Digitalization as a factor of increasing the motivation of university students in China to physical education on the example of tennis

UDC 796

Postgraduate student **Kuang Yixin**[1]
Sun Kaiye[2]
[1]The Russian University of Sport «GTSOLIFK», Moscow
[2]Xinjiang University of Political Science and Law, Xinjiang

Corresponding author: kuangyixin0624@qq.com

Received by the editorial office on 14.06.2025

Abstract

Objective of the study is to investigate ways of implementing and evaluating the effectiveness of university physical education within the framework of digital sports, both from the point of view of building a theoretical basis and from the point of view of practical research.

Methods and structure of the study. A total of 64 students aged 18–20 were divided into experimental and control groups, each subjected to different teaching methods for comparison.

Results and conclusions. Pre-test results showed that all 12 items had p-values greater than 0.05 ($p>0.05$), indicating no significant differences between the experimental (EG) and control groups (CON) prior to the intervention. Post-test results revealed that all p-values were below 0.05 or 0.01, demonstrating that the experimental group scored significantly higher than the control group across all dimensions of intrinsic motivation. The experimental teaching method (incorporating VR, intelligent systems, and online interaction) significantly enhanced students' intrinsic motivation, whereas the traditional approach failed to maintain or improve motivation levels, even showing slight declines.

Keywords: *Digital sports, motivation for physical education, tennis teaching, gamification in learning.*

Introduction. To implement the Outline for Building a Strong Education Nation (2024–2035), digital transformation in education has become a crucial breakthrough in advancing educational modernization. Educational institutions are leveraging pilot programs to develop personalized resources, aiming to bridge the gap between equity and quality while reshaping teaching methodologies and talent development paradigms [1]. With the rapid advancement of digital technologies such as sensor technology and virtual reality (VR), their innovative applications in physical education have significantly enhanced teaching efficiency and learning experiences, providing technological support for the transformation of traditional educational models [2].

Smart sports equipment, powered by sensor technology, enables real-time monitoring of students' physical activity—such as heart rate and gait frequency—providing educators with accurate data to assess students' physical conditions and offer personalized exercise recommendations. For instance, smart running shoes equipped with sensors can analyze a runner's posture and foot strike, delivering precise training guidance for coaches and athletes.

Virtual reality (VR) breaks through spatial and temporal constraints, allowing students to experience high-barrier sports like skiing and golf in the classroom through head-mounted displays, enhancing learning flexibility and convenience. Supplemented with multimedia resources such as animations and interactive games, abstract movements are visualized, stimulating interest while supporting self-directed learning beyond the classroom [3].

Data platforms further bridge the two-way channel between "teaching" and "learning." Teachers dynamically adjust instructional strategies based on real-time analytics, while students tailor training plans according to personal data, achieving self-monitoring and goal management. Consequently, physical education is shifting from experience-driven to data-driven approaches, with scientific, personalized, and high-efficiency practices becoming the new benchmarks.

In parallel to technological advancements, research on learning motivation provides empirical support for innovative teaching methods. Multiple studies have demonstrated the positive impact of gamification design on short-term learning engagement. From the students' perspective, external gamification enhances motivation by fostering a determination to play games and a voluntary willingness to persist with physical activities [4,5]. However, Sun's (2012) longitudinal study revealed a critical caveat: while situational interest in the gamified group remained higher than in traditional teaching, motivation levels in both groups declined in later stages [6,7]. This suggests that gamification design requires dynamic adjustments to sustain long-term effects.

In summary, while numerous studies confirm that motivation and situational interest in physical education can be boosted in the short term, the gradual decline over time highlights the need for ongoing innovation and adaptability in both technological and pedagogical approaches.

Methods and structure of the study. A total of 64 students aged 18–20 were divided into experimental and control groups, each subjected to different teaching methods for comparison.

Control Group: received traditional sports skill instruction, which was teacher-centered and followed a structured process of: Explanation and demonstration, Imitative practice, Error correction, and Repeated drills.

Experimental Group: pre-class, teachers uploaded PPT slides, demonstration videos, and slow-motion animations to a digital platform, guiding students in self-directed learning through group discussions and Q&A. In-class, students wore Meta Quest 3 VR headsets to enter a virtual tennis court, where they practiced swing techniques in competitive scenarios. Teachers facilitated group-based swing drills, while a machine learning-powered smart training system captured and analyzed students' training videos and kinematic data.

Measurement Tool: The Sport Motivation Scale (SMS), grounded in Self-Determination Theory (Pelletier et al., 1995, 2001), was used to assess motivational differences between the two teaching approaches. The scale covers seven subdimensions: three types of intrinsic motivation (to know, to accomplish, to experience stimulation), three types of extrinsic motivation (identified, introjected, external regulation), and amotivation.

Results of the study and discussion. Pre-test results showed that all 12 items had p-values greater than 0.05 ($p>0.05$), indicating no significant differences between the experimental (EG) and control groups (CON) prior to the intervention. Post-test results revealed that all p-values were below 0.05 or 0.01, demonstrating that the experimental group scored significantly higher than the control group across all dimensions of intrinsic motivation. The experimental teaching method (incorporating VR, intelligent systems, and online interaction) significantly enhanced students' intrinsic motivation, whereas the traditional approach failed to maintain or improve motivation levels, even showing slight declines. These findings validate the application of Self-Determination Theory in physical education: the interactivity, feedback mechanisms, and immersive nature of technology-assisted instruction effectively satisfy students' psychological needs, thereby strengthening intrinsic motivation. The motivational decline observed in the traditional control group underscores the necessity for pedagogical innovation.

In conclusion, the experiment demonstrates the significant advantages of digital approaches in enhancing college students' motivation for physical education learning.

This table compares the effects of different teaching methods on external motivation in college students' physical education. Before the experiment, there were no significant differences between the CON and the EG in all motivation indicators ($P > 0.05$); Post-experiment, the experimental group significantly outperformed the control group in all types of external motivation (identification regulation, internal regulation, and external regulation) ($P < 0.01$ or $P < 0.05$), with the most notable improvements observed in the enhancement of health value identification and social interaction. The results indicate that the teaching methods employed in the experimental group effectively enhance students' external motivation, particularly by emphasizing the

Table 1. Comparative analysis of the effects of digital teaching methods and traditional teaching methods on college students' intrinsic motivation in physical education

Motivation	Question	Before experiment			After experiment		
		CON	EG	Sig P	CON	EG	Sig P
Intrinsic Motivation-To Know	Because sports activities allow me to learn more about the sports I participate in, which brings me a lot of joy.	5.28±1.17	5.19±1.73	>0.05	4.88±1.07	5.88±1.16	<0.01
	To experience the joy of discovering new training methods.	5.16±1.25	5.47±1.21	>0.05	4.81±1.00	5.78±1.31	<0.01
	To derive a sense of pleasure from learning new techniques that I have never practiced before.	5.13±1.21	5.31±1.18	>0.05	4.81±0.86	5.69±1.18	<0.01
	To experience the joy of discovering new activity strategies.	5±1.22	5.09±1.30	>0.05	4.78±0.79	5.50±1.19	<0.01
Intrinsic Motivation-To Accomplish	Because when I master relatively difficult sports techniques, I feel a sense of self-fulfillment.	5.22±1.21	5.28±1.05	>0.05	5.13±1.04	5.88±1.29	<0.01
	To experience the joy of overcoming some of my weaknesses.	4.88±1.34	5.25±1.24	>0.05	4.78±0.83	5.47±1.34	<0.05
	To feel a sense of fulfillment when my abilities improve.	5.09±1.20	5.28±1.20	>0.05	4.88±1.01	5.56±1.34	<0.05
	Because I feel joy when I complete a challenging movement.	5.16±1.25	5.41±1.16	>0.05	4.75±1.08	5.72±1.11	<0.01
Intrinsic Motivation-To Experience Stimulation	Because I feel joy in exciting experiences.	5.38±1.19	5.03±1.60	>0.05	4.75±1.02	5.88±1.19	<0.05
	To feel the excitement of being fully immersed in sports activities.	5.09±1.20	5.25±1.14	>0.05	4.94±0.67	5.75±1.12	<0.01
	Because I experience a strong passion when engaging in sports activities I love.	5.13±1.24	5.28±1.11	>0.05	5.00±0.84	5.66±1.13	<0.05
	Because I enjoy the feeling of being fully immersed in the activity.	5.03±1.18	5.25±1.19	>0.05	4.78±0.87	5.53±1.19	<0.01

health benefits and social value of physical activities.

The study results showed that there were no significant changes in the motivation dimension between the experimental group and the control group. This indicates that the foundation for physical activity participation among college students aged 18–20 is relatively solid, and short-term instructional interventions (whether technology-assisted or not) did not trigger a motivation deficit crisis. Although the experimental group slightly alleviated the perception of "inability to achieve success" through the intelligent feedback system (a 0.57-point decrease in Project 5 scores), it failed to significantly address deeper issues of identity disconnection or goal attainment barriers. These results align with the motivational continuity framework of self-determination theory, which posits that the resolution of amotivation requires long-term cognitive restructuring rather than mere technical enhancements to perceived competence. Future research should integrate identity intervention with personalized goal management to further mitigate potential amotivational risks.

Conclusions. Compared to traditional teaching methods, digital teaching methods that integrate VR technology, intelligent feedback systems, and online interaction can significantly enhance college students' motivation for physical education learning: the experimental group showed significant increases in all dimensions of intrinsic motivation (knowledge-seeking, achievement, stimulation experience, and internalization) ($P<0.01$), and successfully promoted the internalization of extrinsic motivation (identification motivation $P<0.01$); Meanwhile, the level of amo-

Table 2. Comparative analysis of the impact of external motivation on college students' physical education under different teaching methods

Motivation	Question	Before experiment			After experiment		
		CON	EG	Sig P	CON	EG	Sig P
Extrinsic Motivation-Identified	I believe that participating in physical activities is essential for maintaining good health.	5.16±1.22	5.38±1.24	>0.05	5.03±0.74	6.06±1.19	<0.01
	Because I must engage in physical activities to feel good about myself.	4.94±1.22	5.06±1.22	>0.05	5.03±0.78	5.53±0.98	<0.05
	If I don't spend some time on physical activities, I feel unhappy.	4.59±1.04	4.53±1.30	>0.05	4.31±0.97	5.09±1.30	<0.01
	Because I must exercise regularly.	4.44±1.32	4.66±1.49	>0.05	4.38±1.01	5.06±1.39	<0.05
Extrinsic Motivation-Introgected	I believe that physical activities are one of the best ways to interact with others.	4.75±1.10	4.84±1.32	>0.05	4.72±1.00	5.72±1.25	<0.01
	Because physical activities are one of the best ways I have chosen to promote my development in other areas.	4.78±1.26	4.97±1.28	>0.05	4.49±0.91	5.72±1.11	<0.01
	Through physical activities, one can learn many things that are beneficial to other aspects of life.	5±1.16	5.31±1.15	>0.05	4.91±0.89	5.78±1.10	<0.01
	Because physical activities are one of the best ways for me to maintain good relationships with my friends.	4.84±1.27	4.91±1.38	>0.05	4.44±1.11	5.13±1.29	<0.05
Extrinsic Motivation-External Regulation	Because physical activities earn me the respect of my acquaintances.	4.22±1.29	4.44±1.22	>0.05	4.13±0.71	4.97±1.40	<0.01
	For the reputation of being an athlete.	3.47±1.19	3.56±1.88	>0.05	3.38±1.21	4.13±1.31	<0.05
	Because the people around me believe that a healthy body is very important.	4.81±1.26	5.28±1.35	>0.05	4.67±1.15	5.5±1.30	<0.01
	To show everyone how skilled I am at physical activities.	3.88±1.24	3.84±1.57	>0.05	3.19±1.47	4.13±1.07	<0.01

Table 3. Comparison of college students' lack of motivation in physical education under different teaching methods

Question	Before experiment			After experiment		
	CON	EG	Sig P	CON	EG	Sig P
I have always had good reasons to exercise, but now I am not sure if I should continue participating in sports.	4.00±1.02	3.88±1.95	>0.05	3.78±1.41	3.59±1.88	>0.05
I feel that I cannot succeed in the sports activities I participate in.	3.41±1.04	3.88±1.72	>0.05	3.50±1.41	3.31±1.94	>0.05
I am not sure at the moment, but I do believe that my identity is unrelated to sports activities.	4.50±1.41	4.31±1.58	>0.05	3.50±1.38	3.34±1.64	>0.05
I often tell myself, "It seems that I cannot achieve the goals I have set for myself. "	3.63±1.39	3.50±1.48	>0.05	3.84±1.11	3.72±1.91	>0.05

tivation remained stable between the two groups (all items $P > 0.05$), reflecting the resilience of college students' baseline willingness to engage in physical activity against intervention. This result validates the core mechanism of self-determination theory—technology-enabled learning effectively drives the transformation of motivation toward intrinsic motivation by fulfilling the needs for autonomy (VR exploration), competence (real-time feedback), and relatedness (community interaction). However, addressing the underlying risks of amotivation requires the long-term integration of identity-based strategies.

References

1. Opinions of the Ministry of Education and Eight Other Departments on Accelerating the Digitalization of Education. URL: http://www.moe.gov.cn/srcsite/A01/s7048/202504/t20250416_1187476.html (date of access: 03.01.2025)
2. Wu S. The significance, challenges, and future prospects of digital technology empowering. School Physical Education Assessment. 2024. V. 14. No. 29. Pp. 159-163.
3. Liu Q. Research on the pathways for promoting the construction of a high-quality system for higher education. Physical Education through Digital Technology. 2024. V. 5. No. 13. Pp. 61- 63.
4. Quintas-Hijs A., Pearrubia-Lozano C., Bustamante J. C. Analysis of the applicability and utility of a gamified didactics with exergames at primary schools: Qualitative findings from a natural experiment. PloS one. 2020. V. 15. No. 4. e0231269 p.
5. Hansen L., Sanders S. Fifth grade students' experiences participating in active gaming in physical education: the persistence to game. ICHPER-SD Journal of Research. 2010. V. 5. No. 2. Pp. 33–40.
6. Sun H. Exergaming impact on physical activity and interest in elementary school children. Research Quarterly for Exercise and Sport. 2012. V. 83. No. 2. Pp. 212–220.
7. Sun H. Impact of exergames on physical activity and motivation in elementary school students: a follow-up study. Journal of Sport and Health Science. 2013. V. 2. No. 3. Pp. 138–145.