

Research on Design and Application of Table Tennis Teaching Based on VR

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Keywords: virtual reality, table tennis teaching, human-computer interaction

Abstract: Human-computer interaction is one of the research hotspots of virtual reality. With the popularization of virtual reality technology, the research on human-computer interaction technology based on virtual reality has a wide application value. The latest virtual reality technology is becoming more and more mature, and it is applied in college physical education. Reality technology must become a reality, and the integration of VR technology can bring a new page to physical education. This paper focuses on the combination of human-computer interaction technology and virtual reality technology, and establishes a table tennis teaching prototype system integrating entertainment and fitness. Through the reasonable and effective application of VR technology, the teaching effect and teaching quality can be effectively improved.

1. Introduction

With the innovation of educational concepts and the rapid development of computer technology, modern science and technology has penetrated into various fields of sports with its strong affinity [1], especially in sports teaching and training. It is a new teaching medium after the multimedia [2], VR Virtual Reality (VR) technology, and virtual reality technology as a new teaching medium, which can not only effectively improve the quality of physical education, but also enable trainees to get in the way. The feelings and experience of the environment can also represent a new means of physical education [3-5]. It will be popularized and improved in physical education and further promote the modernization and networking of physical education teaching techniques, improve the level of modern physical education, and train students to comprehensively understand and master sports knowledge and motor skills, and improve students' physical and mental development[6].

VR is the abbreviation for Virtual Reality, a real-time representation of a computer-generated world that simulates human perception, sometimes referred to as a virtual environment. The "world" here refers to a realistic three-dimensional figure [7], which can be either a real reproduction of a particular real world or a world of ideas. Operators can interact with them through visual, auditory, tactile, and force sensations, thus creating an "immersive" scenario, so virtual reality technology provides new interactive media for human-computer interaction.

2. The Content and Design of VR Teaching Experience

The experience brought by VR teaching should not be limited to the improvement of task solving ability; it should also increase the enjoyment of learners [8-10]. Positive emotions are the premise of curiosity and learning new things. The layered concept that consumers need to satisfy: practicality, applicability and pleasure, also applies to VR teaching experience. The VR teaching experience is based on phenomenon perception and self-perception and described by learners as interesting and pleasing, that is, emotional experience is the criterion for VR instructional design [11-13]. The user interface and interaction designers should use this understanding of the design experience, use the understanding experience, the teaching form problem experience, the perception of multiple effects, the feelings of multiple media, the way of feelings, and so on, to enhance the fun

of the VR teaching experience.

The learner's experience with a VR teaching activity is personalized. It contains the learner's skills, knowledge, and previous similar experiences. It is the emotion and feeling that the learner interacts with the VR system. Since this interaction always occurs in some physical and social environments, understanding learners, the tasks provided, and the environment used are key to the design of the VR teaching experience.

3. Virtual Human Behaviour Modelling

3.1. Perceptual Information Acquisition

For the research content and target population of this paper, we need to choose suitable interactive equipment as the specialty of the research of virtual humans. We need the ability of virtual humans to have human perception information, such as images, voice or gestures. We choose economical and affordable. The interactive device Kinect serves as a virtual person's sensory information acquisition tool.

Distance: Kinect is a depth camera interaction device. It can not only obtain two-dimensional information but also obtain depth map information. Therefore, Kinect can obtain skeleton information of the elderly, and through the three-dimensional coordinate information of the skeleton, virtual humans and old people can be obtained. The interaction distance of the person, the interaction distance is used as the intimacy of interaction with the virtual person, and does not interact beyond a certain range.

Limb Recognition: Since the elderly interact with table tennis games, the virtual person needs to perceive the physical movements of the learner. Based on the Kinect skeleton information, we define the semantics of each pose by limiting the position and the swing angle. Then we calculate the angle and position of the arm and achieve dynamic limb recognition through static pose serialization recognition.

Situation: The virtual person perceives the situation information by obtaining the internal data storage when the learner play the game. We set the game's situation to be a 21-game winning and losing game. In the process of playing against the virtual person, we got three different possible situations, such as a draw, a lead and a lead. In order to be the leader and the lead, we set the score to determine the lead, that is, the ratio of the two scores as the lead.

3.2. Sound Information

Sound is a common feedback signal. Different sounds give people different feelings. The familiar sound makes people feel more intimate. The system uses the text-to-speech library in the Speech Lib library to realize personalized voice content prompts. Because the people facing the population may come from different regions, standard Mandarin is used. Through the signal given by the system, the system voice prompt system can make corresponding prompts according to the signal.

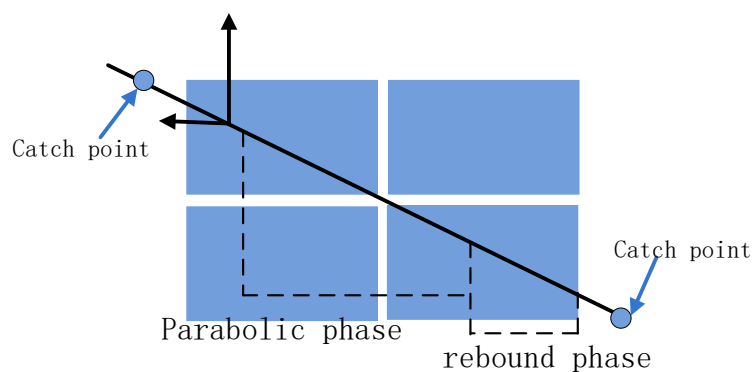


Figure 1 Simulation of table tennis.

4. Design of Table Tennis Teaching Scene

The purpose of table tennis is to simplify the complexity of table tennis and improve the ease of use. The speed and flexibility of the game is relatively slow. Figure 1 shows a complete table tennis simulation process for table tennis, including the tee-to-ball phase, the parabolic phase and the catching phase.

In order to achieve real results, we need to simulate the trajectory of real table tennis. The stage of table tennis trajectory is divided into rebound and parabolic stages. The parabolic phase is from the starting point of the bomb to the falling point of the opponent. Since this stage is parabolic, it is simulated by the parabolic equation of Equation (1).

$$\begin{cases} x = v_g t \cos \alpha \\ y = v_g t \sin \alpha - \frac{1}{2} g t^2 \end{cases} \quad (1)$$

t is the time, α is the angle of the upward serve, g is the acceleration of gravity, and v_g is the initial speed of the serve. In order to realistically simulate table tennis, the serve point and the drop point are random, so the ball's trajectory will also be random, so it can better simulate the table tennis trajectory.

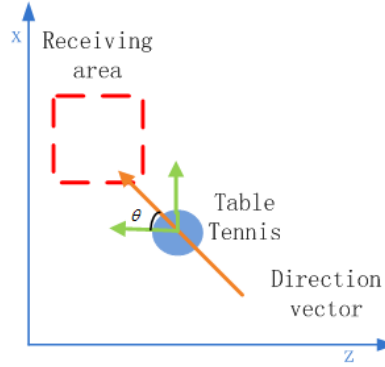


Figure 2 Ball catching diagram.

In the rebound phase, you need to consider the catch prediction problem. In the absence of a fully elastic collision, there will be energy loss after the ball and the table collide, so the position of the ball point must be in front of the parabolic phase, and the amplitude of the bounce is small, as shown in Figure 2. θ is the horizontal angle, d is the distance between the racket and the falling point and P is the probability of being in the catching area.

$$\begin{cases} x = x + d \\ z = z + \arctan(d / \theta) \end{cases} \quad (2)$$

The ball-off point of the second rebound is in front of the direction of the parabolic phase, as shown in Figure 2. Calculate the position of the secondary falling point according to Equation (2).

According to the principle of the above design, the effect of the table tennis experiment shown in Figure 3 is designed.

In order to verify the entertainment of table tennis, we designed a real table tennis game, designed in accordance with the physical collision of table tennis. In the game play, the player must make judgments based on the speed and position of the ball, and what strategies are used, such as the angle of the shot and the strength. These strategies are not only needed in real table tennis but also in entertainment table tennis. As shown in the figure, the red rectangle represents the racket, the different heights represent the position of the shot, the angle of rotation represents the angle at which the racket hits the ball, and the ball can be struck out.



Figure 3 Entertainment table tennis.

5. Teaching Implementation

The teaching implementation consists of three stages: self-study before class, training in class and consolidation after class.

1) Self-study Before Class

Students pre-read the relevant content of this lesson in the textbook before class, and watch related technical action videos through the network platform.

2) Training in Class

Task 1: Listening and visual learning

Step (1) Wearing VR glasses to watch the professional player's forehand shot video, so that students can first establish the correct appearance of the action, laying the foundation for later learning.

Step (2) The students took off the glasses and the teacher explained the demonstration of the table tennis ball forehand. Although the information teaching can greatly improve the students' learning effect, there are also irreplaceable parts in the traditional physical education, such as the face-to-face teaching of physical education teachers and physical education. The most basic and important thing is the teacher's face-to-face teaching. Teachers can explain the action essentials and processes more carefully by decomposing technical actions.

Step (3) Wearing VR glasses to watch coherent pictures, so that students can return to informational teaching again, fully understand the key points of teaching.

Task 2: Practice mastery

Step (1) Students do not wear VR glasses to practice, through this link, so that students first experience the process of consecutive hitting.

Step (2) Students wear VR glasses to practice. In traditional teaching, this link is prone to students not hitting the ball. It is difficult to grasp the difficulty in teaching objectives, that is, mastering the hitting point. By playing virtual video in VR glasses, students can visually master the hitting point.

Step (3) Corrective action analysis and correction, through the teacher to correct the analysis of each student's wrong actions, to achieve timely correction, quickly grasp the effect of the action.

Task 3: Interactive analysis

Step (1) Students watch each other's batting actions and discuss the wrong actions, correct themselves, and improve the spirit of unity and cooperation among students.

Step (2) Re-wear VR glasses to practice and reinforce the technical movements.

3) Consolidate After Class

Empty swing practice: Students carry out their own swing exercises and constantly improve their mastery of proficiency.

Learning and Appreciating the Game: Watch the world's high-level professional players and carefully analyse the hitting video to continuously improve the visual imaging in the mind.

6. Performance Analysis

By incorporating VR technology into table tennis teaching, the following results will be achieved: First, the learners become subjective, and the VR technology is fully applied to the practice of

table tennis teaching. The way of human-computer interaction can increase the students' novel experience and change the students from "passive listening" to "active learning". What is what is raised to what the student wants to learn.

Second, the difficulties are visualized, through the mutual correction of students and the correct guidance of teachers; students repeatedly watch videos to achieve the real difficulty in mastering teaching. It is no longer the students in traditional teaching to understand abstract concepts, but students actually see Things to learn, know where you are wrong, and improve your learning.

Third, VR technology has the function of animated virtual reality, which can vividly reveal the abstract concepts and essentials of teaching through intuitive information transmission in the process of teaching content presentation and learner practice.

Last, help the learners mastering skills happily, the integration of VR technology in the physical education classroom, improve the interest of learners to learn, get rid of the boring feeling of the early learning movement skills, so that students have a sense of "immersive", so that learners are happy Learning sports skills.

We hope you find the information in this template useful in the preparation of your submission.

7. Conclusions

The study of VR into classroom teaching will have a profound impact on improving classroom teaching, improving the teaching environment, optimizing the teaching process, and cultivating talents with innovative and innovative abilities. Full application of VR technology to classroom teaching can greatly stimulate students' interest in learners, subvert the traditional physical education model, and make learners change from "passive listening" to "active learning", which helps students to enjoy lifelong sports habits. Through virtual reality, some abstract concepts, principles and essentials in physical education can be vividly expressed, which helps learners to obtain a more intuitive understanding, so as to better grasp technical movements; future virtual reality education The technology will become more and more mature. This new educational technology means the development trend of the entire educational technology. Virtual reality education will no longer be a dream. With the continuous deepening of the country's "One Belt, One Road", we hope more and more technological elements. Incorporate into the teaching to make learners happy.

Acknowledgements

This research in this paper is partially co-supported by the NSF of Zhejiang (LY19F020001), the Research Foundation of DaHongying University (grant no: xxjg200802). NSF of Ningbo city (2011A610101), NSF of Huzhou city (2016YZ02), Science and Technology Plan Project of Zhejiang (LGG18F020001) and Social Sciences Project of Zhejiang (19NDJC0103YB)

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