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Research Article

Application of Virtual Reality Technology in Martial Arts Situational Teaching

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At present, the integration and development of virtual reality technology and physical education have become a new trend, but its research in the field of martial arts is still in the theoretical stage, lacking specific application countermeasures and schemes, which needs further exploration and research. This paper aims to explore the application of virtual reality technology in martial arts teaching. In response to this, this paper adopts a combination of controlled experiments and questionnaires to conduct research. Before the experiment, through analysis, it eliminated the differences between the two groups of subjects and achieved the purpose of controlling variables. In response to the questionnaire, this paper not only invited a 6-person expert group, but also found 40 participants in the experiment in sports schools. The results of the article show that most students have a positive attitude towards virtual reality technology-assisted martial arts teaching, and their enthusiasm for learning martial arts is significantly improved. And the results of virtual reality teaching are about 15% higher than those of traditional teaching.

1. Introduction

With the continuous improvement and development of virtual reality technology, it has become more and more closely related to daily life, ranging from national defense and military to small decoration design, which has greatly changed people's perception of time and space. It also brings opportunities for educational innovation. Under the background of modern education reform, the continuous innovation and practical research of physical education in colleges and universities have created many teaching experiences and methods that can be replicated and popularized. Wushu, as a traditional sport in China, has its own unique sports form, and now colleges and universities in China pay more attention to it. And it occupies a certain proportion in the elective courses of physical education. However, at present, there are some realistic problems to be solved in Wushu teaching, such as the novelty of teaching methods and the simplification of learning methods, which lead students to gradually form a boring learning state and a learning mode of mechanical memorizing movements, and it is difficult to fully understand the details of movements in Wushu routines and the changes of angles, positions, and directions of movements. In the process of Wushu teaching, how to improve teaching methods and methods to improve the quality of Wushu teaching and stimulate students' interest in learning is now an important problem to be solved. New development ideas have been brought to Wushu teaching, which result in rapid development of modern information technology and the deepening of physical education reform in Chinese colleges and universities. Incorporating virtual reality technology into Wushu-assisted teaching in colleges and universities and providing new presentation methods and teaching methods for Wushu teaching, we should gradually innovate the presentation and teaching methods of Wushu teaching content. Starting with the students, we should stimulate students' interest in practicing Wushu and improve the quality of Wushu movements. In the virtual environment, learners realize real-time interaction of vision, hearing, and touch through a

variety of sensing devices. The meaning construction of knowledge is formed in the transmission of situational information, which changes from the traditional teacher-led teaching method to the teaching mode of cultivating students' autonomous learning ability. It provides new ideas for modern education.

Under the background of educational informationization, in order to actively explore the new teaching method of "VR + teaching." In this study, virtual reality technology is used to assist martial arts teaching, so as to create an immersive learning experience combining virtual reality with reality. It can improve students' mastery of martial arts movement details, and regarding the present situation that martial arts learning is boring and difficult to learn and practice, it can provide certain theoretical and practical experience for the application of virtual reality technology in martial arts teaching.

In the situational teaching of Wushu, this paper discusses the application of VR technology and mainly has the following two innovations: (1) in the use of virtual reality, this paper actually recorded a set of video teaching programs. (2) For the experimental analysis, this paper adopts the form of control experiment plus questionnaire interview to combine research. This not only vividly describes the improvement of the impact of VR use on teaching, but also summarizes the willingness of students to use VR.

2. Related Work

Many scholars have studied the application of VR in teaching. Liu and Zhao believed that martial arts, as an important carrier of national culture inheritance, played an irreplaceable role in physical education teaching. They expounded the difficulties and breakthrough strategies of effective martial arts teaching in colleges and universities from several aspects. They provided a theoretical reference for the effective teaching of martial arts in colleges and universities [1]. Zeming introduced the design and implementation of a Korean language teaching system. In order to improve the efficiency of the teaching process and increase students' interest in learning, he applied virtual reality technology to the system. The results show that VR technology can change the traditional teaching mode, stimulate students' interest in learning, and improve the quality of Korean teaching. His research results contributed to the further application of virtual reality technology in the field of education [2]. Goehle presented a course based on common calculus topics in "virtual reality," including a description of how to implement lectures in virtual reality and augmented reality hardware systems [3]. Zhang et al. main purpose was to combine virtual reality technology with ideological and political theory courses in colleges and universities. They took school students as experimental subjects and divided them into experimental group and control group. The experimental results showed that, after the VR classroom learning, the proportions of group A1 and group B2 who like to think about political theory classes have increased by 8.2% and 8.14%, respectively [4]. Bos et al. discussed the application of VR in geography [5]. Zhou aimed to study the application of virtual reality technology in English teaching [6]. Based on the relevant researches, it is found that many scholars' researches stick to the teaching effect and stay in the classroom teaching, and few scholars conduct research on Wushu situational teaching.

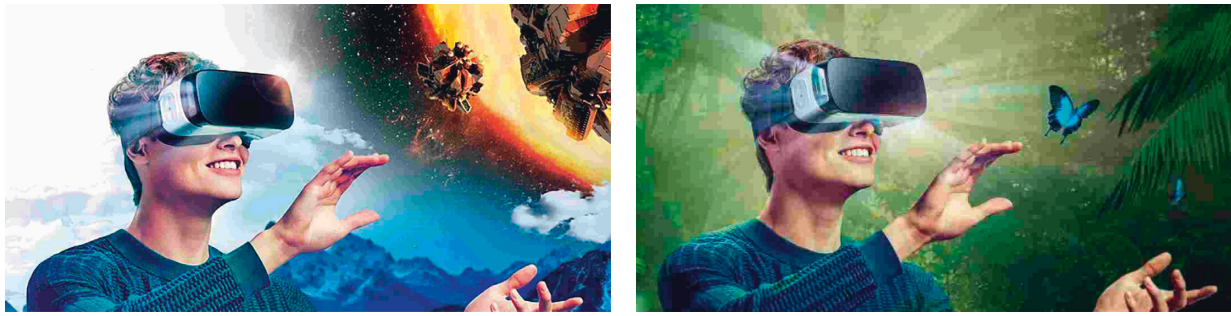
3. Virtual Technology and Wushu Teaching

3.1. Theoretical Basis of Virtual Reality Technology (VR) Application. Virtual Reality (VR for short) is an emerging technology that brings together computer graphics, sensing technology, artificial intelligence technology, and other fields [7, 8]. In the three-dimensional dynamic scene created by the computer simulation system, the user is based on interactive equipment such as head-mounted display, data glove, intelligent language, and others, and it has inherent interactive, immersive, and conceptual characteristics. It realizes visual, auditory, and tactile multisensory enhanced experience feedback, as shown in Figure 1.

3.1.1. Cognitive Theory. Cognitive learning theory emphasizes that learning is the process of acquiring external knowledge, which is transformed into the internalization of mental structure and organically linked with past experience. It actively processes and reorganizes the information provided by the outside world. In the teaching process, the primary task of teachers is not just to mechanically instill knowledge in students. Instead, it aims to tap students' ability to arrange learning independently. It provides learners with a cognitive process in a specific situation and promotes the cognitive development of students. The influence of the inherent characteristics of virtual reality technology on cognitive ability is manifested in positive and negative aspects. The positive impact analysis in this paper can greatly expand the subject's cognitive domain and scope and allow the subject and object to naturally establish a resonance relationship. Due to the lack of some operational standards, there are still many differences in the application process of virtual reality technology [9, 10].

Therefore, to apply virtual reality technology to the teaching process of martial arts in colleges and universities, the first is to understand the cognitive and psychological activities of learners. In the teaching process, it can improve students' deep understanding and memory of teaching content, which enables students to internalize old and new knowledge more quickly and efficiently. It gradually establishes its own reasonable cognitive structure and accumulates its own experience. It constantly improves itself in the learning process and promotes the cognitive ability of new things.

3.1.2. Constructivism Theory. The comparative relationship between virtual reality VR and constructivism can be seen: its immersion characteristics in the virtual reality VR environment can help students establish a natural learning scene. The interactive features in virtual reality can realize remote collaboration for students, and students' learning of knowledge through the platform becomes convenient, fast,



(a) (b)

Figure 1: Virtual reality technology.

and flexible. The perceptual feature of virtual reality is that when students acquire knowledge, it can have a certain impact on their own senses and thinking, which helps improve students' ability to construct knowledge [11, 12]. At the same time, with the assistance of VR equipment, it also provides students with an immersive learning scene, which improves students' interest in learning.

3.1.3. Immersion Theory. The core of immersion theory is immersion experience, which means that participants enter an experience mode. If they are fully immersed in the situation, they will be in a state of tranquility, thereby obtaining a pleasant experience. The research of early scholars suggested that the sense of immersion will change due to challenges and skill factors, and only when these two factors are restrained from each other can participants obtain the ideal immersion experience. With the continuous development of modern information technology, the immersion theory has been further enriched and developed. In 1985, some scholars comprehensively combed and expounded the relationship between skills and challenges. They built a new immersion model. The new immersion model further illustrates that only when skills and challenges maintain a balanced pattern, and both are in a relatively ideal state, participants will enter the immersion state [13]. This paper applies virtual reality technology to martial arts teaching. By combining VR equipment, learners can experience immersive visual senses, stimulate students' interest and pleasure, and enhance students' attention and exploration.

3.2. Integration of Virtual Reality Technology and Martial Arts Situational Teaching. Situational cognition theory holds that knowledge is contextualized. It is a state in which an individual interacts with the environment to provide a situation in which students can participate and interact. It promotes students to construct the meaning of knowledge in situational learning and form an open and autonomous learning style. Teaching link design: after teachers upload VR teaching videos before class, from the beginning of martial arts teaching, it guides students to wear VR equipment to watch martial arts VR videos. Students use the equipment to experience learning independently, interact with the environment through visual operation, and achieve a real environmental experience. Visually, students can observe martial arts movements from multiple angles and directions, so that students can have a preliminary understanding of the changes in the turning angle and arm amplitude of martial arts movements. The auditory explanation of the technical names of the movements enhances the students' understanding of the movements. Tactile students can get an immersive learning experience in a virtual environment and follow the characters in the environment to practice imitation. Through visual, auditory, and tactile interaction in a virtual environment, it strengthens students' understanding of martial arts movement techniques from three aspects: perception, understanding, and consolidation and stimulates students' interest and pleasure in learning martial arts [14, 15].

When virtual teaching is combined with traditional teaching in practical teaching, it tries to implement diversified teaching methods in teaching. First of all, in the teaching video, it demonstrates the decomposition of actions and segmented actions, emphasizing the important and difficult points of actions. By watching the VR teaching video, the students preliminarily further construct the basic technical movements of martial arts and gradually form the memory of movement skills. Teaching link design: students take off the VR goggles, and teachers implement group and group exercises after giving targeted demonstrations and explanations of the key points and difficulties in martial arts movements. It corrects the wrong movements of students and promotes students to master the essentials of martial arts movements more comprehensively. Then, the teacher asked the students to wear the VR goggles to watch the teaching video again according to the situation of the students. It selects the number of views according to its own needs and completes the two-way interaction with the virtual environment in a relaxed and pleasant state of mind. It is immersed in the practice of intelligent feeling and martial arts movements, forming a certain human-computer interaction. When students watch VR videos to learn, teachers ask students to compare the differences between their own practice movements and standard movements and correct them in time if they find problems. The teaching link uses virtual reality technology to assist Wushu teaching, allowing students to experience a different learning method when learning Wushu. It learns by situational substitution

and fully presents a novel teaching method combined with teachers' words and deeds. It further verifies the effect of virtual reality technology-assisted martial arts teaching.

The application feedback stage is to test the students' mastery of martial arts movements during the teaching process. In this section of teaching design, it is mainly aimed at students' after-class review and practice sessions. After class, teachers release the teaching materials integrated by the VR platform to students. It also implements monitoring and punching in to record student learning. The second is to provide effective feedback on students' usage. Aiming at the details of the actions in the teaching video, whether the pictures are clear, and whether the actions highlight the difficulties of teaching, students communicate after using them, and they collect students' opinions on virtual classroom teaching. This article will revise and improve the teaching content. Finally, combined with teaching feedback, teachers can fully grasp the teaching situation, including students' practice, teaching progress, classroom teaching effect, and students' learning effect after class preview. In the first stage of teaching design, students learn martial arts by wearing VR goggles before class, and the teaching method of situational substitution enriches students' psychological experience. The second stage further strengthens the practice and consolidates the learned content through the combination of virtual teaching and traditional teaching. This article combines two different teaching stages in learning martial arts. It improves the accuracy of students' mastery of martial arts movements in the teaching process and cultivates students' awareness and habit of correctly practicing martial arts movements [16, 17].

3.3. Virtual Reality Algorithms. The characteristic mode of optimal scenario control describes how the low-level dynamic control mechanism can be optimized to form the optimal control command under the condition of no disturbance. Assuming that the current moment is t, and the length of time under investigation is T; the working mode adapted to the task situation within the time interval $(t, T]$ and the generative functional accompanying the dynamic development of the movement are interrelated; this functional is

$$\tau(X,t) = \int_t^{\tau} L(x,u,p)\mathrm{d}p + S(x(T)). \tag{1}$$

Among them, x is the system state, $L(x,u,p)$ is the instantaneous cost, and $S(x(T))$ is the terminal cost; when the above formula obtains the minimum value:

$$\tau^*(\mathrm{X},\mathrm{t}) = \min_u \left[\int_t^T L(x,u,p)\mathrm{d}p + S(x(T)) \right]. \tag{2}$$

Inputting u is the optimal control

$$u^* = \arg\min \tau(X,t). \tag{3}$$

The above optimization problem can be solved according to the optimization principle of Richard Bellman; set

$$\tau^*(X,t+\Delta t) = \min_u \left[\int_{t+\Delta t}^T L(x,u,p)\mathrm{d}p + S(x(T)) \right]. \tag{4}$$

According to the optimization principle, we have

$$\tau^*(X,t) = \min_u \left[\int_t^{t+\Delta t} L(x,u,p)\mathrm{d}p + \tau^*(X,t+Vt) \right]. \tag{5}$$

Expanding $\tau^*(X,t+\Delta t)$ at t with a Taylor series, removing the nonlinear higher-order terms, and letting $\Delta t \longrightarrow 0$, we have

$$-\frac{\partial \tau^*(X,t)}{\partial t} = \min_u \left[\int_{t+\Delta t}^T L(x,u,p) + \nabla \tau^*(X,t)X \right]. \tag{6}$$

Minimizing a functional, here, the Hamiltonian quantity, is equivalent to requiring the functional gradient of the functional to be zero at the control input $u = u^*$. In this way, the optimal control u^* can be expressed as a function of which $\nabla_x \tau^*(X,t)$ is the independent variable. In this paper, the optimal control u^* is substituted into formula (6), and the Hamilton-Jacobi-Bellman partial differential formula suitable for the optimal design of the multiple-input multiple-output (MIMO) system controller can be obtained

$$\begin{cases} -\dfrac{\partial \tau^*(X,t)}{\partial t} = H^*\left(x, \nabla_x \tau^*(X,t), t\right), \\ \\ \tau^*(X(T),T) = S(X(T)). \end{cases} \tag{7}$$

Among them,

$$H^*\left(x, \nabla_x \tau^*(X,t), t\right) = H\left(x, u^*, t\right). \tag{8}$$

It is the minimum Hamiltonian quantity that augments the trajectory with respect to the whole system, and $\tau^*(X(T),T) = S(X(T))$ is the boundary condition added by the boundary point information of the trajectory [18].

It is based on optimal control inputs obtained under ideal conditions that do not consider disturbances, uncertainties, and mission logic, that is, to take the optimal control input as the initial control strategy and then assign it to the robust attribute, so as to establish a dynamic control strategy with better frequency-amplitude response attribute. It then automatically transforms the obtained dynamic control strategy into adaptive decision-making and control that conforms to various logics and preset conditions based on professional knowledge and experience.

The characteristic mode of worst-case control describes how the low-level dynamic control mechanism forms robust control commands through constraint optimization under adverse conditions such as system variability and uncertainty. Let Δ be the uncertainty block. It represents the possible dynamic interference, perturbation, and parameter changes of different components in the real system, assuming that

$$M = \begin{bmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{bmatrix}. \tag{9}$$

It is an unknown interconnected transfer function matrix that represents the state-space model of the disturbed system; that is, it describes the relationship between the nominal system and uncertainty. The standard upper linear fractional transformation is

$$F_{\Delta}(M,\Delta) = M_{11} + M_{21}(I - M_{11}\Delta)^{-1}M_{12}. \tag{10}$$

It can be used for uncertainty modeling and stability analysis; $(I - M_{11}\Delta)$ is required to be reversible. Let K be the controller introduced in the open-loop system, representing the active intervention imposed on the system through a feedback pathway. The standard lower linear fractional transformation is

$$F_{K}(M,K) = M_{11} + M_{21}(I - M_{22}K)^{-1}M_{21}. \tag{11}$$

It can be used to describe the input-output relationship of a closed-loop system, and $(I - M_{22}K)$ is required to be invertible.

It considers the following state space model of the system:

$$\sum \begin{cases} x = A(t)x + B(t)u + E(t)w, \\ y = C(t)x + D(t)u. \end{cases} \tag{12}$$

If the above coefficient matrix is time-invariant, and $E(t)$ is zero, the disturbed system degenerates to the nominally dynamic ideal model $\sum 0$. It assumes that one of the time-varying coefficient matrices A(t), B(t), C(t), D(t), and E(t) contains n variable system parameters. Among them, c is one of the above parameters of the system, and the value of this parameter is in the form of

$$\begin{aligned} c &= a + \delta_c b; \\ a, b &\in R; \\ \delta_c &\in [-1, 1]. \end{aligned} \tag{13}$$

Then, this variable parameter can be expressed as

$$(I - M_{22}K). \tag{14}$$

A system with variable parameters can be described as

$$\sum_{v} = \sum \left| C_i = F_{\Delta}(M_{ci}, \delta_{ci}), \quad i = 1, 2, \ldots, n. \right. \tag{15}$$

An interconnected system with variable parameters and additive interference can be described as

$$\sum_{va} = F_{\Delta}(M_a, \delta_a) = F_{\Delta}\left(\begin{bmatrix} 0 & I \\ I & \sum_{v} \end{bmatrix}, \Delta_a \right). \tag{16}$$

Δ_a is the additive disturbance uncertainty module. If the multiplicative input interference is considered on the basis of $\sum_{va}$, the corresponding interconnected system can be described as

$$\sum_{va} = F_{\Delta}(M_a, \delta_a) = F_{\Delta}\left(\begin{bmatrix} 0 & I \\ I & \sum_{v} \end{bmatrix}, \Delta_a \right). \tag{17}$$

4. Application of VR Technology in Wushu Teaching

4.1. Survey Methods. The research object of this paper is the application of virtual reality (VR) technology in the teaching of martial arts in colleges and universities. In order to fully understand the application status of virtual reality technology in education and teaching, this paper will understand the content of this study separately. It includes Chinese databases: Capital Institute of Physical Education Library, CNKI database, and VIP academic website. English database: ScienceDirect, PubMed literature database search, and retrieval of keywords such as "virtual reality technology," "VR technology," "immersion," "martial arts teaching," and "physical education." This paper organizes and summarizes the relevant literature and summarizes and analyzes it carefully. It provides scientific reference and theoretical basis for this study.

Through interviews and exchanges with relevant experts in the field of martial arts and information technology, we can listen to the opinions and guidance of experts on the application of virtual reality (VR) technology in the teaching of martial arts in colleges and universities [19, 20]. And the teaching methods used in this experiment, the test indicators in the teaching experiment, the rationality of the questionnaire design, and the assessment score standards give suggestions and guidance. Finally, this paper determines the reasonable indicators and assessment standards in the teaching experiment based on the suggestions given by the experts. The experts are shown in Table 1:

According to the needs of the research content of this paper, this paper is conducted based on the basic information of the experimental subjects before the experiment, the basic situation and emotional attitude of learning martial arts, and the understanding and application of VR technology. In this paper, questionnaire (1) "Student Basic Situation Questionnaire" and questionnaire (2) "Student Affective Attitude Questionnaire for Learning Wushu" are designed. After the teaching experiment, in order to test the application effect of virtual reality technology in Wushu teaching, this paper designs a questionnaire (3) "Virtual Teaching Feedback Questionnaire" for the students in the experimental group. In this paper, the questionnaire is revised and improved in combination with expert guidance, and a reasonable questionnaire is finally determined. In the early stage of the experiment, a homogeneity survey was conducted on the experimental subjects, and a questionnaire survey was conducted on the two groups of students after the teaching experiment to obtain relevant data. The questionnaires are shown in Table 2:

Based on the validity test, the fundamental purpose is to explore the validity of the questionnaire structure itself. After the items of this questionnaire were formed, the validity level of the above three questionnaires was verified. During the verification, 6 experts were introduced, and half of them were professors and associate professors. In the evaluation and analysis of the quality of the questionnaire, the opinions are shown in Table 3. From the evaluation

Table 1: List of expert interviews ($N = 6$).

Name	Gender	Education	Job title
Young*	Female	Master	Professor
Ding**	Male	Master	Professor
Ye**	Male	PhD	Professor
Open**	Male	PhD	Associate professor
Chui**	Male	Master	Associate professor
Zhu*	Male	Master	Associate professor

Table 2: Questionnaire distribution and recovery statistics.

Questionnaire	Questionnaire	Effective recovery of questionnaires	Efficient (%)
Questionnaire 1	40	40	100
Questionnaire 2	40	40	100
Questionnaire 3	20	20	100

results of the questionnaire, the effective rate of the questionnaire is 83.3%. It further confirms that the validity of the questionnaire meets the requirements.

In order to demonstrate the internal reliability of the questionnaire based on the form of repeated testing, this paper sets a test period of 14 days for the test target. This paper analyzes the correlation coefficient of the questionnaire test results according to the test-retest method. The correlation coefficients displayed by the research questionnaire are $R1 = 0.87$, $R2 = 0.89$, $R3 = 0.85$, which proves the reliability and importance of the research results.

4.2. Purpose and Object of Experiment. In the teaching experiment, students in the experimental and control groups were taught using two different teaching methods, with the experimental group utilizing virtual reality technology to aid in their instruction. The control group received traditional instruction in this study. The experimental and control groups were both subjected to a questionnaire survey and performance evaluation following the teaching experiment. The effects of the two teaching methods on the experimental and control groups of students learning martial arts are investigated in this paper. The impact and viability of using virtual reality technology in Wushu instruction are discussed in this paper. It provides a theoretical foundation as well as hands-on experience with virtual reality technology in Wushu. In the teaching experiment, students in the experimental and control groups were taught using two different teaching methods, with the experimental group utilizing virtual reality technology to aid in their instruction. The control group received traditional instruction in this study. The experimental and control groups were both subjected to a questionnaire survey and performance evaluation following the teaching experiment. The effect of the two teaching methods on the experimental and control groups of students learning martial arts is investigated in this paper. The impact and viability of using virtual reality technology in Wushu instruction are discussed in this paper. It provides a theoretical foundation as well as hands-on experience with virtual reality technology in Wushu. In this study, dance students in the 2019 class of a sports college were selected as experimental subjects. According to the basic information of the preexperiment, the eligible students will be reasonably grouped, with 20 students in the experimental group and 20 in the control group. The experimental route is shown in Figure 2:

Table 3: Expert opinions.

	Number of people	Proportion
Very reasonable	1	16.7%
Reasonable	4	66.6%
More reasonable	1	16.7%
Unreasonable	0	0
Very unreasonable	0	0

4.3. Experimental Method

4.3.1. Experiment Plan Formulation. Before the experiment, the test indicators were determined according to the influence of the subject's practice of martial arts on the basic physical quality of the body, as shown in Table 4.

Control group: this paper uses traditional teaching methods to teach and guides students to preview independently according to the teaching content announced by teachers before class. In the class, teachers demonstrate and explain actions, guide and correct wrong actions for students, and implement group or group exercises. After class teaching summary and evaluation, students are required to review independently, as shown in Figure 3:

Experimental group: this paper uses virtual reality technology to assist Wushu teaching, and it uses VR equipment and teaching videos to stimulate students' interest in learning Wushu. It helps students observe Wushu movements in more detail and improve the quality of students' Wushu movements. Based on the characteristics of VR, it divides the teaching implementation process into three stages, that is, situation presentation stage, practice master stage, and application feedback stage, as shown in Figure 4:

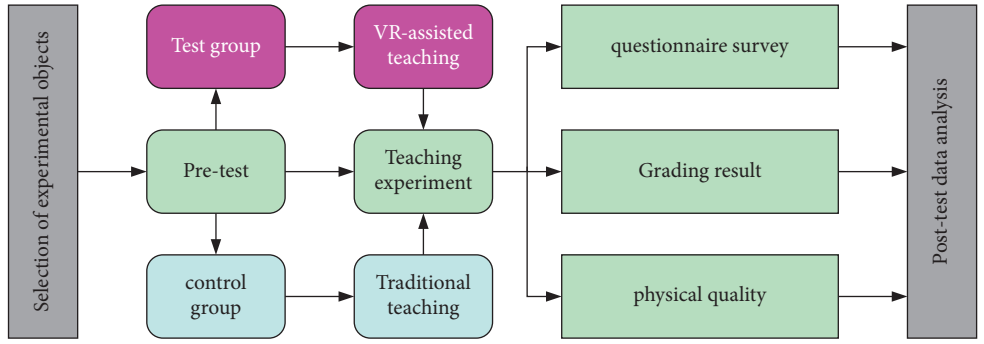


Figure 2: Experimental roadmap.

Table 4: Test indicators and tools.

Index	Test tools
Standing on one leg	Stopwatch
Sit-ups	Stopwatch
Single leg squat	Stopwatch
Plank	Stopwatch

In the teaching implementation, two VR eyepieces were selected as experimental equipment: picoG24k-VR eyepiece and Xiaomi VR eyepiece. The former can play videos independently and can store various videos at the same time, which can better meet the students' learning and review needs. The latter is to create a virtual environment with the support of smart devices. The experimental equipment is shown in Figure 5:

4.3.2. VR Teaching Video Production Process. Preliminary preparations: (1) shooting and installation of equipment in the early stage of this article, VR panoramic shooting of teaching content is carried out. Compared with plane shooting, it is more difficult in terms of process. The equipment assembly must go through the following steps: first, install the tripod on the gimbal, then do the assembly work for the panoramic gimbal, and then install the camera equipment to the gimbal. Finally, the all-in-one camera is mounted on a tripod. (2) The parameter setting of the shooting equipment is adjusted to a reasonable exposure level according to the shooting scene environment, and the ideal color tone can be achieved at this time. It can reasonably deal with saturation and light and shadow levels, which can avoid ghosting problems and present the best results.

Shooting and material arrangement: (1) the shooting process is firstly by using a panoramic camera, which needs to collect the shooting environment multiple times around a central point and record the surrounding 720-degree environment. The second is to use a SLR camera to record martial arts movements. Because, in the VR panoramic video, martial arts movements in different directions need to be presented synchronously, therefore, when shooting, we need to record from different angles and then synthesize them later. It needs to watch the playback repeatedly during the recording process, confirm the standard and normative of the action, the direction, and angle and other factors, and finally achieve a satisfactory effect. (2) Due to the particularity of VR videos, multiple scene cameras need to be set during the shooting of teaching materials. Therefore, for the sorting of materials, it needs to be named and managed based on the scene and then combined with the camera number to determine the final name of the video. All videos should be backed up to prevent material loss.

Postproduction synthesis: (1) editing the teaching materials that were shot. By using professional software for editing, in addition to making ordinary flat video, it needs to remember the direction of each scene when processing VR panoramic video and achieve an all-round perspective through editing and splicing. (2) Stitching after the first editing work, how to stitch each selection must be standardized. Various works are based on medium encoders to achieve the purpose of output, so as to avoid visual effects and avoid the appearance of color grading problems. There are also differences in file size when these encoders perform output operations on VR content. Therefore, it is necessary to partially export the clips required for editing based on fine splicing. When the stitching work is completed, and the images are locked, background music or commentary can be added as needed, usually in the final stage, because any step changes on the timeline will require recompositing. (3) The last step of network publishing is the publishing stage. When the content is repeatedly watched for effect detection, the content effect is not enough to be modified and adjusted. It publishes VR videos to learners by uploading the VR platform, and learners watch videos with smart devices and VR devices. The process is shown in Figure 6:

This research mainly attempts to use virtual reality technology to assist martial arts teaching, which uses VR equipment and video materials to provide learners with a new learning method. When shooting teaching videos, there is not much change to the teaching scene, but the shooting environment is different from the normal teaching environment, so as to achieve the best effect as much as possible. In this way, students can better observe the action from multiple directions and obtain a real sense of immersion when watching VR videos. The VR video shooting scene and screen rendering effect are shown in Figure 7:

4.4. Experimental Results. In order to eliminate the interference of other factors and more accurately test the effect of virtual reality technology-assisted martial arts teaching, this

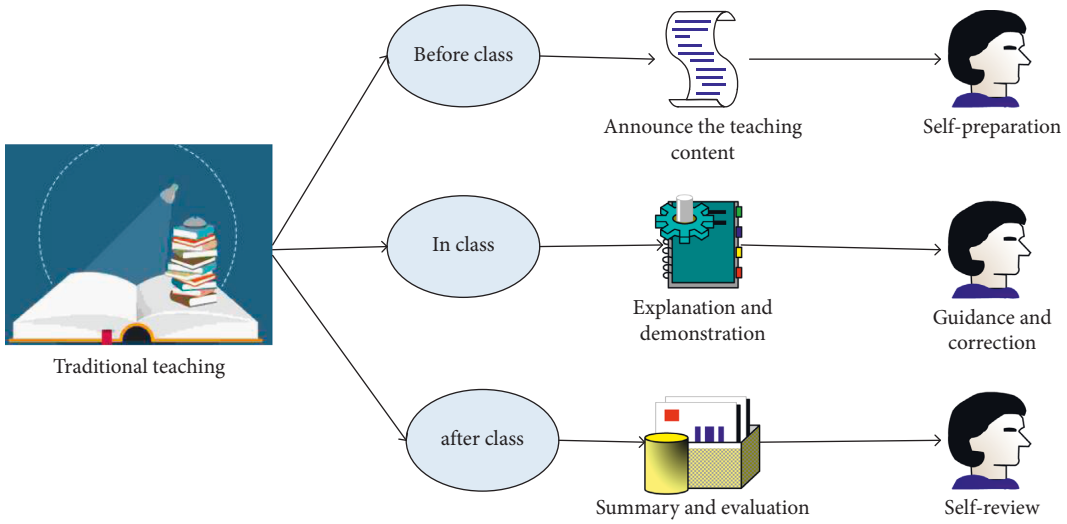


Figure 3: The teaching process of the control group.

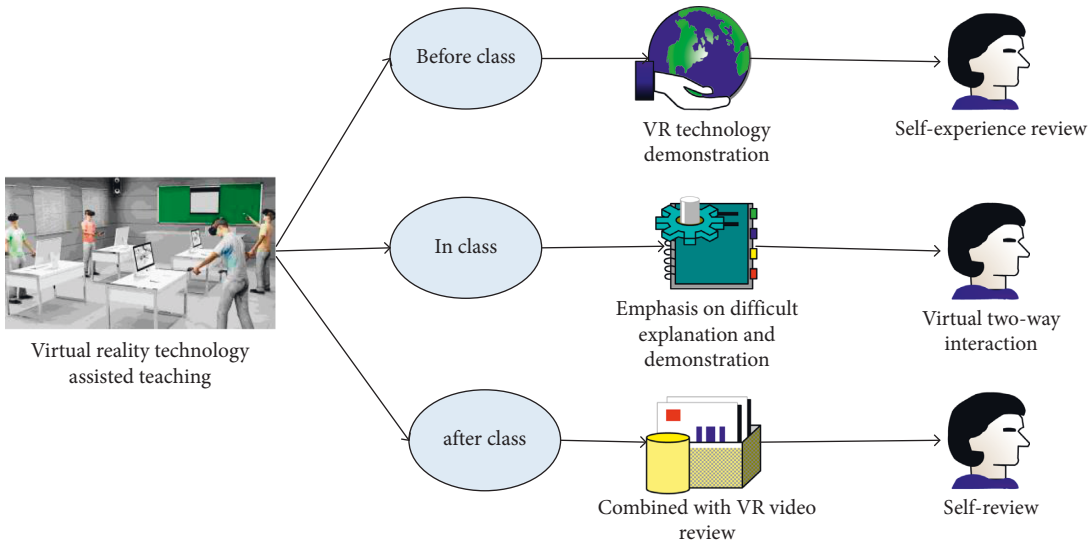


Figure 4: The teaching process of the experimental group.

(a) (b)

Figure 5: Experimental equipment.

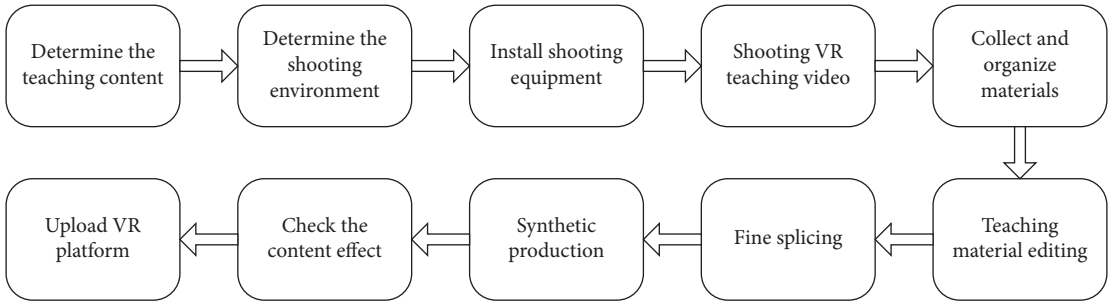
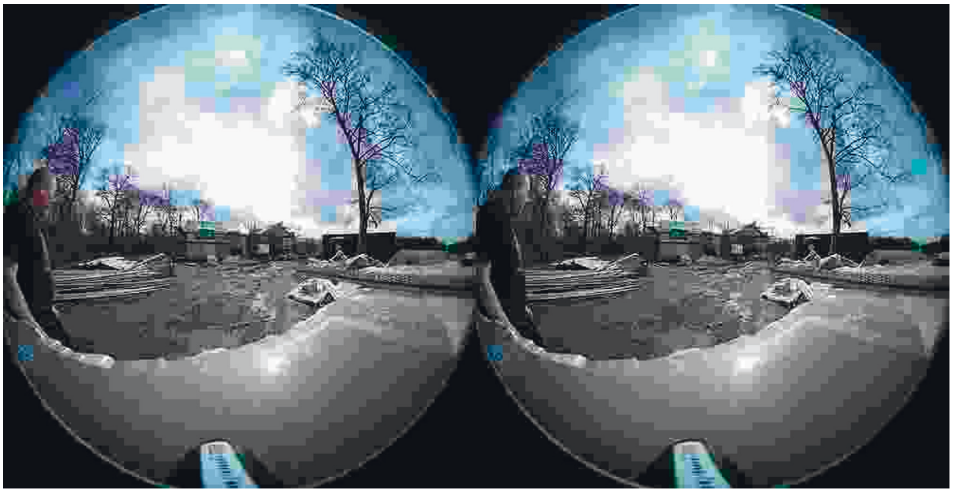


Figure 6: VR teaching video production process.

Shooting scene

(a)



Teaching video

(b)

Figure 7: VR teaching video effect. (a) Shooting scene; (b) teaching video.

paper uses a questionnaire to test the homogeneity of the experimental subjects in the early stage of the experiment. The test is divided into three parts: body shape and basic physical quality, basic situation and emotional attitude of learning martial arts, and VR technology cognition and application.

4.4.1. Body Shape and Basic Physical Quality. By sorting out the data, this paper conducts a homogeneity test on the physical shape and basic physical quality of the students in the experimental group and the control group. The test results are shown in Table 5 and Figure 8:

Table 5: Comparison of body shape differences between experimental group and control group ($N = 40$).

Test items	Test group $\overline{x} \pm s$	Control group $\overline{x} \pm s$	T	P
(Age)	19.55 ± 0.76	19.10 ± 1.02	1.582	$0.122 > 0.05$
Height (cm)	170.90 ± 8.51	170.25 ± 5.37	0.289	$0.774 > 0.05$
Weight (kg)	56.70 ± 9.77	55.95 ± 7.72	0.269	$0.789 > 0.05$

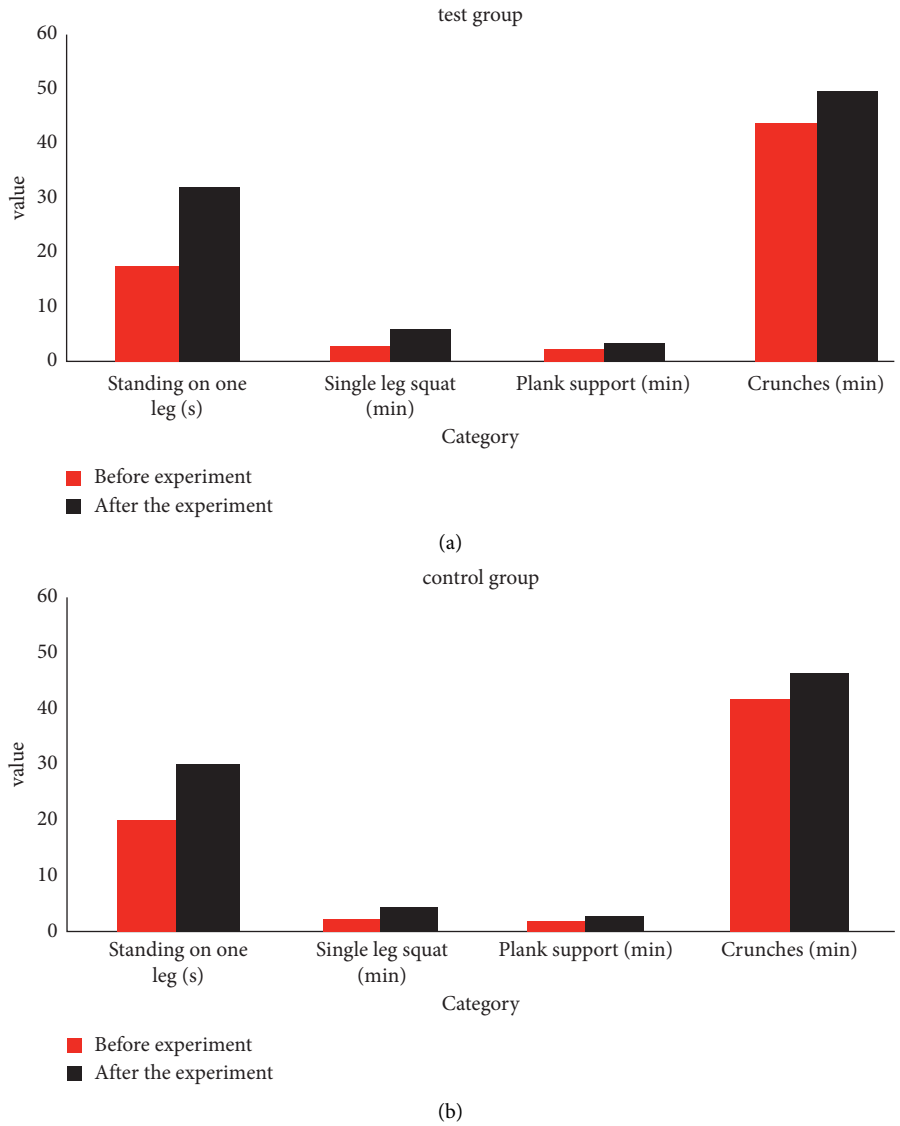


Figure 8: Comparison of the differences in the basic physical quality of the students in the experimental group and the control group ($N = 40$). (a) Test group; (b) control group.

Combined with the data in Table 5, it can understand the body shape of the two groups of students and test the indicators of height, weight, and age. After obtaining these data, this paper can perform a sample T test on these data through the excel tool, and the final P values are 0.122, 0.774, and 0.789. Since the P values are all greater than 0.05, it can be seen that there is no significant difference in the body shape of the two groups of students, and experimental teaching can be carried out.

It can be seen from Figure 8 that, after the experiment, the P values of the students in the experimental group and the basic physical fitness of the students before the experiment were all less than 0.05. In this paper, the P values of the basic physical fitness of the control group and before the experiment are all less than 0.05. After the experiment, this paper found that there were significant differences between the experimental group and the control group and the test data of basic physical fitness before the experiment.

Therefore, this paper concludes that both traditional teaching methods and virtual reality technology-assisted teaching have certain effects on improving the basic physical quality of students.

Through the analysis of the above experimental test results, the P values of the four items of single-leg standing, single-leg squat, plank support, and sit-ups in the independent T-test of the horizontal comparison between the experimental group and the control group are all greater than 0.05. After the experiment, the basic physical quality parameters of the students in the experimental group and the control group were basically the same. It shows that the basic physical quality of the students in the experimental group and the control group has been improved. It can be seen that the use of virtual reality technology to assist Wushu teaching, the experimental group, did not have obvious effective help in improving the basic physical quality after learning Wushu, which is different from the results assumed before the experiment. After the experiment, through personal testing and investigation and analysis, the reason is that virtual reality technology-assisted teaching stimulates students' interest in martial arts learning to a certain extent. In addition, when students study independently with VR equipment before or after class, they can gain a sense of pleasure and psychological experience, but it has no effect on their own willpower. It cannot guarantee that students can overcome their inertia and persist in practicing martial arts. Because the test value of the basic physical fitness of the experimental group is slightly higher than that of the control group, the author believes that the virtual reality technology-assisted teaching improves the enthusiasm of the students to learn martial arts, which indirectly improves the test results of the basic physical fitness of the experimental group.

4.4.2. Basic Situation and Emotional Attitude of Learning Wushu. Learning interest refers to students' initiative and emotional willingness in learning. Only by accumulating sufficient interest can they effectively acquire knowledge and skills. Learning motivation is the internal motivation and demand to promote, motivate and guide students to learn, and self-confidence is the degree of individual's trust in whether they can achieve their goals. Through statistical analysis of the emotional attitude test indicators of the two groups of students before and after learning Wushu, the results are shown in Figure 9:

After the experimental activity, the students in the experimental group changed significantly in terms of emotional attitude indicators compared with the values before the experiment. The P values of the experimental group's interest in learning, motivation, and self-confidence were all less than 0.05, which indicated that there were significant differences in the emotional attitudes of the students in the experimental group before and after the experiment. The control group had a P value of less than 0.05 for learning interest, but greater than 0.05 for both motivation and confidence. Therefore, this paper concludes that the learning interest of the control group after the experiment has been improved compared with that before the experiment, the learning motivation has not changed, and the level of self-confidence is lower.

After the teaching experiment, it was concluded that the students in the experimental group had higher learning interest, motivation, and self-confidence in martial arts than the control group. The main reason is that, on the one hand, the students in the experimental group obtained a novel immersive learning experience by wearing VR equipment before class, and the physical movements of martial arts were more vividly presented in front of the eyes through the learning method of situational substitution. It can observe the changes of martial arts movements from multiple angles. It stimulates students' interest in learning martial arts. It improves students' enthusiasm for martial arts movement practice. And the students in the experimental group explained the important and difficult points of the movements in the combined class. The students in the experimental group have a deep understanding and mastery of the details of the movements and can learn and practice martial arts movements more freely. To a certain extent, it strengthens the motivation to learn martial arts. Due to the improvement of students' interest in learning in the experimental group, it was promoted when students did not have sufficient grasp of martial arts movements in classroom learning. After class, combined with the teaching videos released by teachers to review Wushu independently, it will further improve the understanding and mastery of Wushu movements, so that the overall level of Wushu movements has been generally improved, and students' self-confidence has been enhanced. On the other hand, when using virtual reality technology to assist Wushu teaching, it relieves teachers' teaching pressure to a certain extent. The main purpose is to reduce the time for teachers to demonstrate actions. Teachers spend most of their time and energy on explaining movement usage, movement details, and theoretical and cultural aspects, so that students can truly understand and comprehend the core value of learning martial arts. It improves the effect and quality of students' learning martial arts. Therefore, the use of virtual reality technology to assist Wushu teaching improves the rigidity and dullness of traditional teaching methods and realizes the all-round display of Wushu movements in teaching. It allows students to observe and learn martial arts movements more clearly and further improves the effect of martial arts teaching.

4.4.3. VR Technology Cognition and Application. In Figure 10, A, B, C, D, and E are five evaluation levels, which represent strongly agree, agree, somewhat agree, uncertain, and disagree. Through the survey, most students have a positive attitude towards virtual reality technology-assisted martial arts teaching, and their enthusiasm for learning martial arts has been significantly improved. The main reason is that any angle and direction in the video can be viewed with the stereoscopic rotation of the device. While obtaining an immersive learning experience, it cultivates students' ability to observe and analyze movements, and it helps students more comprehensively correct wrong movements on the basis of correct understanding and

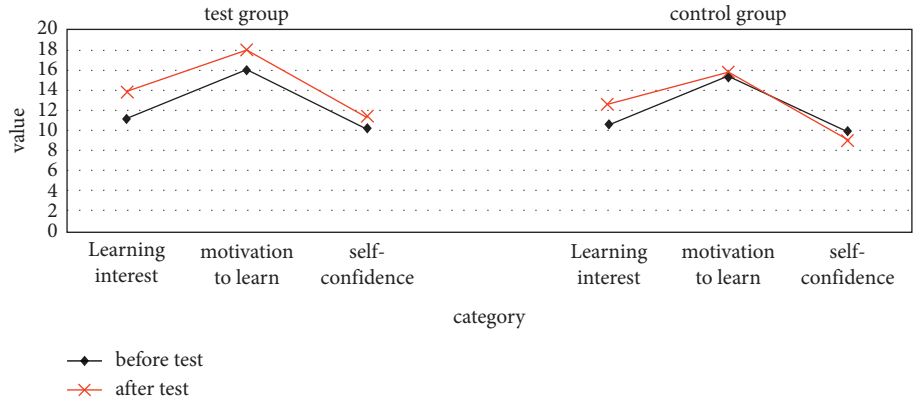


Figure 9: Comparative analysis of the test results of the two groups of students' affection and attitude indicators after the experiment and before the experiment.

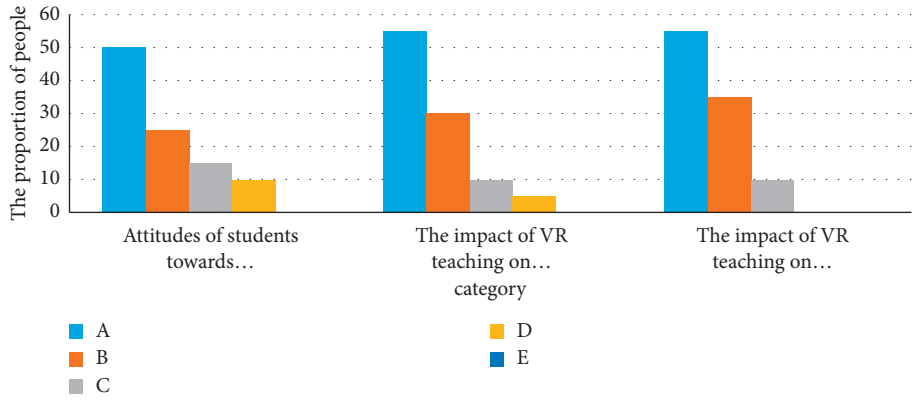


Figure 10: VR technology cognition and application.

recognition of movements. It improves the standard and normative of martial arts movements. On the other hand, it also provides a good auxiliary learning tool for students. It improves students' autonomous learning ability and inquiry ability while transforming students' learning methods. But some students feel uncomfortable with this way of learning. Of course, the problems existing in virtual reality technology-assisted martial arts teaching cannot be ignored, and we should try our best to find solutions to make virtual reality technology-assisted teaching achieve better results. It also needs to further explore the value of virtual reality technology applied to its own professional aspects, so that it can better be accepted and recognized by learners. It can be seen that it is feasible to assist Wushu teaching with virtual reality technology.

5. Conclusion

So far, although traditional teaching methods have many shortcomings in the process of teaching implementation, traditional teaching has unique application value in education and teaching. With the continuous development of modern science and technology, the innovation of education and teaching mode is subtly affected. How to better apply modern science and technology to teaching is the key to promoting the reform of teaching methods. From the results of the teaching experiments, it can be concluded that the control group, which adopts the traditional teaching method in this paper, is lower than the experimental group in the emotional attitude of learning Wushu. During the learning process, the details of the martial arts movements are not fully grasped, and the standardization and familiarity of the movements are not as good as those of the experimental group. Therefore, the use of traditional teaching methods by teachers to improve students' learning effect still has certain limitations. In the traditional teaching process, teachers mainly focus on demonstrations and explanations, while students' mastery of details and angles of martial arts movements is a reference measure to measure the norms and standards of movements. Due to the complexity of martial arts routines, there are certain limitations when teachers demonstrate movements. It affects the students' lack of comprehensive grasp of the movement angle and direction changes in the martial arts routines and reduces the students' internal demand for the movement essentials and theoretical culture taught by teachers. In terms of traditional martial arts teaching materials, it is mainly the text explanation of books and the decomposition of action techniques in the form of pictures. Although the teaching content presented by the video material is three-dimensional and vivid, it has

the defects of poor initiative and single angle of demonstration action. Therefore, in the process of traditional martial arts teaching, what needs to be solved is how to make students see the teacher's demonstration movements more clearly and comprehensively, as well as the direction and position of the connection between each movement. It comprehensively improves the students' mastery of the details of martial arts movements and improves the standardization of martial arts movements. Therefore, the application of virtual reality technology to martial arts teaching can perfectly combine books and video teaching materials, making the text and pictures in the books come alive. The action demonstration in the video presentation is more three-dimensional, intuitive, and multiangle observation. It also adds action explanations and music to enrich the video effects, and students use VR equipment to substitute the situation into learning to improve their clear understanding and memory of martial arts movements. It achieves multidirectional visual observation and obtains an immersive learning experience, stimulates students' interest and pleasure, and gradually improves the quality of martial arts movements. Therefore, the application of virtual reality technology to Wushu teaching has certain validity and feasibility.

Data Availability

No data were used to support this study.

Conflicts of Interest

This paper has no potential competing interests. We confirm that the content of the manuscript has not been published or submitted for publication elsewhere.

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