decisions, and thereby promote the transformation of the art education system from "extensive" to "refined" and "intelligent", truly achieving a dual improvement in educational equity and quality.

2.3. Exploration and practice of intelligent AI in art education

At present, the application of artificial intelligence in art teaching is still in the stage of continuous expansion and experimentation, but many practices have already shown initial results. Some schools and educational platforms

have introduced AI art creation tools, enabling students to conduct digital painting on tablets or computers and enhance their techniques and composition skills with the help of real-time suggestions generated by the system. Some systems can also simulate the painting styles of masters such as Van Gogh and Picasso, helping students understand the aesthetic language and technical characteristics of different art schools^[4].

Intelligent AI is also used in the homework review system to assist teachers in analyzing the color usage, line smoothness, and spatial layout in students' works, providing quantitative references for evaluation, thereby reducing teachers' burden and improving teaching efficiency. In addition, immersive art learning spaces that combine virtual reality (VR) and AI are gradually being developed, enabling students to experience the art creation process through multiple senses. With the help of intelligent AI technology, an online creation community can also be built, allowing students' works to be displayed and interactively evaluated in real time, enhancing their sense of achievement and participation in learning.

Of course, the empowerment of art education by intelligent AI also faces challenges: issues such as the reasonable embedding of technology, the persistence of aesthetic education values, and the preservation of humanistic spirit all urgently need to be considered. It is necessary to prevent students from overly relying on AI in the process of creating, ensuring that technology serves the release of creativity rather than being a restraint. Meanwhile, teachers should still play a leading role in the teaching process, guiding students from the use of tools to aesthetic speculation and artistic expression. Future art education should find a balance point in the integration of "technology + art", making intelligent AI truly a booster for art education rather than a dominant one.

3. The innovative path of art education integration empowered by artificial intelligence

3.1. Intelligent aided design: Enhancing teaching effectiveness and creative ability

Intelligent aided design is an important application of AI in art education. Through intelligent AI technology, students can not only receive more precise creative

guidance but also get immediate feedback during the artistic creation process. Intelligent AI can automatically generate sketches based on students' creative intentions, provide color matching suggestions, and help students master more professional skills and methods during the creative process. In addition, intelligent AI can also help students simulate different creative styles, such as oil painting, sketching, printmaking, etc., enhancing students' artistic expression abilities^[5].

Through AI-assisted design, teachers can monitor and guide students' creative process more efficiently, promptly identify problems existing in students' creations, and provide personalized suggestions and solutions. In this way, students' creative ability and artistic expression can be rapidly enhanced, and at the same time, teachers' teaching burden is also reduced.

3.2. Personalized learning path: Promoting students' independent thinking and innovation

One of the significant advantages of artificial intelligence lies in its ability to make personalized recommendations. In art education, intelligent AI can design personalized learning paths based on each student's learning progress, interests, and creative level. By analyzing students' works, learning data, and historical achievements, intelligent AI tailors the most suitable teaching plans for each student, thereby helping them grow in an environment that better suits their own characteristics.

This personalized teaching method can not only stimulate students' interest in learning, but also promote their independent thinking and innovation. Students are no longer passive recipients of knowledge, but creators who independently explore art. With the help of intelligent AI, students can more freely exert their creative potential, thereby cultivating richer artistic thoughts and innovative abilities^[6].

3.3. Immersive experience: The innovative integration of VR and AI

With the development of virtual reality (VR) technology, the combination of VR and AI provides new ideas for art education. In an immersive learning environment, students can enter the virtual art world through VR devices and have an immersive creative experience. Intelligent AI technology can provide real-time creative

guidance and feedback based on students' behaviors and choices, helping them quickly master artistic creation skills.

With the development of virtual reality (VR) technology, the combination of VR and AI provides new ideas for art education. In an immersive learning environment, students can enter the virtual art world through VR devices and have an immersive creative experience. Intelligent AI technology can provide real-time creative guidance and feedback based on students' behaviors and choices, helping them quickly master artistic creation skills.

4. Challenges and solutions for empowering art education with artificial intelligence

4.1. Obstacles to the integration of technology implementation and education

Although the application potential of intelligent AI technology in art education is huge, there are still many technical obstacles in its implementation process. For instance, the insufficiency of hardware equipment and the lack of technical support make it difficult for some educational institutions to effectively apply intelligent AI technology^[7]. These technical obstacles make it difficult for some schools and educational institutions to fully apply AI technology with limited resources, restricting the innovation of teaching methods. In addition, the uneven technical proficiency of teachers in the application of intelligent AI technology also poses certain obstacles to the promotion of the intelligent AI teaching model. Some teachers lack the necessary technical background and are unable to make full use of intelligent AI tools for teaching, which affects the improvement of teaching effectiveness. Therefore, the education department and schools need to increase investment in AI technology and provide necessary training for teachers to ensure that intelligent AI technology can be effectively applied in art education. Only when corresponding guarantees are provided in terms of hardware, technology, and teachers' skills can intelligent AI technology be better integrated into art education and improve the efficiency and effectiveness of teaching.

4.2. The ethics and humanistic care of intelligent AI technology

Although the application of intelligent AI technology in art education can improve teaching efficiency and students' creative ability, it also brings about discussions on ethical issues. Will the role of artificial intelligence in artistic creation affect students' independent thinking ability and creativity? Could intelligent AI make the artistic creation process overly mechanized and suppress students' individualized expression? These issues have sparked extensive discussions among educators on the role and influence of AI technology in art education. On the one hand, AI can assist students in improving their artistic creation skills^[8]. On the other hand, over-reliance on AI tools may lead students to become dependent on the autonomy and independence of their creations, affecting their personalized expression and thinking development. Therefore, in the application process of intelligent AI, it is necessary to pay attention to humanistic care to ensure that the application of technology does not undermine the essential goal of art education, that is, to cultivate students' independent thinking ability and innovative consciousness. When promoting AI technology, educators should balance the relationship between technology and humanity, encourage students to fully exert their personal creativity in the creative process, rather than relying solely on AI for artistic creation^[9].

4.3. The imbalance of educational resources

Although the application of intelligent AI technology can enrich the resources of art education, in practical application, due to the constraints of economic, geographical, and other factors, there is still an imbalance in the distribution of educational resources. In some remote areas, schools lack sufficient equipment and technical support, which leads to the inability to popularize intelligent AI technology. Therefore, in order to achieve the comprehensive application of intelligent AI technology in art education, the government and the education department need to strengthen the allocation and support of educational resources and promote the balanced development of educational resources^[10].

5. Conclusion

The empowerment of art education by artificial intelligence provides a new path for the innovation of educational models. Through means such as intelligent-assisted design, personalized learning, and immersive experiences, AI technology can not only enhance students' artistic creation abilities but also stimulate their innovative thinking. However, the application of intelligent AI technology in art education also faces many challenges, such as obstacles in technology implementation, ethical issues, and the imbalance of educational resources. To

solve these problems, joint efforts from all parties are needed. By improving technical support, strengthening teacher training, and promoting the fair distribution of educational resources, the deep integration and innovation of intelligent AI technology and art education can be facilitated. In the future, with the continuous development and application of technology, intelligent AI will play a more important role in art education, promoting a comprehensive upgrade of educational concepts and methods.

Funding

Sichuan Private Education Association (Research Center) Project; Research on the Development and Enhancement of Primary School Subject Integration and Aesthetic Education under the Action of Aesthetic Education Infiltration (Project No.: MBXH24YB193)

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Lu P, 2024, Research on the Path of AIGC Empowering Traditional Arts and Crafts. *Art and Design (Theory)*, 2(12): 87–88.
- [2] Qu H, 2024, Innovation in Art and Design Education from the Perspective of “Humanistic Intelligent Manufacturing”: The Two-Way Empowerment of Creative Thinking and Cultural Innovation in the Era of Artificial Intelligence. *Art and Design (Theory)*, 2(12): 134–136.
- [3] Yang Y, Liu C, 2024, Film and Television Creation under the New Quality Productivity: The Innovative Logic and Path Empowered by Artificial Intelligence – A Review of the Theme Forum of the 31st Beijing International Film Festival for College Students. *Film Review*, (22): 44–46.
- [4] Liang L, 2024, The Application of Artificial Intelligence Technology in College Art Education. *Art Education Research*, 2024(22): 109–111.
- [5] Du C, Zhang R, Liu S, 2024, Analysis of the Mechanism and Path of Artificial Intelligence Comprehensively Empowering China's Modern Industrial System. *Economic Review*, 2024(11): 36–45.
- [6] Zhu L, Zhao Z, Hu X, 2024, Research on the Model and Strategy of Normal Students' Willingness to Adopt Artificial Intelligence in Education: An Analysis of 3,671 Questionnaires from Pilot Universities Promoting the Construction of the Teaching Staff with Artificial Intelligence. *Education Review*, 2024(11): 21–29.
- [7] Wang L, 2024, Research on the Impact of New Generation Artificial Intelligence Technology on the Construction of Innovative Teaching Staff in Regular Undergraduate Programs. *University*, 2024(31): 119–122.
- [8] Sun L, Sun W, He J, 2024, Artificial Intelligence Drives the Value Reconstruction and Business Model Innovation of the Digital Creative Industry: Exploring the Transformation and Reshaping of the Digital Creative Industry by Artificial

Intelligence. Journal of Hubei University of Education, 41(10): 71–75.

- [9] Zhang Y, 2024, Exploration of the Reconstruction Path of the Student Evaluation System in Artificial Intelligence Education for Normal School Students. Journal of Anyang Normal University, 26(05): 139–143.
- [10] Wang Z, Rao X, 2024, ChatGPT Empowering Art Education: Opportunities, Challenges and Development Paths. Journal of Northwest Adult Education College, (05): 107–112.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

On the Legal Nature of Live-Streaming Sales

Yifan Lin, Chuyi Peng

School of Law, Guizhou University of Finance and Economics, Guiyang 550025, Guizhou, China

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

With the continuous development of new e-commerce models, live-streaming sales have gradually become an important means to boost product sales. However, the current legal system has yet to reach a consensus on defining live-streaming sales, leading to inconsistent application of the law in practice. Through the analysis of multiple typical cases, this article reveals the differences in the application of the Advertising Law and the Anti-Unfair Competition Law in regulating false advertising practices in live-streaming sales, highlighting the ambiguity in determining the legal nature of such activities. Building on this, the article starts from the controversy over whether live-streaming sales constitute commercial advertising, separately arguing for their role as promotional tools and commercial advertisements. Ultimately, it proposes that live-streaming sales should be defined as commercial advertising with advertising attributes. This definition would help unify enforcement standards, enhance regulatory efficiency, and provide clear legal guidance for the healthy development of live-streaming e-commerce.

Keywords:

Live delivery
Legal attributes
False publicity

Online publication: April 26, 2025

1. Introduction

Under the current legal system, false advertising in live-streaming sales is mainly regulated by the Anti-Unfair Competition Law and the Advertising Law, with additional support from related laws such as the E-Commerce Law, the Consumer Rights Protection Law, and the Product Quality Law. Anti-Unfair Competition Law and the Advertising Law still have some conflicts in applying the same false advertising behavior at the level of legal application^[1]. For similar violations, market supervision departments cannot apply the same law to the same case. This article elaborates on several cases.

2. The different application of law in the case of exaggerating product effects in live delivery

In the case of false advertising by a food and agricultural products business in Zhuji City, the party involved promoted sea buckthorn powder and capsules by sending messages through WeChat groups and playing videos in-store, claiming that sea buckthorn has anti-aging, immune-boosting, liver-protecting, and thrombo-preventive effects. They also emphasized its high content of vitamins, fatty acids, and flavonoids. The party cited research from unknown sources, stating that

sea buckthorn can extend the lifespan of tumor-bearing animals, stimulate immunity, and boast “three clears, three reductions, and three resistances” benefits, such as clearing blood vessels, lowering blood sugar, and antioxidant properties. They particularly highlighted the ten benefits of sea buckthorn seed oil for cardiovascular health, diabetes, and immune regulation. However, the party did not provide sufficient evidence to support the claims and was ultimately penalized by the Zhuji Market Supervision Administration in accordance with Article 8, Paragraph 1 of the Anti-Unfair Competition Law of the People’s Republic of China. Similarly, in the case involving Yiwu Tangtai E-commerce, the party promoted multiple cosmetic products through live streaming on Pinduoduo, using exaggerated phrases such as “after using ‘yeast’, the aging rate slows significantly at age 45, making you look like you’re 35,” and “this divine water can make you whiter, softer, and younger.” They also claimed that the product could fade age spots, melasma, freckles, and other blemishes, leaving the skin smooth, tender, and radiant. Ultimately, the Yiwu Market Supervision Administration penalized them under the Advertising Law.

3. The application of law for false publicity of product ingredients in live delivery is inconsistent

In the cases of the Fanghua Large Size Women’s Clothing Store in Rugao City and the Ranfei Clothing Business Department in Puyuan, Tongxiang City, although both involved false advertising of clothing components during live-streaming sales, there were differences in legal enforcement between market supervision agencies in different regions. In detail, in the case of the Fanghua Large Size Women’s Clothing Store in Rugao City, the party heavily promoted a black-based, white floral-patterned garment they were wearing, featuring a beige-white bow tie and short sleeves claimed to be made of mulberry silk. Upon investigation, it was found that the black-based floral pattern matched the product being advertised, but the label on the short sleeve indicated “Composition: 100% Fiber,” revealing a discrepancy between the promotional claims and the actual product composition. The Market Supervision Administration of Rugao City took corresponding punitive measures based on the Advertising

Law. However, in the case of the Ranfei Clothing Business Department in Puyuan, Tongxiang City, the party sold short-sleeved women’s T-shirts through their store on TikTok, claiming that the T-shirts used “protein Tencel” and “combed cotton,” and stated that Tencel has moisture-wicking and health benefits. Upon inspection, it was found that the main fiber content of the T-shirts was polyester and spandex, which did not match the advertised content, constituting false advertising. The Market Supervision Administration of Tongxiang City, however, imposed administrative penalties on the party for violating Article 8, Paragraph 1 of the Anti-Unfair Competition Law.

4. Case summary and problem induction

By comparing the above four cases, it becomes clear that whether it’s exaggerating product effects or making false claims about clothing during live-streaming sales, the market supervision and administration bureau applies different legal provisions to these violations. This inconsistency reveals a selective approach in the enforcement of legal duties, rooted in varying interpretations and definitions of the legal nature of “live streaming sales activities.” From a legal perspective, according to Article 20, Paragraph 2 of the Anti-Unfair Competition Law, if operators violate Article 8 of this law and publish false advertisements, they will be punished according to relevant provisions of the Advertising Law. As stated in Article 28 of the Advertising Law, any advertisement that uses untrue or potentially misleading content to defraud or mislead consumers is considered a false advertisement. Therefore, if live streaming sales activities are regarded as advertisements, the Advertising Law will apply. If not, then the Anti-Unfair Competition Law will be adopted. However, the crux of the issue lies in the fact that there is currently no clear legal response regarding the legal nature of live streaming sales activities, and there are still inconsistent voices in academic circles.

5. Analysis of the legal attributes of live delivery behavior

5.1. Live delivery is a means of promotion

In the current business environment, live-streaming for sales has gradually become a popular e-commerce

model, breaking down the traditional boundaries between e-commerce and advertising through real-time interaction and product display. Regarding whether live-streaming for sales should be defined as “commercial advertising,” there is still significant disagreement in academic circles. Some scholars who oppose this view argue that live-streaming e-commerce is more of a promotional tool rather than traditional commercial advertising. More specifically, this opposing stance can be explored in two core areas.

The view that live-streaming sales serve as a “promotion” tool rather than a “commercial advertisement” stems from an understanding of the essence of live-streaming sales. Scholars point out that live-streaming sales are essentially an online form of traditional offline shopping assistance activities ^[2]. In physical stores, sales assistants introduce products to consumers through direct dialogue and interaction, explaining their functions and guiding their purchasing decisions. The core purpose of offline shopping assistance is to achieve product sales through interpersonal communication. However, this promotional activity does not directly function as advertising. Advertising typically involves large-scale dissemination through various channels, aiming to enhance public awareness of products or brands and convey relevant information to the general public. Offline shopping assistance primarily targets specific consumer groups. It is fundamentally a sales activity with strong interactivity and personalized service, lacking the universality and media nature of advertisements.

The marketing model of live-streaming sales shares many similarities with the traditional marketing model of physical stores. Both online streamers and offline marketers aim at “selling products,” using skillful language or promotional strategies to stimulate consumer purchasing desire, which is indisputable. However, compared to traditional marketing models, live-streaming sales stand out more in terms of interactivity with consumers. It’s not just a one-way information delivery from the streamer to the consumer; it also integrates emotional expressions from both parties. Consumers often decide to buy goods based on their trust or even reliance on the streamer’s advice. Nevertheless, the strong interactivity of live-streaming sales does not negate its fundamental similarities with traditional offline marketing. A shift in perception about its nature should

not occur solely because one characteristic appears more prominent than others.

In addition to strong interactivity, another characteristic of live-streaming sales that sets it apart from commercial advertising is the “integrated promotion and sales.” Specifically, in traditional commercial advertising models, consumers go through certain necessary steps before making a purchase decision. For instance, when a consumer sees an advertisement for a desired piece of clothing, they first need to get up and visit a clothing store, then engage in thorough communication with the sales staff about the relevant details of the item. If necessary, they may even need to try on clothes in the fitting room. If the size or style does not meet their expectations, they will spend time selecting or sourcing from other sources until they are satisfied, ultimately deciding to make a purchase. This shows that under such traditional commercial advertising models, there is a significant time lag between promotional activities and sales actions. However, during live-streaming, consumers can not only learn about the product’s features and functions but also place orders immediately and complete the purchase. This “integrated promotion and sales” characteristic distinguishes live-streaming sales from commercial advertising.

Due to consumers being able to place orders immediately while watching live broadcasts, the recommendations and introductions made by streamers in the live room can directly have legal effect. Their actions are closer to the form of an “offer” as defined in the Civil Code ^[3], rather than an “invitation to offer.” This also highlights the difference between live-streaming sales and commercial advertising. Traditional commercial advertisements mostly emphasize the appearance and functions of products, highlighting their advantages in certain aspects without detailing information such as prices or sizes. For advertisers, the purpose of publishing ads is often to encourage people to enter into contracts with them. Therefore, from a legal perspective, commercial advertising is essentially an “invitation to offer.” In contrast, during live-streamed product promotions, salespeople in the live room not only provide detailed introductions or answers to questions about the products but also, with the recommendation of popular streamers, directly influence consumer purchasing decisions, leading them to place orders immediately.

Thus, this practice makes the streamer's recommendation behavior directly qualify as an "offer" at the legal level ^[4].

5.2. Live delivery is a commercial advertisement

Most scholars hold a positive attitude towards the view that "live delivery belongs to commercial advertising". They believe that although live delivery and offline promotion have similarities in some aspects, there are also great differences between the two in essence. They demonstrate this from the following aspects, respectively ^[5].

From the perspective of marketing methods, live-streaming sales differ fundamentally from offline shopping guides. This distinction is easy to grasp. In offline settings, shopping guides typically introduce products face-to-face to enhance the consumer's shopping experience, often following a "one guide serves one consumer" model. This approach offers clear advantages, as guides can respond quickly and directly to individual consumer needs, providing personalized services in real time ^[6]. However, its shortcomings are also obvious: the offline shopping guide model limits its service audience, lacking broad influence. In contrast to offline shopping guides, live-streaming sales depend on the internet for dissemination. Products are primarily promoted through live broadcasts, where hosts take advantage of the internet's wide reach to engage with thousands of viewers at once, respond to questions in real time, and drive sales through diverse promotional tactics ^[7]. This speed and impact can significantly enhance brand awareness and boost product sales, achieving effects similar to those of commercial advertisements. This "one host serves multiple consumers" dissemination model significantly expands the number of service recipients. Its reach and dissemination power fundamentally differ from offline shopping guides and resemble the characteristics of commercial advertising ^[8].

In terms of revenue models and content distribution methods, live-streaming sales share common characteristics with traditional advertising. For conventional commercial ads, the revenue model generally works as follows: advertisers seek to attract more public attention to their products by having media outlets promote them, while media outlets earn income through these advertisements. The live-streaming sales model is quite different; streamers sign cooperation agreements with manufacturers to promote their products

in the live stream, thereby earning compensation ^[9]. Therefore, it becomes evident that both live-streaming sales hosts and traditional commercial media serve a similar function by offering "attention resources" to advertisers, thereby creating opportunities for profit.

Of course, some scholars have refuted the view that "live-streaming sales are similar to shopping guides" from both factual and normative perspectives ^[10]. They argue that defining "live-streaming sales" is a normative evaluation, while "shopping guide" is a concept rooted in daily life, a factual description. Therefore, simply defining live-streaming sales as shopping guides is like using a factual description to explain a norm, which confuses the difference between factual description and normative definition ^[11]. It's important to recognize that the concept of a shopping guide is rooted in everyday experience and cannot be used as a basis for defining the legal attributes of a fundamentally different entity. Moreover, from a purely normative perspective, live-streaming sales fully comply with the definition of "advertising" in the Advertising Law, meeting its requirements for "mediation" and "promotion."

6. Conclusion

Live-streaming for sales clearly exhibits the core characteristics of advertising and should be explicitly classified as a form of commercial advertising. Starting from the definition of advertising, its most prominent core attribute is "communicativeness," which means using various media tools to efficiently convey specific information to a broad audience, thereby achieving extensive coverage and effective reach ^[11]. Live-streaming for sales operates on this logic, leveraging internet platforms, especially social media and e-commerce live streaming platforms, to rapidly disseminate product information, significantly enhancing both efficiency and reach. Through real-time interaction, bullet comments, and fan rewards, live streams not only achieve instant dissemination but also attract a large number of consumers' attention in a short time, creating a high exposure effect.

In addition, another core purpose of advertising is to enhance the visibility and influence of a product or brand, thereby stimulating the audience's desire to purchase and their consumption behavior ^[12]. Live streaming for sales has shown particularly significant results in this regard.

During live streams, hosts often win the trust and support of a large audience through their personal influence, professional knowledge, or charisma. This “trust endorsement” effect makes the host’s recommendations more persuasive. As the number of viewers in the live stream increases, product information is quickly disseminated to a broader public. Combined with the host’s firsthand experiences, demonstrations of usage,

and strong emotional resonance, this guides the audience to form a positive perception of the product, further motivating them to make a purchase. In essence, this marketing approach aligns with traditional advertising in terms of its fundamental goals; it is merely that the medium and form of expression have changed. Therefore, live streaming for sales fully meets the definition and characteristics of commercial advertising^[13].

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Ding G, 2024, Construction of Legal Governance System for Online Live Streaming Sales from the Perspective of Collaborative Governance. *Academic Forum*, 2024(2): 18–31.
- [2] Liu S, 2020, Thoughts on the Legal Attributes of Internet Celebrity “Live Streaming for Sales”. *China Market Regulation Research*, 2020(5): 21–23.
- [3] Yu F, 2021, Problems and Regulation in Live-streaming E-commerce. *China Business Review*, 2021(14): 9–11.
- [4] Yang T, 2020, A Brief Discussion on Several Issues of “Live Streaming for Sales”. *China Market Regulation Research*, 2020(5): 40–42.
- [5] Song Y, 2020, Business Model and Legal Regulation of Online Live Streaming for Sales. *China Market Regulation Research*, 2020(8): 9–15.
- [6] Yu Q, 2025, Legal Regulation of False Advertising in Live Streaming Sales under the Digital Economy. *Market Weekly*, 2025(4): 163–166.
- [7] Gu TT, 2024, Research on the Legal Responsibilities of Live Streaming Platforms from the Perspective of Consumer Rights Protection. *Hebei Enterprise*, 2024(11): 149–151.
- [8] Kong M, 2024, Research on Consumer Rights Infringement and Legal Regulation in Live Streaming Sales. *Legal Expo*, 2024(24): 133–135.
- [9] Xu R, 2024, Legal Subject and Liability Determination of Live Streaming E-commerce Hosts. *Encyclopedia Knowledge*, 2024(18): 46–48.
- [10] Fang A, 2024, Legal Regulation of Online Live Streaming for Sales in the Digital Economy. *China Lawyer*, 2024(7): 38–40.
- [11] Zheng X, 2024, Live-streaming Sales “Harvest” of Elderly People Should Bear Legal Responsibility. *China Social Work*, 2024(5): 25.
- [12] Li H, 2024, Legal Issues and Regulation of the New Business Model of Online Live Streaming for Sales. *People’s Justice*, 2024(4): 70–73.
- [13] Chen B, 2023, Legal Regulation of False Advertising in Online Live Streaming Sales. *Cultural Studies*, 2023(10): 93–96.

Publisher’s note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Integrating Technology into Music Learning: A Tool for Enhancement, Not Substitution

Lan Yao*

Bangkokthonburi University, Bangkok 10100, Thailand

**Author to whom correspondence should be addressed.*

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

The integration of technology into music education has significantly transformed the learning experience, particularly for beginner piano students. Technologies such as visual feedback systems and tactile measurement tools provide objective insights into performance, enabling learners to self-assess and improve technical accuracy. Digital platforms support flexible learning environments, allowing personalized practice schedules and fostering interactive engagement through online forums and multimedia resources. Blended learning models further enhance pedagogical effectiveness by combining traditional instruction with digital tools, promoting transparency and traceability in progress. However, the successful application of technology depends on educators' critical selection and alignment with pedagogical goals. While technology offers valuable support, it cannot replace the irreplaceable role of teachers in guiding reflective and critical thinking processes.

Keywords:

Technology
Music education
Piano

Online publication: April 26, 2025

1. Introduction

The development of technology is a long process, and music technology is, in fact, simply the application of existing technology to the field of music ^[1]. Of course, there is now a lot of technology aimed at the music sector, but it is actually also an adaptation of existing technology to the needs of music education. So, how best to make technology work for music education is something that deserves attention ^[2]. This not only requires educators to master existing music technology and make full use

of it to help students, but educators should also actively explore and formulate needs to promote the development of music technology that is relevant to real needs ^[3-6]. When people discuss the impact that technology brings to music education, there are three questions worth discussing: What aspects of music education can technology help? How can students learn better through technology? How can teachers make the most of new technologies for music education? It needs to be clear that the ultimate aim in discussing these questions is to

use technology to bring about a good impact on music education for students ^[7-8].

2. Technology provides impartial feedback and highlights learning priorities for music education

Music technology can help teachers and students to objectively perceive student learning outcomes. Hamond, Welch, and Himonides categorized the feedback provided by digital technology into three main types: visual, auditory, and interpersonal feedback ^[9-10]. Moreover, in piano learning, visual feedback is very important for the learner ^[11]. The use of technology to provide visual feedback allows the performer to be conscious of their performance ^[9-10]. In recent years, various techniques have been developed to provide feedback in piano education, and the application of tactile measurement techniques in piano learning has been detailed by MacRitchie, Faulkner, and Harrison ^[12-16]. With piano tactile measurement technology, people can measure the strength of the playing, capture the pianist's movements, etc., and provide data for analysis to the piano practitioner. This allows the piano practitioner to become better self-aware in terms of hand and body movements. It also gives students and teachers the opportunity to clearly identify weaknesses in the student's power in piano playing through the data analysis provided by the technology and to make targeted corrections ^[17]. In fact, in piano education, Bobbe et al. have found that postural movements of the fingers and body are important factors in piano practice ^[17]. The use of piano tactile measurement technology is something that can be relevant to the needs of piano education and is a good example of the use of technology in the field of piano education. However, as Himonides and Evangelos noted in their study on monitoring the posture of musicians during singing, focusing on external issues such as how to adjust one's posture may hinder the ability to concentrate fully on the learning process, which is counterproductive ^[2, 6]. This also coincides with Hamond, Himonides, and Welch's view that technology is only used to provide feedback, and that the purpose of feedback is to help students reflect ^[9]. Therefore, the focus should not only be on the feedback provided by the technology itself, but more on the new perspectives of reflection brought

about by the objective feedback, which can help improve both the learning process and the teaching process are helpful ^[9, 10, 18].

In addition to the monitoring of body posture, there is also technology that can identify errors in note playing in piano performance and provide visual feedback. Asahi et al. introduce a piano support system ^[14]. It records the student's performance and converts it into data. The student's playing data is then compared with the correct score, and playing errors are marked in different colors on the electronic score. Obviously, this way the student can clearly recognize their mistakes and is more likely to make corrections. The student simply finds the corresponding error on the score and identifies the correct note to practice again. And it is worth noting that this system also supports the recording of historical data of the student's practice ^[14]. Students can recognize bars with a high frequency of errors by comparing the historical data. This further helps students to take stock of their errors and is more likely to enable self-regulation in their individual practice. Asahi et al. found in interviews with ten beginner pianists that this music technology does help students to clarify their practice progress and become more aware of their current situation and immediate goals ^[14-15]. It also provides teachers with a new scientific way of understanding their students' individual practice, which can subsequently be taught in a more targeted way. Of course, it also has the potential to make students lazier and rely too much on the technology rather than focusing on practice to circumvent errors in practice ^[6].

The two techniques above provide objective recording and data analysis of students' musical performance, mainly from their perspective. This helps students to reflect on their musical behavior and also helps teachers and students to find the learning focus of the lesson, contributing to future teaching and learning ^[9, 10, 19].

In the same way, music technology can help music teachers identify what effective teaching strategies are. Himonides and Evangelos note that music technology can transform musical performances into real-time data, which can be used to analyze the types of musical performances that are more likely to elicit strong audience reactions ^[2]. If such music technology is applied to music teaching, it can also help teachers clarify what teaching behaviors are more likely to improve students' concentration. This can help teachers develop good teaching methods to improve

classroom outcomes. Also, if it is found that the teacher and students are not focusing on the same thing, the teacher can communicate his or her ideas to the students in time to clarify the next learning priorities. This process can also ensure that the teacher and students are working towards the same goal for the rest of the learning process ^[5].

3. Technology allows for more flexible learning styles in music education

The use of technology in the music curriculum allows students to engage effectively in learning on their own terms. Using online systems, teachers can provide students with a logical structure for their learning. Like the Moodle system people now use, people are able to understand the lesson objectives and lesson plans from the beginning of the course. In addition, weekly course materials are provided as well as relevant extensions. This provides students with great freedom in their learning ^[7]. Students can plan the content of their studies according to their own time, and they also have the opportunity to study in depth according to their own interests ^[5]. In addition, the online forum facilitates communication between students and promotes interactive learning between them ^[5]. This can help students who are not good at offline discussions to interact with each other ^[5, 20–21]. However, such online discourse is completely public, which may also discourage some students from participating ^[20]. Alternatively, direct communication with the teacher via email is also a viable way. In other words, the online system allows for maximum access to the course, resources, and deeper engagement with the course. This allows for more freedom and flexibility in student learning ^[7]. It is worth noting that technology also has an important role to play in informal music learning ^[5, 22]. In addition to the course content, the teacher can provide appropriate technological extensions, such as SoundJunction, based on the students' previous learning experiences ^[5]. SoundJunction is more suited to online music education than students exploring on the web themselves ^[22–23]. It can support students to explore and create music online. This allows space for more capable students to explore in relation to the content they are learning. Such an extension of technology can cater for the learning experience of students at different levels ^[24].

However, music learning and teaching exclusively through technology require constant adaptation and are costly ^[25]. Moreover, technology should not become a barrier to monopolize learning, but rather play a supporting role. Thus, blended learning is also the focus of current attention ^[6, 20, 25–27].

The integration of technology into the traditional teaching and learning process can provide students with diverse learning styles ^[28]. To assist in piano education, Niu proposes the application of multimedia technology to piano education ^[29]. Smart piano lessons based on digital pianos allow students to watch recorded lessons repeatedly afterwards. This approach helps students to recall the lesson, and watching the teacher's demonstration repeatedly gives them the opportunity to imitate it several times, and they are more likely to follow the teacher's instructions and practice correctly. Every student has the opportunity to experience the joy of learning through technology in this kind of new classroom ^[8, 30]. Students can collaborate with teachers online through Mentimeter. Participating anonymously allows students to hide themselves well without fear of some ridicule if their ideas are too simple and naive. It also gives students the opportunity to express their ideas in a timely manner and get a response from the teacher ^[31]. Through the Mentimeter technology, they could really get involved in the discussion process of the class and felt it was all very interesting ^[31–32]. In addition to this, the online collaboration in music production was very innovative and kept the students engaged ^[33]. This shared, dynamically present online learning environment can contribute to the democratization of education ^[3]. It is clear that blended learning can provide a more diverse approach to learning and can make teaching and learning more interactive, and it helps students learn more scientifically than traditional music education ^[7, 34].

4. Facing various technologies, music education should make a proper choice

The implications of technology mentioned earlier are for music technology that is known to be put into use. It is then worth discussing how music educators should integrate technology with their educational beliefs ^[6]. This can help them to use music technology more in the future of music

education. The key to long-term collaboration between technology and music education is how teachers should critically use technology to suit music education ^[6].

Music education cannot be dictated by technology, but rather serves music education ^[2]. Therefore, if the introduction of new technology would increase the pressure on teachers to use it, instead, they could go on to explore more of the functions of existing technology to suit the needs of teaching and learning ^[4]. For example, a digital recording studio could be replaced by a CD burner ^[35]. By replacing technology in this way, the technical requirements of the teacher would be reduced, but the required classroom functions would be achieved just as well ^[4].

In addition, teachers need to judge what is a valuable tool, rather than accepting it all ^[36]. On the one hand, the teacher needs to be clear about what the purpose of using technology is. In the process of teaching piano, the teacher can use technology that is appropriate to the needs of the student, depending on the individual circumstances of the student. For example, if it is the case that the student does not have a clear perception of the results of his or her practice, the relevant technology can be used to provide the student with objective feedback to help the student reflect and improve ^[14–16]. On the other hand, not every modern technology can be fully adapted to the needs of music education. The program Teamirn, described by Bobbe et al. in terms of mixed reality, allows students to observe from the first-person perspective of the piano player ^[17]. Bobbe et al. suggest that it may help students learn proper fingering techniques through three-dimensional visualizations ^[17]. But in fact, this approach is not very different from watching a demonstration video directly through multimedia technology ^[37]. The question of how to perform finger power may also need to be taught face-to-face by the piano teacher, or using tactile-related technology to assist in teaching ^[15]. Therefore, music educators need to identify what modern technology can really offer to help and choose the technology that meets the needs of teaching and learning in order to better assist the students. This may also push the development of music technology to be more applicable to the needs of music teaching.

5. Conclusions

Mature technology offers more possibilities for music education ^[3]. Technology helps students to understand their own performance and gives a clearer focus to lessons ^[9, 19]. It also gives both teachers and students the opportunity to give feedback on student performance, ultimately facilitating internal feedback ^[9]. Furthermore, when technology is actually put into the process of teaching music, it can make the learning process more transparent and traceable ^[5, 20–21]. Students can better engage with the classroom to review classroom knowledge, and teachers can use technology to create new learning experiences and achieve better classroom results ^[8, 29, 31].

But even as new technologies continue to develop and advance, the core of music education remains with teachers the ability to reflect and think critically ^[6]. Music technology cannot completely solve all the problems we encounter in music education, nor can it replace the teacher in teaching, but it can only be used as a tool to assist in music education ^[2]. Teachers can use music technology critically to provide students with a scientifically interesting learning experience that maximizes their learning. Rather than allowing music technology to replace the teacher's process of guiding students' thinking ^[6].

In short, technology and music education interact with each other. The development of technology has made music education more scientific and varied. The application and demand for technology in music education also drive the development of technology. It is up to music educators to find the best integration of music technology and music curriculum in the process of integrating music technology into their practice, creating a new future of music education ^[3].

Disclosure statement

The author declares no conflict of interest.

References

- [1] Himonides E, 2019, Ave Verum Pentium: Singing, Recording, Archiving, and Analyzing within the Digital Domain, in *The Oxford Handbook of Singing*. Oxford University Press, Oxford.
- [2] Himonides E, 2012, The Misunderstanding of Music-Technology-Education: A Meta Perspective, in *The Oxford Handbook of Music Education*, Volume 2. Oxford University Press, Oxford.
- [3] Himonides E, 2017, Educators' Roles and Professional Development, in *The Oxford handbook of Technology and Music Education*. Oxford University Press, Oxford.
- [4] Purves R, 2012, Technology and the Educator, in *The Oxford Handbook of Music Education*. Oxford University Press, Oxford, 457–475.
- [5] Himonides E, Purves R, 2010, *The Role of Technology*, thesis, University of London.
- [6] Savage J, 2012, Driving Forward Technology's Imprint on Music Education, in *The Oxford Handbook of Music Education*, Volume 2. Oxford University Press, Oxford.
- [7] Crawford R, 2017, Rethinking Teaching and Learning Pedagogy for Education in the Twenty-first Century: Blended Learning in Music Education. *Music Education Research*, 19(2): 195–213.
- [8] Gorgoretti B, 2019, The Use of Technology in Music Education in North Cyprus According to Student Music Teachers. *South African Journal of Education*, 39(1): 1–10.
- [9] Hamond L, Himonides E, Welch G, 2020, The Nature of Feedback in Higher Education Studio-based Piano Learning and Teaching with the Use of Digital Technology. *Journal of Music, Technology, and Education*, 13(1): 33–56.
- [10] Hamond LF, Welch G, Himonides E, 2019, The Pedagogical Use of Visual Feedback for Enhancing Dynamics in Higher Education Piano Learning and Performance. *Opus*, 25(3): 581.
- [11] Banton LJ, 1995, The Role of Visual and Auditory Feedback during the Sight-reading of Music. *Psychology of Music*, 23(1): 3–16.
- [12] MacRitchie J, 2015, The Art and Science behind Piano Touch: A Review Connecting Multi-disciplinary Literature. *Musicae Scientiae*, 19(2): 171–190.
- [13] MacRitchie J, Bailey NJ, 2013, Efficient Tracking of Pianists' Finger Movements. *Journal of New Music Research*, 42(1): 79–95.
- [14] Asahi S, Tamura S, Sugiyama Y, et al., 2018, Toward a High Performance Piano Practice Support System for Beginners. 2018 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC).
- [15] Marky K, WeiB A, Gedeon J, et al., 2020, Mastering Music Instruments through Technology in Solo Learning Sessions. arXiv preprint. <https://doi.org/10.48550/arXiv.2012.13961>
- [16] Marky K, WeiB A, Kosch T, 2021, Supporting Musical Practice Sessions Through HMD-Based Augmented Reality. arXiv preprint. <https://doi.org/10.48550/arXiv.2101.00874>
- [17] Bobbe T, Oppici L, Luneburg LM, et al., 2021, What Early User Involvement Could Look Like—Developing Technology Applications for Piano Teaching and Learning. *Multimodal Technologies and Interaction*, 5(7): 38.
- [18] Waddell G, Williamon A, 2019, Technology Use and Attitudes in Music Learning. *Frontiers in ICT*, 2019(6): 11.
- [19] Borota B, 2011, Motivation and Learning Results in Music Education Related to Blended Learning. *Metodicki Obzori*, 12(6): 49–59.
- [20] Rasheed RA, Kamsin A, Abdullah NA, 2020, Challenges in the Online Component of Blended Learning: A Systematic

- Review. *Computers and Education*, 2020(144): 103701.
- [21] Bouilheres F, Le LTVH, McDonald S, et al., 2020, Defining Student Learning Experience through Blended Learning. *Education and Information Technologies*, 25(4): 3049–3069.
 - [22] Zaripovich KS, 2024, Pedagogical Requirements for a Modern Music Teacher and his Possibilities of using Technologies. *Multidisciplinary Journal of Science and Technology*, 4(2): 164–168.
 - [23] Himonides E, 2018, The Misunderstanding of Music-technology Education: A Meta Perspective. *Creativities, Technologies, and Media in Music Learning and Teaching: An Oxford Handbook of Music Education*, 2018(5): 119.
 - [24] Merrick B, 2024, Informed Teaching and Practice in Music Education: Exploring Music Technologies, Curriculum Design and Learning Environments in an Everchanging World, in *Music, Technology, Innovation*. Routledge, England, 113–131.
 - [25] Seiter E, 2008, Practicing at Home: Computers, Pianos, and Cultural Capital. MacArthur Foundation Digital Media and Learning Initiative.
 - [26] Zhang Y, Fen BW, Zhang C, 2024, A Systematic Review of Blended Learning Strategies and Outcomes in Music Education. *Harmonia: Journal of Arts Research and Education*, 24(2): 247–262.
 - [27] Hrastinski S, 2019, What Do We Mean by Blended Learning? *TechTrends*, 63(5): 564–569.
 - [28] Hartman RJ, Townsend MB, Jackson M, 2019, Educators' Perceptions of Technology Integration into the Classroom: A Descriptive Case Study. *Journal of Research in Innovative Teaching & Learning*, 12(3): 236–249.
 - [29] Niu Y, 2021, Penetration of Multimedia Technology in Piano Teaching and Performance Based on Complex Network. *Mathematical Problems in Engineering*, 2021(8872227): 12.
 - [30] Chen Y, Zhang LC, Ding Y, et al., 2025, Multi-task Oriented Team Formation in Online Collaborative Learning. *Expert Systems with Applications*, 2025(259): 125289.
 - [31] Mayhew E, Davies M, Millmore A, et al., 2020, The Impact of Audience Response Platform Mentimeter on the Student and Staff Learning Experience. *Research in Learning Technology*, 2020(28): 1–16.
 - [32] Vallely K, Gibson P, 2018, Engaging Students on their Devices with Mentimeter. *Compass: Journal of Learning and Teaching*, 11(2): 1–6.
 - [33] Holland D, Chapman D, 2019, Introducing New Audiences to Sound-Based Music through Creative Engagement. *Organised Sound: An International Journal of Music Technology*, 24(3): 240–251.
 - [34] Namysova G, Tussupbekova G, Helmer J, et al., 2019, Challenges and Benefits of Blended Learning in Higher Education. *International Journal of Technology in Education*, 2(1): 22–31.
 - [35] Schumacher EF, 2004, Intermediate Technology. 1975: ACTION, International Operations, Planning Group.
 - [36] Cain T, 2004, Theory, Technology and the Music Curriculum. *British Journal of Music Education*, 21(2): 215–221.
 - [37] Tung BT, Schnieders D, 2018, Pianow—Piano Self-learning Assistant in Mixed Reality, thesis, The University of Hong Kong.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Triple Dimensions of Precision Teaching in Physical Education under the “Four New” Initiatives Framework: Mechanism Development, Current Bottlenecks, and Pathway Innovations

Wensu Dong¹, Rui Liu², Shuyong Liu^{1*}

¹Harbin Normal University, Harbin 150025, Heilongjiang, China

²Lingnan Normal University, Zhanjiang 524048, Guangdong, China

**Author to whom correspondence should be addressed.*

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

To accelerate educational modernization and address unprecedented global challenges, the Central Committee of the Communist Party of China has introduced the “Four New” policy framework. In physical education, this translates to leveraging multimodal data and advanced technologies to achieve precision teaching, a critical strategy for advancing national education and sports development. This study employs a problem-cause-solution analytical framework to systematically explore the mechanism construction, practical constraints, and innovative pathways of data-driven precision teaching in physical education. Key findings indicate: (1) Mechanism construction requires establishing an integrated data-driven platform that enables closed-loop workflows spanning real-time data collection, AI-powered analytics, and adaptive feedback delivery; (2) Practical constraints stem from multifaceted challenges including poor data quality (low signal-to-noise ratios), resistance to technology-integrated pedagogy, inadequate teacher technological competency, ethical dilemmas in sensitive data handling, and fragmented data ecosystems—all systematically deconstructed through causal analysis; (3) Innovative pathways propose a four-pillar solution framework: technological augmentation (e.g., multi-camera AI vision, edge computing), pedagogical transformation (e.g., dynamic grouping, competency-based progression models), systemic resource orchestration (e.g., federated learning platforms, interoperable cloud architectures), and institutional safeguards (e.g., tiered data governance protocols, AI ethics guidelines). This multidimensional approach not only addresses current implementation barriers but also provides a scalable model for aligning precision teaching with the strategic objectives of the “Four New” initiatives, ensuring both educational efficacy and technological sustainability in the digital era.

Keywords:

“Four New” initiatives
Data-driven education
Precision physical education
Educational modernization

Online publication: April 26, 2025

1. Introduction

Entering the third decade of the 21st century, the global education system has undergone a profound transformation from traditional models to intelligent and precision-based approaches, driven by modern information technology. Since the 19th National Congress of the Communist Party of China, the central leadership, with the General Secretary at its core, has placed great emphasis on interdisciplinary integration and the cultivation of innovative talent. The “Four New” Initiative—New Engineering, New Medicine, New Agriculture, and New Humanities—has been proposed as a strategic framework to enhance national competitiveness through educational modernization. As a crucial component of holistic education, sports education urgently needs to break away from the limitations of the traditional “one-size-fits-all” teaching model. By leveraging data-driven teaching, precision and intelligence-driven reforms can be realized, facilitating the deep integration of science, technology, and educational principles^[1].

In 2018, the Ministry of Education issued the “Education Informatization 2.0 Action Plan,” which focuses on the new demands of talent cultivation in the digital era. It recognizes educational informatization as an inherent variable driving systemic transformation and advocates for the deep integration of information technology with teaching. This initiative provides theoretical guidance and policy support for the transition of sports education from “experience-based instruction” to “data-driven empowerment.” Precision teaching, driven by data, enables real-time collection and analysis of students’ multidimensional data, allowing for dynamic adjustments to teaching strategies, thus enhancing instructional efficiency and promoting health.

However, the current development level of sports informatization, digitization, and intelligent education in China still falls short of the strategic goals outlined in the “14th Five-Year Plan for Sports Development,” the “Outline for Building a Leading Sports Nation,” and the “Healthy China 2030 Plan.” Significant bottlenecks remain in areas such as data collection, feedback mechanisms, and evaluation systems, limiting the potential of precision teaching in improving athletic skills and promoting overall health development^[2].

2. The coupling logic of the “Four New” construction and the digital transformation of education

2.1. Connotation deconstruction

In April 2021, when visiting Tsinghua University, the General Secretary clearly pointed out the requirements of promoting the construction of new engineering, new medical science, new agricultural science, and new liberal arts (referred to as the “four new” construction), aiming at the world’s scientific and technological frontiers and the national strategic needs, speeding up the cultivation of talents in short supply, and promoting the change of China’s higher education paradigm. As a specific projection of the national innovation-driven development strategy in the field of education, the “Four New” construction presents multi-dimensional characteristics: new technology (5G/AI/VR), new basis (data-driven decision-making), new industry (integration of sports and education), new industry (sports science and technology services), which constitutes a four-in-one sports precision teaching model (see **Figure 1**). New technology empowers the intelligentization of sports teaching, new basis helps teachers to make faster and better decisions, new industry promotes the integration of physical education and the development of the integration of industry and education, and new industry realizes the sports science and technology service, which jointly promotes the transformation of sports teaching from the judgment of experience to the decision-making of data, from the teaching of groups to the individual adaptation, and from the static evaluation to the dynamic optimization, providing a new path and example for the modernization of physical education and relying on the experience of teachers and the management of groups, and it is difficult to take into account the individual difference of the traditional physical education. It also injects new vigor and possibilities into traditional physical education, which relies on teachers’ experience and group management and is difficult to take individual differences into account^[3].

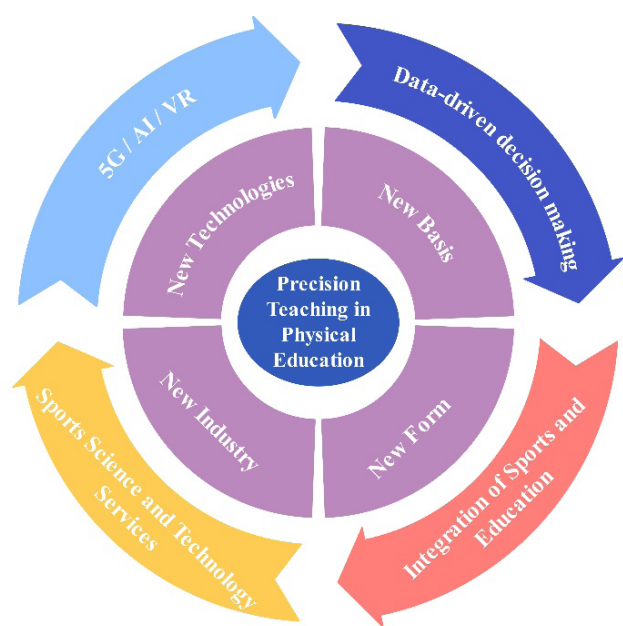


Figure 1. Precision teaching in physical education

2.2. Opportunities for transformation

The evolution of physical education teaching mode can be roughly divided into three stages. In the early days, the “one-size-fits-all” teaching mode emphasized uniform standards and collective activities, ignoring individual differences, resulting in students’ low participation and obvious deficiencies. With the continuous progress of the concept of education, layered teaching gradually emerged, and teachers began to group teaching according to students’ physical fitness and athletic ability, and strive to achieve hierarchical and targeted training. However, tiered teaching still has problems such as inconsistent evaluation standards and untimely adjustments in practice, making it difficult to fully reflect the true level and progress of students^[4].

In the wave of global digital transformation, China’s physical education has ushered in unprecedented development opportunities (see **Figure 2**), and policies have been intensively introduced at the national level, such as the “Outline for the Construction of a Strong Sporting Nation,” the “14th Five-Year Plan for the Development of Physical Education,” the “Healthy China 2030” Plan, and the Outline of the Plan for the Construction of a Strong Education Nation (2024–2035) all emphasize the need to accelerate the digital transformation of education, promote the in-depth integration of modern information technology and physical education teaching, and make

the data-driven precise teaching mode gradually become a new direction for physical education reform. At the same time, the rapid development of information technology provides realistic feasibility for the practice of precision teaching in physical education. Numerous studies have shown that sports games (Exergames) or smart wearable devices developed based on the new generation of information technology have intrinsic motivational effects on clinical and non-clinical populations, regulate their negative emotions, and have a significant impact on their attention, motor skill development, etc.^[1], which is a valuable step for subsequent large-scale application and promotion. Artificial intelligence and big data analysis can achieve personalized exercise program customization, smart wearable devices can monitor students’ exercise status in real time, virtual reality (VR) technology provides an immersive sports training experience, and high-speed and low-latency 5G communication ensures real-time interaction of remote sports teaching. This makes sports teaching gradually change from static assessment to dynamic optimization, and from sloppy teaching to personalized teaching. In addition, the innovation of modern education concept forces the reform of physical education teaching mode, the traditional physical education teaching mode is oriented to the teacher’s experience, and the school physical education teaching and social sports training are relatively separated. While the integration of physical education and the learner-centered education concept requires that the physical education teaching is more scientific, intelligent, personalized, and integrated, and the students’ sports characteristics are accurately analyzed with the help of digital technology means, breaking the school, society, family, and dynamically adjust teaching strategies according to individual differences, so as to enhance teaching efficiency and learning effects and realize the integration and sharing of quality sports resources. Finally, the sudden global public health events in recent years have also accelerated the digital transformation of education, during the COVID-19 epidemic, the distance between people and people, people and sports competition environment increased, online teaching, blended learning has become the mainstream, physical education has also begun to explore digital means of remote guidance and data analysis. The innovation of the precise teaching

Factors contributing to the transformation of the physical education teaching model

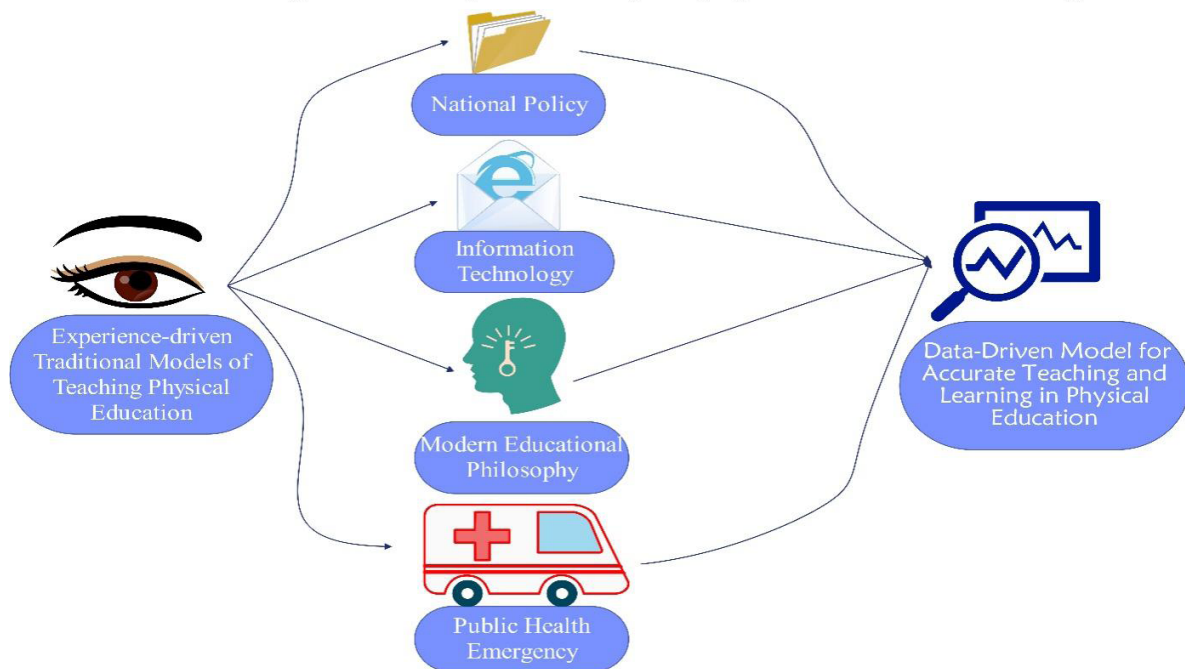


Figure 2. Factors contributing to the transformation of the physical education teaching model

mode for sports provides an unprecedented development opportunity ^[5].

3. The breakthrough path of data-driven sports precision teaching under the background of “Four New”

Under the “Four New” background, the data-driven sports precision teaching model aims to achieve personalized and efficient teaching through the integration of technology and education. However, the idealized blueprint of the mechanism construction encounters various phenomena of “not suited to the soil” in the process of landing, so it is necessary to put forward the corresponding optimization of the technique, model innovation, resource integration, and system guarantee—four major breakthrough paths to face the reality of bottlenecks and feed back into the optimization of the mechanism to make it more feasible and adaptable, and to promote the accurate teaching mode of physical education from theoretical ideas to real-world applications ^[6].

3.1. Technology optimization path

In collective projects, complex sports scenes will reduce the data signal-to-noise ratio and produce a large amount of inefficient or even invalid data, in order to solve this problem, it can be used to eliminate the blind area of the occlusion by setting up multi-camera (4–6) high-definition cameras, combined with the deep learning algorithms (e.g., YOLO, PoseNet), which is not only real-time but can also pre-determine the locating, movement, and trajectory of the athletes. Deep learning algorithms for classification, detection, tracking, and trajectory prediction are discussed and have shown great advantages in various sports. For implementation, a portable tripod or a special stand can be used to fix the camera, and edge computing and data preprocessing can be utilized to filter invalid data and extract key features to increase transmission speed to reduce latency. In addition, “digital twin” as a fusion between real and virtual products can also be used to improve the effect of data application, to make digital objects coexist with real-world objects and interact with them in real time through extended reality (XR) technology, making them “digital doppelgängers” of the

learners. For example, in table tennis training, the system collects students' serve speed and reaction time, generates virtual coaches for their weaknesses (slow receiving and serving), and repeatedly reinforces technical movements according to the dynamically adjusted practice plan ^[7].

3.2. Mode innovation path

Traditional physical education teaching is based on large classes, ignoring individual differences, resulting in uneven teaching results. While the sports precision teaching model is personalized by analyzing students' physiological, movement, and behavioral data, the rigidity of the model and the lack of teachers' adaptive ability limit its implementation. Based on the Newell constraint model (see **Figure 3**), motor skill development needs to balance individual constraints, task constraints, and environmental constraints. To this end, individual constraints (e.g., fitness data), task constraints (e.g., shot hit rate), and environmental constraints (e.g., field conditions) are dynamically grouped based on historical data and current sport performance using a K-means clustering algorithm, taking into account both individualized and collaborative needs. Within different groups, personalized training tasks are intelligently assigned through AI algorithms to ensure that students have the best experience within their abilities. For example, in handball training, the system analyzes the

shooting hit rate, passing success rate, and physiological data to assign technical movement exercises for students with weaker skills and low-intensity ballistic exercises for those with insufficient physical strength. In addition, the development of motor skills can never be accomplished through classroom practice, but requires the concerted efforts of “family-society-school” to integrate the high-quality data collected in the classroom into a “movement-problem-solution” motor knowledge map, improve data analyzability, and help learners develop their motor skills in the classroom. The data can be analyzed to help learners practice at home and in society. For example, in handball training, the knowledge map can link “blocked shot” with “late jump and short lag time,” and recommend explosive leg strength and core strength training ^[8].

3.3. Resource integration path

The sports precision teaching model requires high requirements for smart devices, curriculum resources, and teachers' abilities, but uneven resources and budgets between regions and schools limit the popularization. For this reason, we should lower the threshold, bridge the education divide, and improve the efficiency of resource utilization through cloud platform sharing and low-code (LCP) tool development, as well as cooperation with technology companies. Specifically, the ability of cloud computing platforms to integrate equipment,

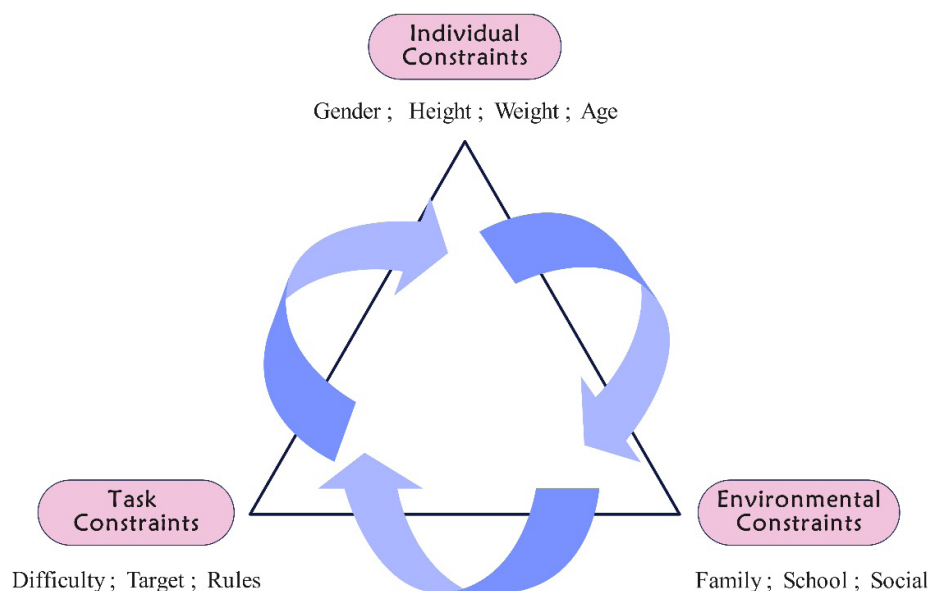


Figure 3. Newell constraints model

curriculum, and experience resources can greatly reduce the investment of separate schools in precision teaching, where schools in economically developed regions share equipment by uploading multi-camera AI vision systems and mature lesson plans to the platforms, and schools in economically less-developed regions obtain services through subscriptions. In addition, the rise of low-code platforms has made the lack of teachers' digital literacy no longer a limiting factor in the promotion of precision teaching. In handball teaching, teachers drag and drop modules to generate running trajectories and heart rate analysis panels, which allow them to formulate training plans without programming, lowering the threshold of data visualization and improving data availability^[9].

4. Conclusion and prospects

As a powerful engine for national revitalization and social progress, data-driven sports precision teaching has far-reaching strategic significance and practical value as an innovative practice of the "Four New" construction in the field of physical education. Based on the background of the "Four New" construction, this paper focuses on the mechanism construction, practical bottlenecks, and breakthrough paths of physical education precision teaching, and seeks to promote the transformation of physical education teaching from the traditional

experience mode to intelligent, personalized, and data-driven, so as to realize the quality revolution and high-quality development of physical education in China. The data-driven precision teaching of physical education needs to adhere to the concept of technology integration and practice orientation, adhere to serve the people's expectations for a healthy life, adhere to serve the people's aspirations for high-quality education, adhere to serve the modernization and development of national and local education, and adhere to better show the educational value and social function of physical education. Breaking through the limitations of traditional "one-size-fits-all" teaching, creatively constructing a precise teaching mechanism that includes technology integration, operation guarantee, and collaborative innovation, promoting the in-depth fusion and revolutionary innovation of "technology-teaching-capacity-system," realizing the connotative, high-quality, and innovative development of physical education, and cultivating more high-quality physical education talents who can adapt to the social needs. To better serve the national strategy of building a strong education country, a strong sports country, and a healthy China, future research can focus on cost control, teacher empowerment, and system improvement to ensure its universality in different regions and provide sustainable impetus for physical education reform^[10].

Funding

Research on Data-driven Precision Teaching of Physical Education in the Context of "Four New" Construction (XJGY2023036)

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Stanmore E, Stubbs B, Vancampfort D, et al., 2017, The Effect of Active Video Games on Cognitive Functioning in Clinical and Non-Clinical Populations: A Meta-Analysis of Randomized Controlled Trials. *Neuroscience & Biobehavioral Reviews*, 78: 34–43.
- [2] Huang K, Zhao Y, He R, et al., 2022, Exergame-Based Exercise Training for Depressive Symptoms in Adults: A Systematic Review and Meta-Analysis. *Psychology of Sport and Exercise*, 63: 102266.

- [3] Carney R, Firth J, 2018, mHealth and Physical Activity Interventions among People with Mental Illness, Exercise-Based Interventions for Mental Illness, Academic Press, 217–242.
- [4] Monroe CM, 2016, Valuable Steps Ahead: Promoting Physical Activity with Wearables and Incentives. The Lancet Diabetes & Endocrinology, 4(12): 960–961.
- [5] Wang JB, Cadmus-Bertram LA, Natarajan L, et al., 2015, Wearable Sensor/Device (Fitbit One) and SMS Text-Messaging Prompts to Increase Physical Activity in Overweight and Obese Adults: A Randomized Controlled Trial. Telemedicine and e-Health, 21(10): 782–792.
- [6] Mu S, Cui M, Huang X, 2020, Multimodal Data Fusion in Learning Analytics: A Systematic Review. Sensors, 20(23): 6856.
- [7] Liu S, Zhang J, Zhang Y, et al., 2020, A Wearable Motion Capture Device Able to Detect Dynamic Motion of Human Limbs. Nature communications, 11(1): 5615.
- [8] Liang JM, Su WC, Chen YL, et al., 2019, Smart Interactive Education System Based on Wearable Devices. Sensors, 19(15): 3260.
- [9] Richlan F, Weiß M, Kastner P, et al., 2023, Virtual Training, Real Effects: A Narrative Review on Sports Performance Enhancement Through Interventions in Virtual Reality. Frontiers in Psychology, 14: 1240790.
- [10] Suo X, Tang W, Li Z, 2024, Motion Capture Technology in Sports Scenarios: A Survey. Sensors, 24(9): 2947.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Social Contract Theory and Legitimacy: From History to Modern Times

Ying Gao, Jialei Cao

School of Marxism, Chang'an University, Xi'an 710064, Shaanxi, China

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

As a core theory of Western political philosophy, social contract theory shapes the foundation of Western political systems and plays an important role in understanding the sources of state power and the construction of government legitimacy. This article explores the relationship between social contract theory and political legitimacy and analyzes the evolution of ideas from history to modern times. Through the viewpoints of classic social contract theorists such as Hobbes, Locke, and Rousseau, this paper constructs the legitimacy basis that government power originates from the consent of the people. At the same time, the paper explores the influence of contract theory during the Enlightenment period on the American Declaration of Independence and the French Revolution, and discusses John Rawls' reconstruction of modern contract theory, as well as the challenges posed by feminist and environmental ethics. Social contract theory has not only shaped political legitimacy in history but also demonstrated

its lasting vitality and broad application prospects in contemporary political and ethical issues.

Keywords:

Social contract theory
Political legitimacy
Modern politics

Online publication: April 26, 2025

1. Introduction

The theory of the social contract, as a political philosophy, posits that the state is not divinely ordained but rather a rational choice made by individuals. Since its inception, it has occupied a significant position in Western intellectual history. Legitimacy is a crucial concept in political philosophy, referring to the moral foundation upon which a government or political system is deemed rightful and authoritative. Through the social contract, governmental power is understood as being granted by the people, and

thus its legitimacy stems from their consent and support. The social contract theory not only provides a historical account of the origins of the state but also offers a novel interpretation of the principles of justice underlying state legitimization. What are the principles of justice that bind citizens in their relationships with one another? Under what circumstances can the state legitimately serve as the ultimate arbiter of these relationships? The social contract theory addresses these two questions by articulating principles of justice applicable to governing

society and establishing a sovereign state endowed with legitimate coercive power ^[1]. By tracing the evolution of the social contract theory and legitimacy from historical to contemporary contexts, people gain deeper insight into its role not only as a key to understanding past political thought but also as a powerful tool for reflecting on current political institutions and power structures.

2. The social contract theory and legitimacy from a historical perspective

2.1. Thomas Hobbes

Hobbes' social contract theory begins with a depiction of the state of human nature. Influenced by Machiavelli, Hobbes posits that human nature is inherently evil, and the state of nature is a "state of war among men", where individuals are in a state of anarchy. In this state, individuals pursue their own interests, leading to endless conflicts and wars due to resource scarcity and mutual competition. Hobbes describes: "When there is no common power to awe all, people are in what is called a state of war" ^[2]. The key feature of this state of nature is the absence of collective authority and public order, where individuals' lives are often threatened due to the lack of laws or a central authority to protect them from harm. This chaotic and fearful state of nature, which Hobbes believes is prevalent in human society, results in uncertainty, insecurity, and ongoing conflict. This state makes life unpredictable and dangerous, making it difficult for individuals to enjoy a stable and peaceful existence.

To escape the chaos and fear of the state of nature, Hobbes introduced the concept of the social contract. He argued that individuals could secure safety and order by voluntarily relinquishing some of their natural rights. In "Leviathan", Hobbes outlines a hypothetical process of forming a social contract: individuals agree to transfer their natural rights to a centralized government known as "Leviathan." This government, Leviathan, is granted absolute sovereignty and power to ensure societal security and order. It has the authority to protect people's lives, property, and freedom through laws and policies, and to resolve social conflicts and disputes.

2.2. John Locke

Locke's description of the state of nature differs from Hobbes' chaotic state, where "man is a wolf to man." Locke argues that in the state of nature, people are free, equal, and rational. The natural human disposition is not self-preservation but mutual cooperation. They follow the law of nature, which is the universal moral principle discovered by reason, guiding them to respect others' lives, freedom, and property. In the state of nature, everyone enjoys equal rights and freedoms, capable of guiding their actions and resolving disputes through reason.

Locke's definition of a legitimate government emphasizes the limitations of governmental power and the protection of citizens' rights. According to his theory, a legitimate government must meet several conditions. First, the government's authority comes from the people's consent, which is the core principle of the social contract. The people agree to establish a government through a contract, granting it limited powers to protect their natural rights. Second, Locke proposed the idea of the separation of powers. He argued that the government should be divided into three branches: legislative, executive, and judicial, to prevent the concentration and abuse of power. The legislative branch formulates laws, the executive branch enforces them, and the judicial branch interprets the law and resolves disputes. Through the separation and checks of these powers, the government's actions are restrained, preventing autocracy and dictatorship. Third, the primary duty of a legitimate government is to protect citizens' lives, freedoms, and property. Any government action that violates this duty is considered illegitimate, and the people have the right to resist and revolt.

2.3. Jean-Jacques Rousseau

In Rousseau's social contract theory, the state of nature marks the starting point of human societal development. Rousseau describes people in the state of nature as "noble savages" who are free, equal, and independent, living a simple and harmonious life. Unlike Locke, Rousseau argues that in the state of nature, there are no clear property rights or systematic law; people live by instinct and natural sympathy. Moreover, unlike Hobbes' view of human nature, natural beings are not purely self-interested or selfish; they exhibit a complex dual emotional aspect:

while pursuing personal safety and happiness, they also show deep concern and assistance for others. The state of nature, as Rousseau describes it, is an ideal life characterized by mutual aid, harmony, and coexistence.

However, with the emergence of private property and the development of human society, the natural state of equality and freedom has gradually been undermined. Private property has led to inequality, competition, and conflict, complicating people's lives and creating contradictions. To regain freedom and equality, people need to establish a new social order through a social contract. The core of this social contract is to achieve citizens' freedom and equality through public will (the common good). The common good represents the highest interest of the collective and is the sovereignty of the entire society. Each individual voluntarily relinquishes some personal freedom when signing the contract, in exchange for collective freedom within the community. Through this contract, individuals gain greater freedom under the protection of laws and institutions, while also becoming part of the community.

3. Social contract theory and legitimacy in the Enlightenment

3.1. The application of social contract theory in the Enlightenment

The Enlightenment was an intellectual and cultural movement in Europe in the 18th century, emphasizing reason, science, and individual rights. Social contract theory is an important part of Enlightenment thought. Its main point is that the legitimacy of a state comes from a contract between citizens, rather than divine or royal authority.

In 1776, the Declaration of Independence served as a significant application of social contract theory. Thomas Jefferson wrote in the Declaration: "We hold these truths to be self-evident: that all men are created equal, endowed by their Creator with certain unalienable rights, including life, liberty, and the pursuit of happiness." This statement directly reflects Locke's theories of natural rights and social contract. The Declaration emphasizes that the legitimate authority of government comes from the consent of the governed. When the government infringes upon these fundamental rights, the people have the right to change or abolish it and establish a new government.

The French Revolution, through the theory of social contract, criticized the injustices and autocratic rule of the old regime, leading to the establishment of a new republican government and the recognition of the people as the sovereigns of the state. The ideas of freedom and equality promoted by Rousseau were also put into practice during the revolution. During this period, especially under Robespierre's leadership, a strong emphasis on public morality was reflected in moral education and revolutionary tribunals, aiming to purify society and achieve the moral society Rousseau envisioned. Rousseau firmly opposed autocratic rule and all forms of oppression, advocating that the people overthrow tyranny through revolutionary means. The storming of the Bastille and the execution of King Louis XVI exemplified this spirit of resistance against autocracy, highlighting the intense struggle of the people for freedom and equality.

3.2. The influence of social contract theory on the modern political system

The proposal of social contract theory marks the shift from theocracy or monarchical power to the people's rights as the core of political philosophy, which is an important basis for modern democratic thought. In a modern democratic system, representative democracy and direct democracy are two main forms of democracy.

Social contract theory in the Enlightenment was not only a theoretical discussion but also a catalyst for practical political change. Its influence continues to this day, and the design and revision of modern state constitutions are often based on the principles of social contract theory, through the consent and participation of citizens to make and revise the constitution.

The social contract theory of the Enlightenment, by exploring the legitimacy of government, the sources of power, and citizens' rights, laid the theoretical foundation for modern democratic systems. The social contract ideas in the American Declaration of Independence and the French Revolution demonstrated how these theories were applied and influenced real political changes. The representative and direct democracies in modern democratic systems continue to reflect the core principles of social contract theory, ensuring the legitimacy of government and social equity and justice through citizen consent and participation.

4. Social contract theory and legitimacy in modern society

4.1. John Rawls

In modern society, social contract theory continues to evolve, adapting to new social and political environments. John Rawls' theory has become a representative of contemporary social contract theory, offering new interpretations of social justice and the legitimacy of government by proposing the original position and principles of justice. Meanwhile, modern critiques and reconstructions have challenged and enriched traditional social contract theory from various perspectives.

John Rawls, one of the most significant political philosophers of the 20th century, reconstructed social contract theory in his work "A Theory of Justice." Rawls introduced a new theoretical framework centered on the original position and principles of justice, exploring social justice and the legitimacy of government. His social contract theory is grounded in an assumed original position where rational and self-interested individuals, under the veil of ignorance, form a social contract. The veil of ignorance means that these individuals are unaware of their social status, abilities, gender, race, and other characteristics, ensuring that they do not favor any particular group when designing social institutions. Through this assumption, Rawls aimed to ensure the fairness of the social contract.

Rawls' principle of justice is not only a theoretical concept but also provides a new foundation for modern political legitimacy. "Through the basic institutional arrangements and regulations of society or the state, to achieve a fair and just distribution of the basic rights and obligations of all citizens, thereby realizing universal fairness and justice within the political framework of modern democratic states" [3]. According to Rawls, fairness is the primary standard of justice and the foundation of the legitimacy of social institutions. In traditional social contract theory, legitimacy primarily stems from citizens' agreement to the social contract. However, Rawls argues that true consent must be given under conditions of fairness, and only agreements reached under such conditions in the original position are considered legitimate.

4.2. Modern criticism and reconstruction

Although Rawls' theory occupies an important position in the modern social contract theory, it still faces many criticisms and reconstructions. Different schools and thinkers challenge the traditional social contract theory from various perspectives, such as gender, environment, and global justice [4].

Feminists have offered a profound critique of traditional social contract theory, arguing that it overlooks gender inequality and fails to adequately address the unique roles and needs of women in both family and society. Carol Petman, a prominent figure in this field, argues in her book "The Gender Contract" that traditional social contract theory implicitly includes a "gender contract" aimed at maintaining male dominance over women. This gender contract consists of two main components: first, women's unacknowledged status as individuals and their passive dependence on men; second, women are confined to the private sphere through marriage, effectively excluded from the public sphere [5]. Petman contends that the original state and the process of forming the social contract in social contract theory are premised on male perspectives and interests [6].

Environmental ethicists have also challenged traditional social contract theory, particularly concerning issues of intergenerational justice and environmental protection. Traditional social contract theory primarily focuses on the rights and obligations of the current generation, often overlooking the responsibilities to future generations. The issue of intergenerational justice arises from how the existing social contract treats future generations that have not yet been born. Environmental ethicists argue that current social and economic activities significantly impact future generations, but the original position in traditional social contract theory does not adequately address this. Future generations cannot participate in the current social contract, yet their interests are heavily influenced by current decisions. John Rawls, in his work "A Theory of Justice", also addressed the issue of intergenerational justice, proposing the "preservation principle." This principle suggests that each generation has a responsibility to preserve adequate capital and resources for future generations to ensure they can achieve the ideal of a just society. While this principle does not fully resolve all concerns of environmental ethicists, it provides an

important starting point for integrating intergenerational justice into social contract theory ^[7].

The social contract theory, as reconstructed by John Rawls, emphasizes the original position and principles of justice, offering new interpretations for social justice and the legitimacy of government. Rawls' theory ensures the fairness and moral foundation of the social contract through the veil of ignorance and the principles of justice. However, this theory has faced numerous criticisms and reconstructions from various perspectives, including gender, environmental, and global justice, which have enriched and challenged traditional theories. By incorporating gender equality, environmental protection, and global cooperation, the social contract theory continues to evolve, addressing emerging challenges in modern society and globalization. These critiques and reconstructions not only deepen the understanding of the social contract theory but also provide a new theoretical foundation for building more equitable and sustainable social systems ^[8].

5. Conclusions

Social contract theory, a crucial theoretical tool in political

philosophy, has evolved and developed from ancient times to the present, reflecting humanity's relentless pursuit of social justice and legitimacy. From Hobbes' concept of the terrifying state of nature and the necessity of an absolute monarch, through Locke's ideas on natural rights and the legitimacy of government, to Rousseau's concepts of public will and direct democracy, social contract theory has demonstrated its unique ideological appeal and practical significance across different eras and contexts. During the Enlightenment, social contract theory became a key theoretical foundation for the American Revolution and the French Revolution, profoundly influencing the formation and development of modern political systems ^[9].

In modern times, John Rawls has significantly restructured social contract theory through the concept of the original position and principles of justice, emphasizing that fairness is the foundation of social justice and the legitimacy of government. Rawls' theory has sparked extensive academic debate and influenced the policy and legal frameworks of many countries. However, his theory has also faced numerous critiques and reconstructions, including feminist calls for gender equality, environmental ethicists' emphasis on intergenerational justice, and global justice theorists' focus on transnational inequality ^[10].

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Jing JY, 2024, Inheritance and Rebellion: A Dialogue Between "The Interpretation of the People's Covenant" and "The Social Contract". Yichun University Journal, 2024(11): 86–93.
- [2] Hobbes T, 1985, *Leviathan*, translated by Li Sifu and Li Tingbi. Commercial Press, Beijing, 120.
- [3] Rawls J, 1988, *A Theory of Justice: Preface*, translated by He Huaigong. China Social Sciences Press, Beijing, 1.
- [4] Lu JS, 2019, Critique of Locke's Liberal Contract Theory by Pettman's Gender Contract Theory, thesis, University of International Business and Economics.
- [5] Li HJ, 2024, Critique of Modern Western Social Contract Theory by "Das Kapital". Philosophy Research, 2024(9): 14–21.
- [6] Xu G, 2024, On Value Conflicts: An Analysis Based on Social Contract Theory. Daqing Social Sciences, 2024(1): 65–69.
- [7] Wang YK, 2023, "The Social Contract": What Does Rousseau Really Want to Say? Secondary School History Teaching Reference, 2023(17): 61–63.
- [8] Zhang L, 2023, Ethical Regulation of Social Media Privacy Protection from the Perspective of Social Contract Theory. Media Forum, 2023(6): 36–39.
- [9] Liu QP, 2023, Deep Paradox Analysis of Rousseau's "The Social Contract". Academic World, 2023(2): 27–36.

- [10] Fan GX, 2022, People-Oriented and People's Covenant: Liu Shippei's Interpretation of Rousseau's Social Contract Theory. *Chinese Philosophy History*, 2022(6): 116–122.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Research on the Role of Physical Education in Kunming in Promoting the Development of Youth Sports in Southeast Asian Countries

Yue Li, Nurul Nadiyah Binti Sahimi, Haohai Wang

Management and Science University, Graduate School of Management, 40100, Malaysia

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

In recent years, sports, as an effective means of cultural exchange and the establishment of international friendly relations, have become increasingly important, especially for Southeast Asian countries in the Asian region, where they hold special value. This study takes the physical education in Kunming City as the specific research object to explore its promoting effect on the development of youth sports in Southeast Asian countries. By using quantitative and qualitative research methods, through questionnaire surveys, interviews, and in-depth analysis of relevant data in Kunming City, it is concluded that physical education in Kunming City plays an important role in promoting the development of youth sports in Southeast Asia. Furthermore, the research found that physical education in Kunming has performed outstandingly in helping to improve their physical fitness, enhance their sports skills and love for sports. The statistical results of various data show that this promoting effect not only drives the sports exchanges between Kunming and Southeast Asian countries, but also helps to enhance the sports quality and interest of teenagers in these countries. Therefore, physical education in Kunming has demonstrated tremendous value and potential in promoting the development of youth sports in Southeast Asia and facilitating friendly exchanges between the youth of Kunming and those of Southeast Asian countries. The results of this study may provide new perspectives and references for future youth sports exchanges between Kunming and more Chinese cities and Southeast Asia.

Keywords:

Physical education in Kunming City
Teenagers in Southeast Asian countries
Sports development
Cultural exchange
Quantitative and qualitative research

Online publication: April 26, 2025

1. Introduction

Sports, as an important form of cultural dissemination, play a significant role in building international friendly and cooperative relations. Due to their geographical and cultural advantages, Southeast Asian countries have long-term potential for collaboration with China in the field of sports, especially in the development of youth sports. Kunming City serves as a key node connecting China and Southeast Asia. Relying on its profound accumulation of sports education and resource advantages, it plays a special role in promoting regional sports exchanges. At present, research on how physical education in Kunming can promote the development of youth sports in Southeast Asian countries in detail is still insufficient. This study focuses on physical education in Kunming. Through questionnaires, interviews and data analysis, it evaluates its practical role in improving the physical fitness, technical level and sports interest of teenagers in Southeast Asian countries. It aims to demonstrate the effect and significance of physical education in Kunming, provide new ideas for regional sports cooperation, and explore the potential for future cooperation between China and Southeast Asian countries in the field of sports.

2. The background and development overview of physical education in Kunming City

2.1. The history and current situation of physical education in Kunming City

Kunming is a core city in the southwest of China. The development history of physical education is very long and the cultural foundation is particularly profound. At the beginning of the 20th century, the first modern sports institution was officially established here. Subsequently, the physical education system of schools at all levels was gradually established. After the founding of the People's Republic of China, physical education received strong support from the government. Various sports facilities were rapidly built and various sports activities were frequently carried out.

Since the beginning of the 21st century, physical education in Kunming has achieved remarkable improvement. The arrangement of physical education courses has become increasingly meticulous and

appropriate, covering basic sports such as track and field, basketball, football, badminton, etc. No effort was missed to promote off-campus sports activities in schools, cooperate with social sports institutions, and expand the popularization and improvement of youth sports training. In terms of hardware facilities, Kunming has invested a huge amount of funds in building modern sports venues and improving campus sports facilities, providing a favorable environment and conditions for the physical education of teenagers.

Kunming also attaches great importance to the international development of physical education. By hosting global sports events and exchange activities, it deepens sports exchanges and cooperation with Southeast Asian countries. The physical education in Kunming has established a very complete teaching and management system in China, and is gradually demonstrating its special appeal and obvious advantages worldwide. The physical education in Kunming has gone through the entire process from infrastructure construction to the completion of the curriculum system, and from single-project teaching to multi-level progress. It has long become a key component of Kunming's education cause^[1].

2.2. The relationship between sports and international exchanges

Sports have a deep relationship with international communication. Sports are like a language that the whole world can understand, which can help people from different countries and regions get to know each other and cooperate together. Kunming City often organizes many international sports competitions and activities, warmly inviting young people from Southeast Asian countries to participate. This has greatly enhanced the friendly ties among people. Physical education not only plays a role in competitions, but also enables people to understand each other better and learn to accept different cultural backgrounds by spreading sports culture. Kunming City pays special attention to the diverse integration and mutual respect of cultures in sports exchanges and has successfully established a channel for everyone to connect. Such cross-cultural interactions have significantly deepened the emotional bonds among young people in the region, consolidated the good relations between Kunming and Southeast Asian countries, and are

of great significance and far-reaching influence.

3. The current situation and demands of youth sports development in Southeast Asian countries

3.1. Common problems in youth sports development in Southeast Asia

The development of youth sports in Southeast Asian countries encounters a host of common problems. The severe shortage of sports facilities and resources has become the biggest stumbling block. Many Southeast Asian countries have poor economic conditions and cannot afford sufficient funds to build or maintain sports facilities, which makes it impossible for teenagers to participate in high-level sports training and find suitable activity venues. Most of the sports equipment is dilapidated and the condition of the venues is ridiculously poor, seriously hindering teenagers from participating in complete and organized sports activities. The shortage of teaching staff in physical education is also a very serious problem. The number of physical education teachers in Southeast Asian countries is small, and their professional levels vary. The training opportunities for physical education teachers are scarce and the learning resources are limited. When teaching professional skills, they often find it difficult to meet the real needs of teenagers to learn and improve their physical education skills, which affects the overall development level ^[2].

There are hidden problems in the family, social, and cultural atmosphere regarding teenagers' participation in sports activities, which has become one of the key points that need attention. In the cultural environment of some Southeast Asian countries, sports activities are not regarded as an important link that contributes to academic progress or future career development. The support given to sports activities by families and society appears relatively weak.

This concept directly leads to a significant reduction in teenagers' interest and motivation to participate in sports activities, severely hindering their overall development and advancement space in the field of sports. Health problems and lack of nourishment also have a negative impact on the shaping of teenagers' sports abilities. In some Southeast Asian countries, teenagers

are unable to actively participate in physical exercise and various competitions due to health problems such as a lack of nourishment and physical illness. This not only limits the regular presentation of teenagers' sports potential but also makes them prone to serious physical injuries and various hidden risks and threats during sports activities. The imperfect policies and systems constitute the key factors hindering the progress of youth sports. In many Southeast Asian countries, sports progress policies lack comprehensive consideration and long-term planning, and are unable to establish a high-quality sports education system and incentive measures. This results in teenagers being unable to obtain reliable guarantees when developing sports and affects the overall improvement of sports levels.

3.2. The social and cultural impact of sports activities on teenagers in Southeast Asia

Sports activities have a profound influence on young people in Southeast Asia, demonstrating significant social and cultural roles. Participating in sports activities can improve the physical health of young people, enhance their physical vitality, and at the same time, it can also exercise their teamwork ability and competitive spirit, and have a positive impact on their psychological growth and social behavior. Sports activities also offer teenagers the opportunity to make friends. Through the process of making friends, they can learn about different cultural backgrounds and enhance cross-cultural understanding and respect ^[3].

4. The correlation between physical education in Kunming and the development of youth sports in Southeast Asia

4.1. The internationalization characteristics of physical education in Kunming

The international characteristics of physical education in Kunming have played a very important role in the development of youth sports in Southeast Asia. Kunming is located at the junction of China and Southeast

Asian countries, enjoying a particularly advantageous geographical location. Therefore, there are many opportunities for physical education in Kunming to exchange with foreign countries. Kunming City makes use of its rich and diverse sports courses and activity designs, incorporates international elements, and arranges the sports education curriculum with a global perspective. Kunming City frequently organizes various sports competitions and exchange activities, attracting many teenagers from Southeast Asian countries to participate and helping these teenagers gain better international sports exchange experiences. Kunming City is determined to cultivate sports talents with an international perspective. This goal is reflected in the setting of school physical education courses and the improvement of teaching methods.

At the same time, through cooperation with international sports organizations and institutions, the physical education in Kunming City is gradually reaching international standards. The international nature of physical education in Kunming is reflected in the diversity of the teaching staff. Foreign sports experts are invited to teach sports courses for teenagers, enabling teenagers from Southeast Asian countries to understand diverse sports training concepts and techniques, and promoting the improvement of teenagers' sports levels. Kunming takes the initiative to promote the communication and integration of sports cultures between China and foreign countries, organizes international sports forums and seminars, and builds a sports exchange platform between Kunming and Southeast Asian countries. This international characteristic not only promotes the progress of physical education in Kunming itself, but also has a long-term effect on the progress of youth sports in Southeast Asia, helping them optimize their physical fitness, enhance their sports skills, shape their love for sports, and promote the vigorous development of regional sports culture ^[4].

4.2. The promoting role of physical education in cultural exchange and integration

Physical education is a very important tool for cultural dissemination, which can help different cultures communicate and integrate better. The physical education in Kunming makes use of physical education courses,

interactive training and various sports competitions to enable young students from Southeast Asia to have a deeper understanding of Chinese sports culture and form a positive way of cultural exchange. In physical education courses, young students from Southeast Asia can learn various sports skills. At the same time, they can also personally participate in local traditional sports activities in Kunming, such as practicing martial arts and playing traditional games. These activities greatly increase their understanding and curiosity about Chinese culture. During the interactive training, local physical education teachers in Kunming will directly communicate with young students from Southeast Asia, teach them training methods and practical experience, help cultural integration deepen mutual understanding, enhance friendship, and grow and progress together. Sports events and exchange activities not only contribute to building friendships but also provide a platform to showcase the cultural characteristics of both sides, allowing Southeast Asian teenagers to enhance their sense of identity and belonging to Chinese culture while experiencing the sports charm of Kunming. With the help of sports education, Kunming has become an important bridge connecting cultural exchanges between China and Southeast Asia.

5. The practical effects and influences of physical education in Kunming City

5.1. The impact of physical education curriculum and interactive training on teenagers in Southeast Asia

Kunming has promoted the development of youth sports in Southeast Asia through physical education, achieving remarkable results. In particular, physical education courses and interactive training have had a profound impact on teenagers in Southeast Asia, and their role is indeed significant.

Kunming City makes full use of diverse sports resources and advanced educational concepts to carefully plan various forms of sports courses, covering a wide range of sports such as basketball, football, badminton and table tennis. These physical education courses help teenagers in Southeast Asia enhance their physical fitness and develop teamwork spirit and competitive awareness through learning. In terms of interactive

training, Kunming City takes the initiative to arrange various sports training camps and exchange activities, inviting teenagers from Southeast Asia and China to participate in the training together. Through the exchange of skills, they deepen their friendship and mutual understanding. These activities create a platform for Southeast Asian teenagers to communicate and discuss with their Chinese peers, helping them feel and adapt to different cultural backgrounds and experience the unique charm of multiculturalism. During the training process, young students from Southeast Asia can experience the meticulous and patient guidance of professional coaches in Kunming, as well as the great convenience and assistance brought by first-class sports facilities, which has significantly improved their sports ability and level.

The interactive training content places great emphasis on cooperation among teams and the abilities demonstrated by each individual. Through practical hands-on operations, it enhances the love for sports and a more comprehensive and in-depth understanding, promoting the all-round development of both body and mind. The physical education courses, combined with various interesting interactive training activities, have significantly improved the physical health of young students in Southeast Asia, and aroused their strong passion and full confidence in participating in sports. The sports courses and training activities held in Kunming have enabled young friends from Southeast Asia to deeply understand the true value contained in the sports spirit through practical participation and interactive communication, jointly creating a sports cultural environment full of optimistic and enterprising spirit. Such practical achievements have significantly enhanced the close collaborative ties between Kunming and Southeast Asian countries. At the same time, they have provided extremely valuable experience and references for the development of sports among the younger generation in Southeast Asia, promoting in-depth exchanges and cooperation among the younger generation in the region in terms of sports culture^[5].

5.2. Actual achievements of sports events and exchange activities

The sports events and exchange activities organized by Kunming City have provided many platforms for young

people from Southeast Asian countries to participate and have achieved good results. Such sports events help young people improve their physical fitness and also make their sports skills stronger. On the international competition ground, competitions and exchanges are carried out. Young people from Southeast Asian countries can compete with local students in Kunming, exchange experiences and methods in training with each other, and cultivate a tenacious will and the spirit of teamwork through activities. International sports exchange activities have enabled young people in Southeast Asian countries to have a better understanding of the charm of Chinese culture, enhanced their sense of belonging, and at the same time promoted friendship and mutual trust between the two sides.

6. Conclusion

This survey report comprehensively analyzes how physical education in Kunming has promoted the improvement of youth sports in Southeast Asian countries. It adopts both quantitative and qualitative research methods to carefully study how the physical education model in Kunming has improved the physical health of teenagers, enhanced their sports skills, and aroused their interest and enthusiasm for participating in sports activities. Pay particular attention to the results of students' physical fitness tests and the effects of interest cultivation activities. The sports education in Kunming promotes the exchange and interaction of sports culture among young people from Southeast Asian countries, contributes to the continuous progress of regional youth sports, strengthens friendly ties and mutual understanding, and at the same time enhances the teamwork spirit of young people.

Some problems and deficiencies were detected during the investigation. For instance, the collected data was only derived from the practical activities of physical education in the Kunming area. The sample size was small, the coverage was not broad enough, and the research on the specific influence of the social and cultural background of Southeast Asian countries on cooperation and exchanges was not in-depth enough. The investigation proposes to expand the scope of coverage, incorporate more cases of urban physical

education in China, formulate appropriate project plans in combination with the cultural background and actual needs of Southeast Asia, measure the long-term role of physical education by using long-term monitoring data, pay attention to the key role of policy support and the coordinated use of social resources, and strive to build a regional sports exchange and cooperation platform that

can develop in the long term. Strive to achieve a win-win situation for all parties. The purpose of conducting this research is to analyze the youth sports cooperation between China and Southeast Asia, provide theoretical support, promote cultural exchanges, and reflect the social value of physical education.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Chang S, 2022, Research on the Appropriate Political Mechanism in Southeast Asian Countries. *Academic Circle*, 2022(8): 30–40.
- [2] Comparative Political Science Studies, 2021, A Review of the Construction Theory Research in Southeast Asian Countries, 2021(1): 122–144.
- [3] Zhou Y, Yu X, Sun L, 2023, Investigation on the Development of Trade Between China and Southeast Asian Countries. *Chinese Science and Technology Journal Database (Full Text Edition) Economic Management*, 2023(7): 64–67.
- [4] Gao S, Liu M, Liu Y, 2023, Research on Reports Related to China in Southeast Asian Countries. *Journal of the People's Police University of China*, 39(9): 32–37.
- [5] Zeng X, Wu Y, Gou S, 2020, Research on the Types of Chinese Language Transmission Routes in Southeast Asian Countries. *University Teaching in China*, 2020(1): 84–88.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Research on the Effect of TABATA High-Efficiency Fat-Burning Training on Improving the Health of Obese College Students

HehuaTang¹, Lei Zhang²

¹Xi'an Fanyi University, Xi'an 710105, Shaanxi, China

²Qingshuitou Primary School, Wangmang Street, Chang'an District, Xi'an 710000, Shaanxi, China

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract:

The period from 2024 to 2027 has been officially designated as the “Global Weight Management Year” by the World Health Organization (WHO), marking that weight management has become a top priority in the global public health field^[1]. On March 9, 2025, at a press conference during the Third Session of the 14th National People's Congress, Lei Haichao, Director of the National Health Commission, stated that China will continue to advance actions during the Weight Management Year, calling on the whole nation to scientifically manage weight, develop good living habits, and jointly embrace a new healthy life. During the 2025 Two Sessions, Director Lei Haichao spent 7 minutes specifically explaining the urgency of weight management: obesity has become an increasingly severe health problem nationwide and a key threat to human health. The overweight rate among Chinese adults reaches 34.3%, and the obesity rate among adolescents is nearly 20%. Obesity has become a core trigger for chronic diseases such as hypertension and diabetes. Under the advocacy of the “Weight Management Year,” more and more people are paying attention to the relationship between weight and health. However, weight management is not just about diet and exercise but also a long-term balance of psychology and behavior. Many focus on diet control and exercise but often overlook a key factor - psychology. In fact, there is a close connection between weight management and mental health, which influence and interact with each other, jointly shaping our physical condition and quality of life. Health should be discussed comprehensively in terms of physical health, mental health, and good social adaptability, rather than just pursuing a normal BMI range. In recent years, TABATA high-efficiency fat-burning training has gained increasing attention among young people. Previous studies have shown that TABATA training has significant effects on physical health indicators. This study recruited 26 obese college students (BMI > 25) as research subjects and conducted a 12-week exercise intervention experiment of TABATA high-efficiency fat-burning training, guided by coaches. Each session included a 5–10-minute warm-up, progressive-intensity continuous training, and a 10–15-minute cool-down. Using a within-subject pre-post control design, the study tested 9 mental health indicators of obese college students through psychological scales to provide new perspectives for future physical education curriculum development and offer directions and paths for improving the health-related physical fitness of obese college students in colleges and universities. After 12 weeks of TABATA training, significant changes were observed in somatization, obsessive-compulsive behavior, interpersonal communication, depressive symptoms, anxiety, hostility, fear, paranoia, and psychotic symptoms compared with pre-intervention levels. Both males and females showed significant changes in expressiveness and anxiety.

Keywords:

TABATA high-efficiency
fat-burning training
obese college students
health-related physical
fitness

1. Introduction

1.1. Research background

With the development of social economy and changes in lifestyle, the global obesity rate has been increasing year by year. According to the World Health Organization (WHO), more than 1.9 billion adults worldwide are overweight, and about 650 million of them are classified as obese^[2]. In China, the obesity problem is also becoming increasingly serious^[3]. As a special group, college students face rising obesity rates due to academic pressure, lack of exercise, unhealthy eating habits, and other factors. Relevant studies show that the obesity rate among Chinese college students has exceeded 10%, showing a trend of youthfulness and rapid growth.

Obesity not only causes many harms to physical health but is also closely related to mental health. Studies have found that obese people are more prone to negative emotions such as anxiety and depression, and their self-esteem and confidence are significantly affected. Obese college students often face more psychological pressures in social interaction, study, and life, such as being laughed at by others and low self-identity, which may lead to a decline in their mental health level.

Exercise has been widely recognized by the academic community as an important way to improve mental health. Many studies have shown that regular physical exercise can regulate neurotransmitter secretion, relieve anxiety and depression, and enhance individual psychological resilience and stress resistance. At the same time, exercise can promote the secretion of endorphins, making people feel happy and thus improving overall mental health.

1.2. Purpose and significance

1.2.1. Research purpose

As a classic form of HIIT, TABATA training is widely

used in fat loss and health improvement due to its unique cycle mode of 20 seconds of high-intensity exercise and 10 seconds of rest^[4]. However, regarding the specific effects of TABATA training on obese college students, this study aims to assess its impact on body composition indicators (such as weight, body fat percentage, fat mass, and muscle mass) and mental health of obese college students.

1.2.2. Research significance

By analyzing the comprehensive effects of TABATA training on physical indicators, cardiopulmonary function, and mental health, this study further improves the application theory of high-intensity interval training (HIIT) in obese populations. It provides a reference for the design of physical education curricula in colleges and universities, promotes the development of college physical education teaching toward a more scientific and effective direction, and helps obese college students improve their health status.

1.3. Conceptual definition

- (1) Definition of obesity: From a nutritional perspective, obesity is a manifestation of overnutrition, which is a state in which excess fat stored in the body occurs due to the supply of energy exceeding energy consumption.
- (2) Body Mass Index (BMI): Proposed by the Belgian Quetelet in the 19th century, BMI refers to the body mass index and is an internationally widely used measurement parameter index for defining obesity and obesity grading standards. Known as the body mass index or weight index (calculation formula: $BMI = \text{weight} \div \text{height}^2$), it is currently a common indicator used internationally to measure human body fatness and nutritional status.

Table 1. Reference standards for obesity (BMI)

| International criteria | | Asia-Pacific (China) criteria | |
|------------------------|------------------|-------------------------------|------------------|
| BMI < 18 | Underweight | BMI < 18.5 | Underweight |
| 18 ≤ BMI < 25 | Normal weight | 18.5 ≤ BMI < 24 | Normal weight |
| 25 ≤ BMI < 30 | Overweight | 24 ≤ BMI < 27 | Overweight |
| 30 ≤ BMI < 35 | Mild obesity | 28 ≤ BMI < 30 | Mild obesity |
| 35 ≤ BMI < 40 | Moderate obesity | 30 ≤ BMI < 35 | Moderate obesity |
| BMI ≥ 40 | Severe obesity | BMI ≥ 35 | Severe obesity |

Generally, the World Health Organization (WHO) developed relevant standards for Asians in 1998: a BMI > 24 kg/m² is considered overweight, and a BMI > 28 kg/m² is considered obese.

This study mainly refers to the Asia-Pacific (China) standards. The indicators involved in this paper are physical fitness scores (BMI = weight [kg]/height [m²]).

2. Research subjects and methods

2.1. Research subjects

This is an evidence-based study on the intervention effect of TABATA high-efficiency fat-burning training on the health-related physical fitness of obese college students. The subjects are 26 simple obese college students (11 males and 15 females) majoring in non-physical education at Xi'an Fanyi University.

2.2. Research methods

2.2.1. Literature review

To meet the needs of this study, a large number of professional books and materials are widely consulted in various fields such as health-related physical fitness, sports training, sports training methodology, modern sports training, and educational psychology. At the same time, using “obese

college students & TABATA high-efficiency fat-burning training” as the search keyword, relevant literature is widely collected through the library mirror site to comprehensively grasp the current research status and development trends of interventions for obese college students. On this basis, the research contents involved (including intervention training methods and related indicators) are systematically collected, classified, and sorted out, and in-depth analysis and comparison are conducted.

2.2.2. Questionnaire survey

Questionnaires are designed to gain a deeper understanding of obese college students.

2.2.3. Mathematical statistics

The SPSS 26.0 software system is used to input the survey data one by one. The paired samples T-test method is adopted to process the data, and a database is established for the indicators set in the recovered valid questionnaires.

3. Results and analysis

After a 12-week high-intensity interval training intervention for obese college students, the changes in physical indicators of the subjects are shown in **Table 2**.

Table 2. Paired sample testing

| | | Paring difference | | | | | <i>t</i> | Degree of freedom | Sig. (Double Tail) |
|-----------|--|-------------------|--------------------|---------------|---|-------------|----------|-------------------|--------------------|
| | | Average value | Standard deviation | Average value | The difference is 95% confidence interval | | | | |
| | | | | | Lower limit | Upper limit | | | |
| Pairing 1 | Pre-measured vital capacity - Post-measured vital capacity | -222.154 | 203.057 | 39.823 | -304.170 | -140.137 | -5.579 | 25 | 0.000 |
| Pairing 2 | Anterior weight measurement - posterior weight measurement | 8.5192 | 4.4383 | 0.8704 | 6.7266 | 10.3119 | 9.787 | 25 | 0.000 |
| Pairing 3 | Pre-measured BMI - Post-measured BMI | 2.934 | 1.417 | 0.278 | 2.361 | 3.506 | 10.556 | 25 | 0.000 |
| Pairing 4 | Measure the waist circumference in the front - measure the waist circumference in the back | 5.000 | 3.567 | 0.699 | 3.559 | 6.441 | 7.148 | 25 | 0.000 |
| Pairing 5 | Measure the hip circumference at the front - measure the hip circumference at the back | 6.808 | 3.868 | 0.759 | 5.245 | 8.370 | 8.974 | 25 | 0.000 |
| Pairing 6 | Measure the thigh circumference in the front and then in the back | 2.577 | 1.815 | 0.356 | 1.844 | 3.310 | 7.240 | 25 | 0.000 |
| Pairing 7 | Measure the arm circumference in front - measure the arm circumference in rear | 0.385 | 1.098 | 0.215 | -0.059 | .828 | 1.786 | 25 | 0.086 |
| Pairing 8 | Forward sit and reach - Backward sit and reach | -1.7731 | 1.0854 | 0.2129 | -2.2115 | -1.3347 | -8.330 | 25 | 0.000 |

Vital capacity and sit-and-reach are important indicators for measuring human body functions, while weight, BMI, waist circumference, hip circumference, and thigh circumference are important indicators reflecting body characteristics. It can be concluded from the above that all indicators of the TABATA high-efficiency fat-burning training group for obese college students showed significant differences.

4. Conclusion

4.1. Physical health

After 12 weeks of TABATA high-efficiency fat-burning training, compared with before the intervention, the body function indicators were all enhanced, and the

body circumference indicators were all reduced. Significant differences existed in all indicators except arm circumference.

4.2. Mental health

After TABATA high-efficiency fat-burning training, varying degrees of changes occurred in somatization, obsessive-compulsive behavior, interpersonal communication, depressive symptoms, anxiety, hostility, fear, paranoia, and psychotic symptoms^[5]. Compared with males, females showed statistically significant differences in depression, anxiety, and fear ($P < 0.01$), while males had statistically significant differences in obsessive-compulsive symptoms, hostility, and fear indicators ($P < 0.05$).

Funding

Teaching Reform Project of Xi'an Fanyi University, "Research on the Effect of TABATA High-Efficiency Fat-Burning Training on Improving the Mental Health of Obese College Students" (Project No.: J24B03)

Disclosure statement

The authors declare no conflict of interest.

References

- [1] WHO, 2020, Obesity and Overweight, viewed March 1, 2024. <https://www.who.int/>
- [2] Dietz WH, Bellizzi MC, 2016, Introduction: The Use of Body Mass Index to Assess Obesity in Children. *Journal of Clinical Nutrition*, 70(1): 123–125.
- [3] Gong L, Fang C, Fu J, et al., 2025, The Impact of Unhealthy Lifestyle on the Risk of Overweight and Obesity Among College Students. *Chinese Journal of School Doctor*, 39(1): 24–27, 59. DOI: 10.20161/j.cnki.32-1199/R.202501002
- [4] Liu B, Dou X, 2025, Experimental Study on the Effects of High-Intensity Interval Training on the Physical Fitness of Obese College Students. *Ice and Snow Sports Innovation Research*, 6(4): 83–85. DOI: 10.20155/j.cnki.issn2096-8485.2025.04.027.
- [5] Li Y, Tang DY, 2024, Study on the Weight Loss Effect of Multipath Intervention With Exercise as the Core on Obese College Students. *Hubei Provincial Sports Science Society, Abstracts of the 2nd Hubei Provincial Sports Science Congress and the 5th Academic Forum on Modern Sports and Military Training Development, Wuhan Sports University School of Physical Education*: 841–842. DOI: 10.26914/c.cnkihy.2024.056335.

Publisher's note

Whioce Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.