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Research on immersive interactive method of simulated anatomy experiment teaching based on virtual reality

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Abstract: *At present, most of the immersive interactive nodes in anatomy experiment teaching are set as single-target deployment, and the frequency of teaching interaction is limited, resulting in the reduction of interaction times. Therefore, this paper proposes the analysis and research on the immersive interactive method of simulated anatomy experiment teaching based on virtual reality. According to the actual interaction requirements and standards, the interactive environment of anatomy teaching is preprocessed, and the form of multi-objective layout is adopted to break the limit of traditional teaching interaction frequency. The teaching interaction node of anatomy experiment is set, the virtual reality teaching interaction model is constructed, and the three-dimensional servo virtual simulation conversion method is used to realize teaching interaction processing. The final test results show that, after three stages of measurement, the number of interactions of the four anatomical experimental courses has been significantly increased with the help of virtual reality immersion teaching interaction method, which also shows that this method can also exercise students' comprehensive practical ability to a certain extent and form a circular auxiliary learning tool, which has practical application value.*

Keywords: *Virtual reality; Analog processing; Simulation; Experimental teaching; Immersive interaction; Interaction method*

1. Introduction

In recent years, with the innovation of teaching technology and forms, some higher vocational colleges cultivate students' comprehensive practical ability and mostly adopt practical teaching methods, the most representative of which are computer teaching and multimedia teaching, etc. These teaching methods are relatively flexible in structure, especially for the teaching effect of analog anatomy subjects [1]. However, at the present stage, with the increasing number of college enrollment, the existing teaching system of some medical colleges and universities cannot fully meet the needs of actual teaching, resulting in the lack of practicality and creativity in the learning process of students, and it is difficult to improve themselves faster. The emergence of immersive interactive teaching method solves this problem. This form is not limited by traditional analog anatomy teaching, and it uses the latest technology to help students participate in atlas anatomy practice and improve their learning structure [2]. However, the immersive interactive teaching in some colleges and universities is incomplete in deconstructing the anatomical map model, which still has some drawbacks and is difficult to really play a role. Therefore, the analysis and research of immersive interactive teaching method of simulated anatomy experiment based on virtual reality are put forward.

The so-called virtual reality technology, also known as virtual reality or spiritual reality technology, mainly refers to a kind of dynamic reality restoration technology. When it is combined with the immersive interactive teaching of simulated anatomy experiments, it can further strengthen the actual teaching effect, expand the influence range of virtual teaching, and gradually form a more stable and flexible teaching structure, The disadvantages and problems of the traditional immersive interactive teaching of simulated anatomy experiments are abandoned, and the teaching innovation is realized by means of technology, science and technology, and design, to achieve the set practical objectives, and to provide a reference basis for the subsequent development of relevant medical anatomy technology and industry.

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2. Construct an immersive virtual reality interactive method for anatomy experimental teaching

2.1. Pretreatment of anatomy teaching interactive environment

The traditional teaching of anatomy experiment is mostly single-direction teaching, which refers to the student-led learning mode with the teacher as the leading role. Although it can achieve the expected teaching objectives, it is not conducive to the improvement of students' comprehensive practical ability. At the same time, it is difficult for students to construct their own anatomy logic, and the effect is not ideal [3]. To alleviate this problem, it is necessary to change the traditional teaching form, integrate virtual reality technology, and create a stable and safe interactive teaching environment [4]. First, use the computer technology and simulation technology in virtual reality to design virtual anatomical scenes and objects. In order to better present the anatomical environment, a virtual human atlas model can be built, as shown in Figure 1:

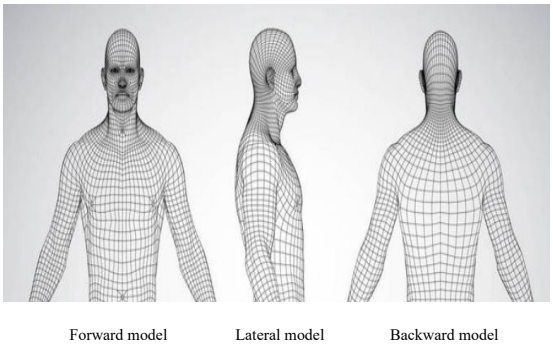

Figure 1: Diagram of virtual anatomical human atlas model

According to Figure 1, the design of the virtual human body map model is completed, and on this basis, the anatomical process is formulated to facilitate students' later practice and communication [5]. At the same time, in the virtual control program, it is also necessary to add three-dimensional induction and recognition devices and three-dimensional image display and feedback devices. In the process of practice, students can correct the processing of errors in time to avoid interactive teaching errors. It should be noted that due to the limited coverage of virtual interactive teaching environment, the control of teaching environment should be strengthened in the teaching process according to the actual situation, so as to establish a positive correlation for subsequent teaching [6].

2.2. Deployment of multi-objective teaching interaction nodes

The single-target interaction node can achieve the expected teaching task in a specific environment, but once a complex teaching task occurs, the selection and adjustment of anatomical objects are relatively inaccurate, which is easy to have a negative impact on students' learning [7]. Utilize the servo processing and simulation technology in virtual reality, first clarify the teaching scope according to the specific teaching needs and standards, set fuzzy points around the applied teaching objects, and ensure the consistent distance between the interactive points. Identify points through the designed human body atlas model, set monitoring nodes, establish contact with the model, and form association overlap. For different anatomical units, design corresponding teaching objectives and adjust the control index parameters of interactive teaching nodes, as shown in Table 1:

Table 1: Control index parameter setting table of teaching interaction node

Virtual node control indicators	Preset standard	Measured standard
Identification time (s)	0.33	0.25
Interaction ratio	1.62	1.35
Perception rate (%)	85.44	93.16
Synergy deviation	1.13	0.96

According to Table 1, complete the setting of interactive teaching node control index parameters. Next, a fixed control and recognition matrix of interactive teaching nodes is constructed by integrating virtual reality technology. With the advantage of virtual reality technology, students can obtain relevant virtual anatomical data and information more quickly and timely, laying a solid foundation for subsequent anatomical learning.

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2.3. Build virtual reality teaching interaction model

The coverage of the interactive teaching form of virtual anatomy is usually large. With the assistance of virtual reality technology, it is necessary to establish a more flexible and changeable teaching model. The above nodes can be used to collect the data and information of anatomical objects, and the master control system can be used to convert the data into data packets and transmit them to the application location. Students wear learning equipment such as sensing helmets, tracking balls and sensing gloves as required to understand human body structure and organs, and learn human anatomy in an immersive environment.

The whole process should be completed by using virtual interactive teaching model. Teachers give corresponding processing instructions according to teaching requirements, and students complete corresponding anatomical tasks according to the instructions, so as to realize multi-dimensional interactive learning. The details are shown in Figure 2 below:

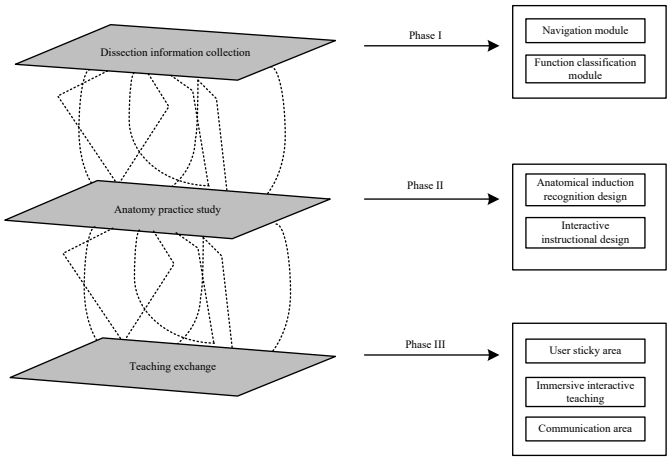

Figure 2: Structure diagram of virtual reality teaching interaction model

According to Figure 2, complete the design and research of the virtual reality interactive teaching model structure. According to the needs and standards of daily teaching, integrate virtual reality technology, and constantly adjust the application model to help students better perceive anatomy, more vividly present the experimental results, and complete the construction of the model.

2.4. 3D servo virtual conversion to realize teaching interactive processing

The so-called 3D servo virtual transformation is a kind of adjustment and correction of anatomy teaching position and scene by using virtual reality technology. First, the correction deviation of virtual transformation is calculated according to the demand and anatomical object, as shown in Formula 1 below:

$$G = (m + j)^2 \times \sum_{i=1} \kappa j - \frac{\Re i}{2} + \Re \kappa^2 \tag{1}$$

In formula 1: G represents virtual conversion correction deviation, m represents preset range, j represents edge range, κ represents virtual interactive unit, $\Re$ represents servo orientation value, and i represents conversion times. According to the calculated virtual conversion correction deviation, construct the correction of 3D servo conversion teaching structure. In the process of virtual anatomy, through servo conversion, the wrong teaching instructions are converted, cleared and re-issued to avoid damage to the anatomy model. At the same time, the application effect of interactive teaching is strengthened and the teaching quality is improved.

3. Method test

This time is mainly about the analysis and research of the actual application effect of immersive interactive method of simulated anatomy experimental teaching based on virtual reality. Considering

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the authenticity and rationality of the final test results, four simulated anatomy experimental teaching courses of D Medical College are selected as the main target objects of the test, and the analysis is carried out by comparison. According to the actual measurement requirements and standards, the final test results are compared and verified. Next, we will integrate virtual reality technology to tackle the basic measurement of the background environment.

3.1. Test preparation

Based on the above design and analysis, virtual reality technology is used to build the corresponding virtual anatomy teaching interactive testing environment. First, a 3D recognition device is set up in a specific environment to recognize and induction the real experimental scene and form a virtual 3D image. The conversion ratio of virtual scenes was set as 1:12. In order to ensure the authenticity and flexibility of anatomy teaching, the teaching interaction level was divided into three stages, each of which needed to set corresponding interactive targets.

On this basis, anatomical objects are set for the selected 4 courses, and relevant data and information are collected by the deployed nodes. At this point, the initial equivalent interaction frequency needs to be calculated, as shown in Formula 2:

$$K = \pi + \sum_{e=1} oe - \frac{\pi e \times \frac{c}{2}}{c + \upsilon^2} + c\pi^2 \tag{2}$$

Formula 2: K represents the equivalent interaction frequency, π represents the controllable interaction range, o represents the conversion deviation, e represents the preset interaction times, c represents the equivalent processing range, and υ represents the peer-to-peer interaction unit. Based on the test results, the interactive model of virtual anatomy experiment teaching is adjusted to lay the foundation for the subsequent test and complete the construction of the test environment.

3.2. Test process and result analysis

Based on the established testing environment and integrated virtual reality technology, specific measurement research was conducted. 100 students were selected for measurement. Under the same anatomical experimental environment, the number of directional interactions between students was determined. The test is divided into three stages, and the measurement is carried out for 4 anatomy courses. In the process, computer technology and simulation technology in virtual display technology are used to assist processing, and the final interaction times are determined, as shown in Formula 3:

$$A = \sum_{Q=1} \phi Q + \frac{dQ}{2} - (\varpi + d)^2 \times \phi Q \tag{3}$$

In formula 3, A represents the number of interactions, ϕ represents the range of interaction areas, Q represents the equivalent interaction frequency, d represents the conversion preset difference, and ϖ represents the virtualization interaction standard value. Under the background of stable equivalent interaction frequency, according to the actual needs, adjust the state of virtual teaching interaction stage, and complete the analysis and research of the test results based on the above calculations, as shown in Figure 3:

According to Figure 3, the analysis and research of the test results are completed: after three stages of measurement, it can be seen that the interaction times of the four anatomical experimental courses are significantly increased with the help of the virtual reality immersion teaching interaction method, which also shows that this method can also exercise students' comprehensive practical ability to a certain extent, and form a circular auxiliary learning tool, which has practical application value.

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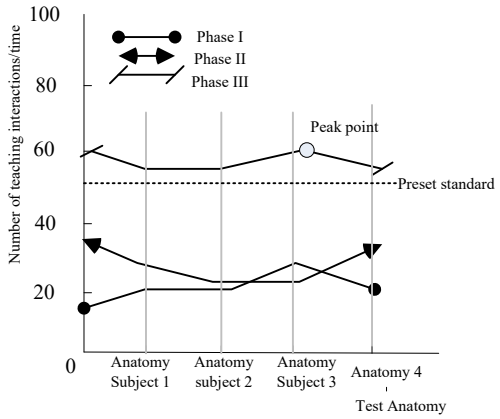

Figure 3: Comparison and analysis of test results

4. Conclusion

In a word, the above is the analysis and research of immersive interactive teaching methods of simulated anatomy experiment based on virtual reality. Compared with the traditional interactive teaching method, the immersive interactive teaching structure constructed by integrating virtual reality technology is relatively more flexible and changeable, and has stronger pertinence and stability. In the process of simulated anatomy experiment, students can form a controllable immersive learning environment by wearing virtual interactive devices, and construct their own anatomy logic. Moreover, multi-dimensional communication with students and teachers in view of their own problems is conducive to the improvement of comprehensive practical ability and has practical teaching significance.

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(2) Supporting project of ideological and political model course of "war epidemic" course in undergraduate colleges and universities of Henan Province (JG [2020] No. 531).

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