The Effect of Virtual Reality Technology on College Students' Interest in Sports Learning

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Abstract-**The purpose of this study is to explore the influence of virtual reality technology on college students' interest in sports learning. This paper applies virtual reality technology to table tennis teaching practice, and constructs a new teaching mode with teachers as the leading role and students as the main body. In this study, 19 non-sports major students were selected as subjects, and a single-subject experiment was conducted to evaluate the indicators of interest in sports situations in the pre-experiment and post-experiment stages in a four-week intervention experiment from June to July 2019.The results show that the use of virtual reality games in table tennis learning can improve students' interest in sports learning, learning attitude is more positive.**

Keywords-virtual reality technology, College students, interest in sports learning

I. INTRODUCTION

Virtual reality technology is to simulate the virtual network space through computer simulation system, so that users can immerse in the virtual environment with three-dimensional information, and then realize the real-time interaction of multiple senses [1]. With the continuous improvement and development of virtual reality technology, it has become more and more closely related to our daily life, ranging from national defense and military to decoration design, which has greatly changed people's understanding of time and space, but also brought opportunities for educational innovation [2]. Compared with the traditional teaching model, virtual reality games construct a new teaching paradigm for learners to converge "technology, education and space", and complete the learning of knowledge and skills in the process of experiencing game situations [3]. Introducing virtual reality technology into teaching is a powerful force to promote the reform of modern education. It is conducive to clarifying the orientation and development trend of teaching in the future, further promoting the design and implementation of teaching links, providing inspiration for the specific operation path of teaching, and bringing new learning experience to teachers and students [4]. In the virtual environment, learners can realize real-time interaction of vision, hearing and touch through a variety of sensing devices, form the meaning construction of knowledge in the transmission of situational information, and change the traditional teacher-led teaching mode to the teaching mode of cultivating students' autonomous learning ability. At present, the application of virtual reality technology in sports practice is mainly used as an auxiliary means to promote the training level of high-level athletes. But the research on school teaching is very limited. Therefore, how to combine virtual reality technology with physical education activities to improve participants' interest and motivation is a hot research topic in this field in the future.

Interest is the psychological tendency of exploring something or activity according to individual needs [5]. It is a kind of subjective intention, which may not lead to the emergence of behavior, but it can closely combine individual attention, enthusiasm, pleasure and teaching activities. With the perfection and development of constructivism, the value of situational interest in the process of sports learning has attracted much

attention. Situational interest is regarded as the core of interest [6]. Therefore, to improve students' interest in sports learning as the starting point of classroom teaching reform, so that students actively participate in sports technology, skills learning, so as to improve the teaching effect and quality. The emergence of virtual reality technology provides a new way of thinking for education reform, greatly stimulates learners' interest in sports learning, and is conducive to improving the status quo of low participation and unsatisfactory teaching effect.

The purpose of this study is to explore the influence of virtual reality technology on College Students' interest in table tennis learning. Expect to improve the dullness of traditional table tennis learning process and the sense of boredom caused by not hitting the ball. Through virtual reality technology, students can quickly enter the role in the process of participating in table tennis learning, achieve the training effect and teaching purpose, and develop the behavior habits of physical exercise.

II. LITERATURE REVIEW

A. Virtual Reality Technology

With the development of digital science and technology, virtual reality technology comes into being [7]. The virtual reality world simulated by psychological immersion and physical immersion, as well as its interactive, immersive and conceptual characteristics [8], provides users with a more scientific and efficient use experience. At present, virtual reality technology has been widely used in military, games, education, medicine, design and other fields, and has achieved a series of positive results. From the teaching point of view, virtual reality technology aims to enhance students' learning experience and improve the quality of teaching. Improve the traditional teaching process boring, students' low interest in learning, time and space constraints and other practical problems. Under the network environment, users can interact and collaborate with people, objects and peers in virtual environment through matching relevant VR devices [9], and share VR data and files, thus achieving the teaching effect of visualization of abstract knowledge, stereoscopic plane knowledge and interest of dull knowledge. At present, there are few researches on the application of virtual reality technology in physical education teaching, mostly focusing on the auxiliary training of high-level athletes. Sports are a comprehensive subjects which integrates many disciplines. When constructing the virtual environment, it will inevitably simulate the corresponding virtual scenes and action

characteristics according to different sports items. It integrates terminals, application systems and intelligent platforms to create immersive interactive experience with strong sense of presence for learners. Nowadays, virtual reality technology is becoming more and more mature, and its application forms in physical education classroom will be more colorful. This research is based on HTC Vive head-mounted virtual reality display. Through Steam platform, ((Eleven: Table Tennis)) virtual reality game is selected for table tennis technical movement exercises. It can be used directly like other APP software without additional programming developed. It provides convenience for students to participate in virtual table tennis learning.

B. Table Tennis Teaching Method

Table tennis, as one of the most advantageous sports in China, is deeply loved by students. However, there are still some problems that need to be solved urgently in view of the current situation of table tennis teaching in Colleges and universities. For example, the teaching methods are old and single, the teaching content emphasizes skills. In order to improve the quality of table tennis teaching, different scholars are committed to reforming the traditional teaching process of table tennis, aiming at improving students' interest in learning and indirectly achieving teaching effect. It mainly includes flip classroom, serve machine and multi-ball practice mode, PBL teaching method, role-playing teaching method and so on. The results show that the teaching method of table tennis under the new concept aims at developing students' lifelong sports consciousness, highlighting students' subjectivity and learning initiative, and cultivating excellent qualities of independent thinking, solidarity and cooperation, and social adaptation. Let students change from learning skills to understanding skills. With the development of information technology, the emergence of virtual reality games has brought new teaching concepts for table tennis. Competition and training are carried out by means of interaction and feedback, which makes up for the deficiencies in practical training. Therefore, the purpose of this study is to provide a new learning method for students to learn table tennis by using virtual reality games.

C. Research questions

The purpose of this study is to solve the following problems:
- Does virtual reality game-assisted table tennis teaching help zero-basic table tennis

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practitioners overcome the fear of not hitting the ball in their initial school?

- Can virtual reality games help table tennis practitioners maintain a good interest in learning and a good state of exercise in the process of boring technical exercises?

III. METHODS

A. Research object

Nineteen non-sports majors of Northwest Normal University were recruited as experimental subjects. Recruitment criteria: similar age; good health; no table tennis experience and virtual reality game experience, signed informed consent before the experiment. This study is a single subject experiment, taught by a table tennis teacher with rich experience.

B. System Design

Hardware equipment: This research adopts HTC Vive virtual reality head-wearing device, which consists of VR head display, VR control handle and locator. Users can synchronize signals by two infrared laser transmitters of Lighthouse base station, cooperate with the head display and the photosensitive sensor of the controller, and calculate the head display position and motion trajectory. Provide users with excellent virtual reality experience. At the same time, the tracking and positioning of head display and controller are very accurate, the delay is very low, and there is no vertigo. It greatly stimulates users' immersion and interaction.

Software equipment: The virtual reality game Eleven: Table Tennis developed by For Fun Labs Company is selected. Build an international standard table tennis table with a length of 2.74 meters, a width of 1.525 meters and a height of 0.76 meters for users. The range of user activity is within 3.5 * 3.5 meters. The game supports single-player practice and multi-player online confrontation, and can freely choose the difficulty of the game, set ball speed, fixed point, rotation and other parameters. Provide users with an excellent virtual table tennis experience. To be shown in Figure1.
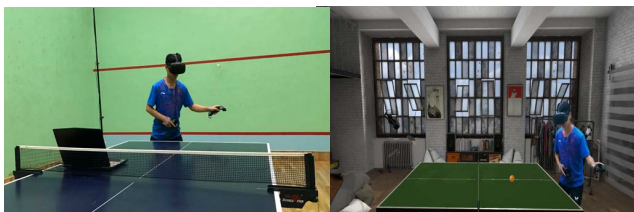

Fig. 1 Virtual reality game-assisted table tennis teaching scenario

C. Measurement Tools

This study used the Sports Situational Interest Scale to investigate the subjects' interest in sports learning before and after the experiment. The purpose of the pre-experiment test is to evaluate whether the subjects' interest level in sports learning is consistent before participating in sensory games. The experimental post-test explores the changes of students' interest in sports learning after physical game table tennis training.

"Sports Situational Interest Scale" divides sports situational interest into six dimensions: novelty, challenge, attention, exploratory, pleasure and general interest. Subjects were asked to respond accordingly to their own situation. The scale is composed of 15 options. The Likert scoring scheme with 5 points is adopted. All the questions are positive scoring. The higher the score, the higher the subjects' interest in learning.

D. Design of Teaching Scheme

According to Robert Mills Gagne's information processing theory [10], this study divides the learning process into eight stages: motivation - understanding - Acquisition - retention - recall - generalization - homework - feedback, and designs a virtual reality table tennis teaching course. To be shown in Figure 2.

a) Motivation stage：Students' learning is driven by motivation or expectation, is the inherent requirement of learning, can guide and maintain the psychological state [11], higher learning motivation can effectively promote learners to improve learning effectiveness [12], it points out the direction for sports knowledge and technology learning. In teaching, the teacher first plays a video of table tennis in the virtual reality environment, and then wears

HTC Vive equipment to show students the experimental tools needed for this study. At the end of the demonstration, the teacher will explain the essentials of table tennis forehand and backhand technical movements and matters needing attention. Easy and interesting classroom introduction is conducive to stimulating students' learning motivation and forming learning expectations, and then leads to the main content of this experiment, in order to prepare for the subsequent table tennis skills learning.

b) Comprehension stage：After students' learning motivation is aroused, students make selective perception of external stimuli, which are transmitted to students' information processing system, and then into short-term memory. In teaching, the teacher divides the students into three study groups to discuss table tennis forehand and backhand movements. Each student is required to correct each other's wrong actions during the demonstration. Teachers will guide each other in turn, give full play to the students' principal position, cultivate the ability of unity and cooperation, and enable students to master the main

points of forehand and backhand technical actions very well. On the basis of perfect technical action, the teacher explained the composition of HTC Vive virtual reality device framework and the game principle and operation method of Eleven: Table Tennis. Then let each student, using table tennis forehand and backhand technical movements to participate in virtual reality table tennis practice, and share their emotional experience. It effectively stimulates the students' attention.

c) Acquisition stage: The acquisition stage is for students to encode and store information entering short-term memory. In the course of teaching, on the basis of students' basic mastery of HTC Vive virtual reality equipment and table tennis forehand and backhand technology, teachers guide students to further process the input information, take groups as units, participate in the forehand and backhand exercises of virtual reality table tennis in an orderly manner, and stipulate the number and time of exercises, gradually relax the control of students' movement during the period, so as to cultivate students' essence. Fine processing ability, further encoding and processing information stored in short-term memory, into long-term memory, students in the virtual environment through the table tennis forehand and backhand technical movements of continuous practice, so that students have a deep understanding of technical movements, perception process continues to improve, accurate, action coordination and flexibility to strengthen, so as to achieve the understanding and application of teaching objectives.
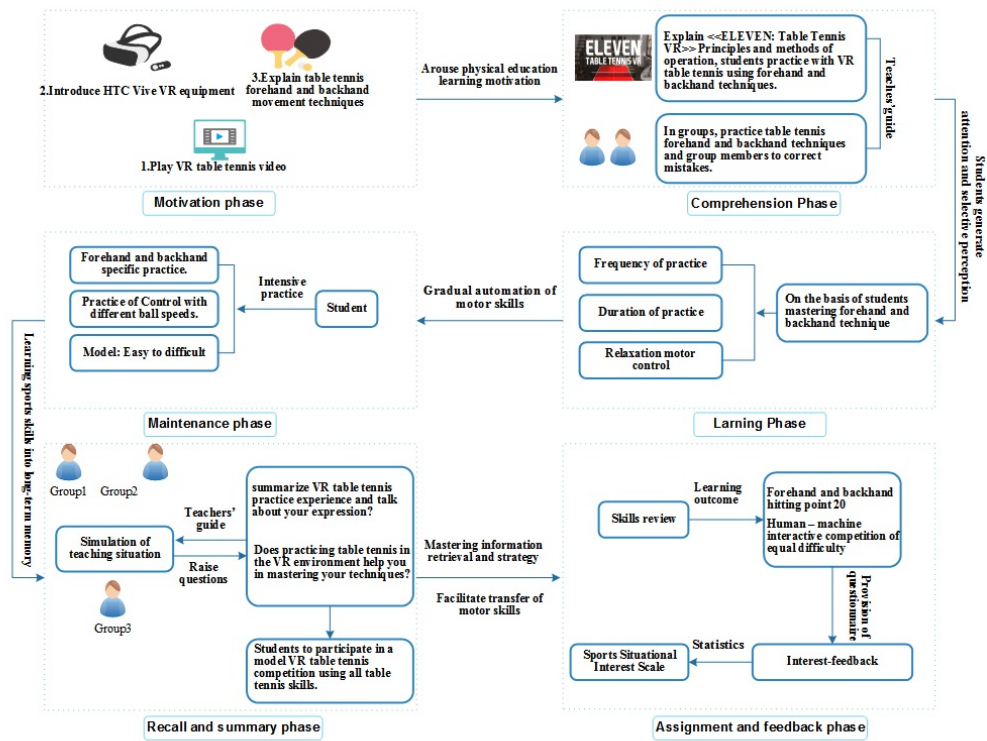

Fig. 2 Virtual reality game-assisted table tennis teaching task design process and structure

d) Stage of retention: After the reinforcement of repetition in the acquisition stage, the encoded information is stored in the long-term memory storage for a long time for extraction. In teaching, students table tennis skills are gradually automated on the basis of practice. In this process, according to students' mastery of forehand and backhand skills, teachers choose more intensive training programs pertinently, including speed control, forehand and backhand fixed-point exercises, and multiple choices of difficult and easy modes. At this time, students have been able to use table tennis more skillfully.

e) Recall stage: Recall stage is the information retrieval stage, according to the clues provided for information retrieval, in this process, teachers should guide students to master information retrieval strategies, and make them proficient, and change the acquired sports skills into behavior habits. In the process of teaching, the teacher designs a simulated situational exercise of classroom teaching in groups. Each student acts as a teacher in order to teach and combine teaching with learning. Firstly, this paper introduces the system framework and implementation principle of HTC Vive virtual reality equipment, then introduces the virtual reality game Eleven: Table Tennis and its operation method used in this study. Finally, it teaches table tennis forehand and backhand technical movements. During this period, teachers

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observe and guide each group. After that, teachers put forward three questions for this teaching link: 1. Combining virtual reality table tennis; How do you feel about your tennis practice experience? (2) Which do you think is more attractive between traditional table tennis teaching mode and table tennis practice in virtual reality environment? Does table tennis practice in virtual reality help you master table tennis skills? In this stage, the teacher combines the knowledge learnt by students with the practice of classroom teaching to achieve the retrieval of the knowledge learnt.

f) Summary stage: Summary stage is the process of learning traction. Teachers guide students to summarize and master the principles and rules, promote students' learning transfer, and apply the acquired knowledge and skills to a variety of similar situations. In this stage, the teacher chooses the difficulty of VR game ((Eleven: Table Tennis)) as the general competition mode for human-computer interaction, and observes the overall mastery of students according to table tennis technical action standards.

g) Assignment Stage: Through completing assignments, to test whether students have learned information. Job functions not only to feedback, but also can observe the learning results of knowledge. In this process, physical education teachers designed a comprehensive application ability assessment of table tennis forehand and backhand technical movements based on virtual reality environment, including: 20 forehand and backhand fixed-click balls, the same difficulty of human-computer interactive competition, the assessment results are presented in the form of scores, to reflect the quality of learning.

h) Feedback Stage: As anticipated, learning behavior is formed. Feedback enables students to know whether their homework achieves the expected goal in time, thereby reinforcing their learning motivation. Before and after the experiment, the changes of students' interest in learning were compared through questionnaires to achieve the purpose of feedback.

E. Data Analysis

In this study, a single subject experiment was conducted. The independent variables of the experimental design are the teaching plans, and the dependent variables are the challenges, attention, exploration, pleasure and general interest before and after the experiment. In order to control the influence of irrelevant variables, the subjects' teaching content, participation times and participation time were identical. In the aspect of data collection and analysis, by SPSS 20.0 software and using the statistical method of "paired sample t test", this paper compares the subjects' interest in sports learning before and after participating in table tennis somatosensory game experiment.

IV. RESULTS

The six dimensions of the subject's sports situational interest scale showed normal distribution by single sample t test before the experiment, and paired sample t test was used for comparison before and after the experiment.

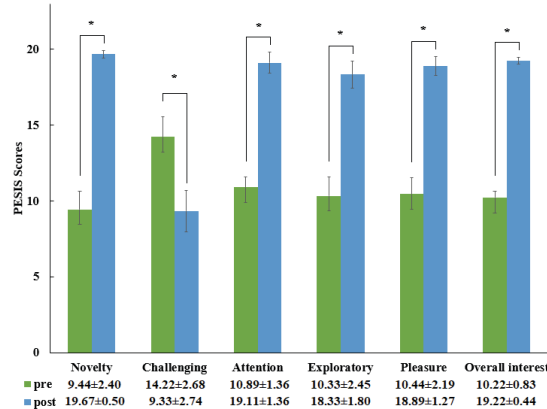|	Novelty	Challenging	Attention	Exploratory	Pleasure	Overall interest
pre	9.44±2.40	14.22±2.68	10.89±1.36	10.33±2.45	10.44±2.19	10.22±0.83
post	19.67±0.50	9.33±2.74	19.11±1.36	18.33±1.80	18.89±1.27	19.22±0.44

Fig. 3 Interest in learning index of virtual reality game-assisted table tennis teaching analysis

As shown in the figure 3, the results showed that there were significant differences in the six dimensions of the subjects' interest scale in sports situation after the experiment compared with before the experiment (p < 0.05). It shows that using virtual reality games to train table tennis can create a network virtual sports sensory platform for students, give full play to its immersion, interaction and imaginative characteristics, which not only achieves the training purpose, but also meets the entertainment needs, and lays a foundation for stimulating students' subjective initiative in learning and cultivating students' interest in sports learning. It embodies the teaching form of "combining teaching with pleasure" and makes students more active in participating in sports training.

V. DISCUSSION

At present, there are few empirical studies on the influence of virtual reality games on students' interest in sports learning. To this end, the purpose of this study is to compare the intervention effect of HTC Vive virtual reality equipment on College Students' interest in sports learning before and after the experiment. By issuing questionnaires and data collation, the changes of six dimensions of the scale of interest in sports situation are systematically compared.

The results showed that after the intervention of virtual reality table tennis game for 4 weeks, there were significant differences in the levels of novelty, challenge, attention, exploratory, pleasure and overall interest, and the level of interest in sports learning was improved. This conclusion validates Subramaniam's

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view that students' interest in sports activities can be aroused through situational creation in sports classes. The reasons for the results of this study may be as follows: 1) Sports games based on virtual reality technology, while satisfying the user's entertainment, also pay attention to the real-time interaction of psychological and physical senses in the virtual environment, breaking the boundaries of time and space, so as to make the learning of sports skills more timely.2) Under the guidance of students' own action characteristics and thinking mode, the two-way interaction between students and virtual game environment can be completed, so as to stimulate the sense of participation and on-the-spot experience of sports. In addition, the Eleven: Table Tennis game selected in this study can realize participants' decomposition exercises of table tennis technical movements, such as forehand attack, backhand push, flat serve and so on. Students can choose according to their own needs. At the same time, the game provides six different game modes from easy to difficult, supporting the saving and reading of progress. Let the students immerse themselves in intelligent feeling and table tennis training with a relaxed and pleasant mind.3) Combining virtual reality and sports simulation technology, sports games have changed the traditional single and boring training mode of table tennis, and pay more attention to the cultivation of students' interest in learning and sports literacy in the learning of knowledge and skills. Let students have a positive awareness and want to engage in sports activities or physical exercise psychological tendency, thus effectively stimulate the motivation of students to participate in sports activities. The application of virtual reality technology in table tennis teaching not only provides new contents and methods for education and teaching reform, but also promotes the improvement of students' interest in sports. In the future, virtual reality technology will surely bring a new chapter in the field of physical education [13].

VI. CONCLUSION

Using HTC Vive virtual reality equipment, students can quickly realize real-time interaction with table tennis virtual scene by using body movement and movement, which has the characteristics of immersion, clear training purpose and strong interest. This study confirms that adding HTC virtual interactive game control platform in the process of sports learning and training can not only promote students' interest in sports learning, but also be beneficial to them. Helping students to overcome the impatient period when they can't play the ball at the beginning is also conducive to helping students to overcome the boring period of technical learning.

As a practical discussion on the application of virtual reality games in table tennis teaching, the author believes that virtual reality games cannot replace traditional physical education because of the biological characteristics of neuromuscular control and feedback in sports skill learning, but can only be used as a tool or means to enrich teaching forms and improve teaching quality. In addition, the team is also concerned about the psychological impact of virtual reality games on students' sports skills learning, aiming at a deeper and broader understanding of the new future that virtual reality games can give modern education.

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