Application of Computer Virtual Reality Technology in College Physical Education Training

Rufei Ma*

marfWbu@163.com*

School of Physical Education, Wuhan Business University, Wuhan, Hubei, 430056, China

Abstract. With the continuous advancement of science and technology, computers have found increasingly diverse applications. One noteworthy application is the integration of "virtual reality" technology into college physical education. This incorporation holds the potential to enhance the content of physical education classes, refine the teaching process, and elevate the overall quality and effectiveness of physical education.In this paper, we begin by analyzing the distinctive features of virtual reality technology, harnessing its technical advantages to complement physical education in higher education institutions. Subsequently, we present empirical data gathered during students' tennis training sessions. Through an independent sample test, we conclude that students in the experimental group, who received virtual reality-based training, demonstrated significant improvements in their scores for forehand and backhand oblique strokes as well as forehand precision strokes when compared to students in the control group who underwent traditional training methods. These findings underscore the superiority of virtual reality technology as a training method.Ultimately, this innovative approach aspires to equip college students with a broader range of sports knowledge and skills, nurturing them into exceptional athletic talents sought after by society.

Keywords: Computer; Virtual reality technology; Physical training.

1 Introduction

With the continuous improvement of China's comprehensive national strength, the party and governments at all levels pay more and more attention to the development of national physical quality. In recent years, people's awareness of physical exercise has been continuously strengthened, and more and more people have begun to engage in physical exercise activities in their spare time. Physical exercise in colleges and universities have trained all kinds of sports skills for people, but the traditional exercise methods cannot meet the needs of the time. Physical training methods are a bridge between sports theory and training practice and play a very important role in physical training[1]. Educational reform and technological advancement share an intertwined relationship, influencing one another. This interconnectedness has led to subtle yet significant changes in the physical training methods employed by colleges and universities. Consequently, there is a growing demand for higher standards and enhanced training approaches in the realm of physical education. As a result, contemporary sports training increasingly calls for innovative methods to address the intricacies encountered in the training process. One such groundbreaking approach involves the integration of virtual reality (VR) technology, which constructs computer-generated immersive environments closely

ICMEIM 2023, September 08-10, Wuhan, People's Republic of China

DOI 10.4108/eai.8-9-2023.2340048

mirroring reality. VR technology, characterized by its interactive, absorbing, and imaginative qualities, boasts a wide array of applications, spanning fields like surgery, education, and rehabilitation training, among others. In the context of education, virtual reality technology serves as a transformative tool, playing a pivotal role in advancing the educational landscape. Compared to traditional teaching methods, it provides full play for students to start learning. In college sports training, a new training model has been developed to help students learn and master sports quickly and improve their sports skills[2-3].

2 Research methods

The utilization of virtual reality technology within the sports domain can be aptly described as a revolutionary leap forward. By incorporating computer-generated virtual experiences into physical education instruction, the realm of physical education classrooms is on the cusp of a profound and transformative change. No longer limited to traditional single teaching methods, virtual reality technology will make comprehensive training of sports events possible. This also means that physical education teaching work will no longer be limited to traditional oral teaching, but will shift towards high-tech training methods, bringing more diverse trends to competitive sports[4]. The integration of virtual reality technology in the sports sector offers a multitude of diverse possibilities and opportunities, as shown in Figure 1.

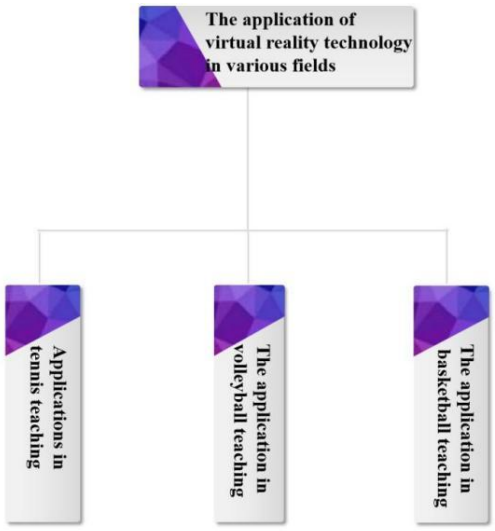

Figure. 1. Application of virtual reality technology in various fields of sports

2.1 Research object

To undertake a comprehensive exploration of the implementation of virtual reality technology in college sports training, this paper places its primary research emphasis on college students involved in tennis training. Upon defining this research focus, an extensive review of pertinent literature was conducted to gain insights into the most recent advancements in this area,

thereby establishing a robust foundation for subsequent investigations. In order to infuse practicality into the study, interviews were conducted with university tennis instructors, affording a holistic comprehension of the entire collegiate tennis training process. Furthermore, to delve deeper into the integration of virtual reality technology within tennis training, a consultation with a tennis expert was organized, aimed at gaining a specialized understanding of the application of virtual reality technology in the context of tennis training. On this basis, relevant experts were interviewed and their understanding and opinions on this topic were listened to, ultimately forming a practical and feasible experimental plan. In the process of evaluating the learning effectiveness of tennis, the "Tennis Learning Effectiveness Survey Questionnaire" is used to distribute the questionnaire before and after the experiment, the questionnaire data undergoes rigorous statistical analysis to gauge and compare students' learning outcomes. This analysis is instrumental in ascertaining the empirical validity and scientific rigor of virtual reality technology within the educational context[5-6].

2.2 Reliability and validity test of the questionnaire

This article used the retesting method to analyze the reliability of the Tennis Exercise Effectiveness Scale. Based on the questionnaire data filled out for the first time, a further survey was conducted 30 days later, and the sample data filled out twice was compared. SPSS 22.0 was used to compare the data, and the final result was that the validity of the Tennis Exercise Effectiveness Scale was 0.838>0.8, and the questionnaire reliability met the requirements. The specific testing steps are as follows:

Divide the contestants into an experimental group and a control group of 20 each, and distribute survey questionnaires to the contestants at the beginning of the experiment, and collect the survey results on the spot;

(2)After 30 days, the same questionnaire was distributed to the experimental group and the control group, and it was distributed and recycled on the spot;

(3)Collate the data of the two questionnaires, analyze, calculate and compare.

The test of validity mainly adopts expert evaluation method, and 20 tennis experts are invited to form an expert jury. Through the judgment of the jury, it is considered that the validity test of the questionnaire is qualified, and the questionnaire can fully reflect the interest, learning motivation and learning effect of the experimental subjects. Therefore, the questionnaire has good validity[7].

2.3 Experimental design

(1) Independent variables, dependent variables and control variables

In this study, the independent variable pertains to the distinct training methodologies employed. Specifically, the control group is subjected to conventional training methods, whereas the experimental group is exposed to training methods utilizing virtual reality technology. The primary aim of this research paper is to scrutinize the impact and significance of virtual reality technology in the realm of sports training. After interviewing relevant experts, combined with the research objectives of this paper, a dependent variable was ultimately determined, which is the effectiveness of tennis learning. In terms of controlling variables, it is necessary to ensure that there are no significant differences in the experimental subjects, that

both the teaching and testing teachers are consistent, and that the teaching and testing time and location are consistent.

(2)Application of Virtual Reality Technology

Considering the application attributes of virtual reality technology, it can be segmented into three key phases: pre-capture, in-process synthesis, and post-application. Within this research, the primary utilization of virtual reality technology is concentrated within the experimental group. In the pre-shooting, camera equipment needs to be arranged in advance to capture the movements of the experimental subjects. In the middle stage, all video materials are processed in 2D and 3D; In the later stage, you can watch the video resources repeatedly and make necessary tests[8].

(3)Experimental test indicators

Before the experiment, the students' vital capacity, standing long jump and 50 m sprint scores were measured according to the National Standards for Students' Physical Health, and the physical function of the subjects was measured. In the aspect of tennis ability test, the test content mainly includes forehand and backhand oblique stroke and forehand and backhand precise stroke. Ball sense test: the subjects were tested with 20 s in-situ shot, 20 s landing ball and 20 s volley ball, and the cumulative number of successes was recorded as a result.

3 Results and analysis

3.1 Forehand and Backhand Slant Hitting Analysis

Drawing insights from the data presented in Table 1, it becomes evident that the students in the experimental group have made substantial progress in their ball sense and diagonal hitting abilities, owing to the iterative training of operational techniques. Specifically, when evaluating the average scores for both groups in forward and backhand diagonal strokes, we observe that the experimental group achieved an average score of 87.42 points for the former and 84.34 points for the latter. In comparison, the control group's average scores were 74.21 points for forward diagonal strokes and 71.37 points for backhand diagonal strokes. Notably, the average score of the experimental group significantly surpasses that of the control group, and this difference carries statistical significance. The main reason is that the experimental group adopts virtual reality technology training method, which allows students to practice multiple times in a virtual environment, thereby better mastering diagonal hitting techniques. In contrast, the control group used traditional training methods, and students may have relatively fewer exercises and feedback, resulting in limited progress. This indicates that virtual reality technology has played a huge role in physical education teaching, providing students with more practice opportunities and personalized guidance, thereby promoting the rapid improvement of skills. The virtual reality technology method can not only enhance students' ball sense, but also make more significant progress within the same time, proving its huge potential and advantages in physical education teaching[9].

Table 1. Statistical table of students' forehand and backhand diagonal strokes in experimental group and control group

score	Experimental group		Control group		Value T	Value P
	Average value	Standard deviation	Average value	Standard deviation		
Forehand diagonal stroke	87.42	10.27	74.21	9.22	9.28	0.00
Backhand diagonal shot	84.34	10.58	71.37	8.02	8.73	0.00

3.2 Forehand and Backhand Precision Hitting Analysis

Referring to the scores of both the experimental and control groups in precise forward and backhand strokes, as depicted in Table 2, a notable trend emerges. Specifically, the precision hitting scores for the experimental group stand at 82.43 and 78.67, while the control group's scores register at 72.36 and 70.12, respectively. Evidently, the performance of the experimental group has exhibited marked improvement. Upon scrutinizing the experimental findings, it becomes evident that a substantial disparity exists between the virtual reality technology training method and the conventional training approach. Notably, students in the experimental group exhibit a higher level of accuracy in their ball-hitting precision compared to their counterparts in the control group. The reason may be that in the virtual reality technology training, students have a full understanding of the technical details of hitting the ball through virtual reality technology, which has been continuously strengthened during the training process. With the improvement of proficiency, the hitting skills of the experimental group students will become better and better, which will stimulate students' interest in learning.

Table. 2. Statistical table of students' forehand and backhand precision hitting scores in experimental group and control group

score	Experimental group		Control group		Value T	Value P
	Average value	Standard deviation	Average value	Standard deviation		
Forehand precision stroke	82.43	10.08	72.36	9.06	9.03	0.00
Backhand precision shot	78.67	10.32	70.12	8.65	7.34	0.00

Following a comprehensive comparative analysis between the experimental group and the control group, it has become evident that the adoption of virtual reality technology in training methods yields notably favorable outcomes in sports education compared to conventional training approaches. Subsequent to the experiment, students within the experimental group demonstrated remarkable enhancements in their performance in activities such as the standing long jump, the 50-meter run, and vital capacity measurements. This compelling evidence underscores the substantial impact of virtual reality technology in enhancing physical capabilities and functions[10].

4 Conclusion

The application of virtual reality multimedia technology has played a huge role in the field of sports, transforming basic sports actions into vivid video information, accompanied by detailed annotations, and repeatedly playing and explaining according to teaching needs. This teaching method not only helps to impart theoretical knowledge, but more importantly, it can effectively teach various motor movements and skills. Through virtual reality technology, physical education teaching can become more vivid and intuitive. Students can simulate various sports events in a virtual environment, observe the correct execution of actions, and practice repeatedly based on actual situations. This interactive learning method enables students to participate more actively, improving their enthusiasm and efficiency in learning. The application of virtual reality technology in sports field is not only limited to teaching Motor skill, but also can be used for tactical training and competitive simulation. Athletes can conduct tactical exercises in a virtual environment to improve their ability to cope with complex competition scenarios. Simultaneously, the integration of virtual reality technology with motion data analysis offers the potential to furnish educators and athletes with more comprehensive training feedback and the ability to develop finely-tuned optimization strategies.

Acknowledgments. （1）Hubei Provincial Teaching Research Projects：Research and Practice on Cooperative Governance and Teaching Utilization of Hubei University Stadium from the Perspective of Integration of Sports and Education（2020690）

（2）Provincial First-Class Course“Theory and Practice of Horsemanship”

（3）the National First-class Undergraduate Major Construction Points (Leisure sports)

（4）The Experimental Class of Excellent Equestrian Talents

References

[1] Hassandra, M. , Galanis, E. , Hatzigeorgiadis, A. , Goudas, M. , Mouzakidis, C. , & Karathanasi, E. , et al. (2021). A virtual reality app for physical and cognitive training of older people with mild cognitive impairment: mixed methods feasibility study. JMIR serious games, 9(1), e24170.

[2] Cornejo Thumm, P. , Giladi, N. , Hausdorff, J. M. , & Mirelman, A. . (2021). Tele-rehabilitation with virtual reality a case report on the simultaneous, remote training of two patients with parkinson disease. American Journal of Physical Medicine and Rehabilitation(5), 100.

[3] Mitsea, E. , Drigas, A. , & Skianis, C. . (2022). Mindfulness strategies for metacognitive skills training in special education: the role of virtual reality. Technium Social Sciences Journal, 35.

[4] Jameson, J. , Essex, R. , Stiell, M. , Markowski, M. , & Gordon O. Ade-Ojo. (2022). A systematic scoping review and textual narrative synthesis of physical and mixed-reality simulation in pre-service teacher training. Journal of Computer Assisted Learning, 38(3), 861-874.

[5] Kiryukhin, P. K. , Romanenko, V. I. , Khomyakov, D. A. , Shcherbakov, A. A. , Pugachev, P. A. , & Yushin, I. M. , et al. (2022). Virtual analog of uranium-water subcritical assembly. Annals of nuclear energy(Jul.), 172.

[6] Solberg, A. , Jacobsen, E. L. , Golovina, O. , & Teizer, J. . (2022). Active personalized construction safety training using run-time data collection in physical and virtual reality work environments. Construction Innovation , 22(3), 531-553.
[7] Braun, P. , Grafelmann, M. , Gill, F. , Stolz, H. , Hinckeldeyn, J. , & Lange, A. K. . (2022). Virtual reality for immersive multi-user firefighter training scenarios. Virtual Reality & Intelligent Hardware, 4(5), 406-417.
[8] F. Gabriele Pratticò, & Lamberti, F. . (2021). Towards the adoption of virtual reality training systems for the self-tuition of industrial robot operators: a case study at kuka. Computers in Industry, 129(5), 103446.
[9] Yamada, M. , Nikita, K. A. , Diekfuss, J. A. , & Raisbeck, L. D. . (2021). The effect of attentional focus on movement accuracy in an immersive and interactive virtual reality environment. Neuroscience Letters, 752(1), 135814.
[10] Jia, B. , Wu, X. , & Zhao, C. . (2023). A novel training quantitative evaluation method based on virtual reality. Journal of Circuits, Systems and Computers, 32(04).