Design of Psychology Experiment Teaching System based on CAD Virtual Reality Technology

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Abstract. Computer-aided virtual reality is a research hotspot in recent years. The educational characteristics of computer-aided virtual reality include multi-perception, interactivity, immersion and conception. It is of positive significance to apply computer-aided virtual reality to the design of psychology experimental teaching system. Therefore, in order to improve students' ability of scientific research, practice and innovation and to realize a batch of psychology experimental teaching projects that cannot be done in traditional psychology laboratories, or have high risk and high cost, this paper studies a set of system suitable for psychology experimental teaching based on computer aided virtual reality technology. The research results show that in the process of using virtual reality technology, the school is committed to explore new mode under the background of Internet psychology experiment teaching, the introduction of virtual reality technology characteristic of the experiment teaching content and implement internationalization mode of running school, arouse the enthusiasm of the students' interest in learning and scientific research, and to promote the quality of higher education made beneficial exploration to the cultivation of innovative talents.

Keywords: Computer aided; Virtual reality technology; Teaching system

1 INTRODUCTION

Virtual reality (VR) is a research hotspot in recent years. Since the 1990s, "VR" has entered the stage of comprehensive development and started to shine in various fields, thus gradually moving towards practical application. In recent years, VR technology has been widely applied. VR application in the field of education is not only the need of the development of virtual reality itself, but also the need of the development of education. The characteristics of virtual reality education

can be summarized into four aspects: multi-perception, interactivity, immersion and conception. Yan [1] thinks that the educational application value of VR is that virtual learning classes can be established, and relevant knowledge can be contextualized and visually displayed in front of students, allowing students to experience natural phenomena or the change process of things that cannot be observed in real life with the identity of roles. Students immersed in such virtual reality learning environment, through multi-level perception, get similar to the real experience effect, all-round access to information, active natural knowledge cognition and construction, when immersed in exploration activities, jump, pick fruit, as shown in Figure 1.

Figure 1: Teaching system based on CAD virtual reality technology.

Li and Zhao [2] consider that the application of virtual reality technology in experimental teaching is one of the hotspots in the field of higher education. The key problem of adopting this mode is how to construct a perfect and open teaching resource system, and cover all links in the teaching process through this system, so that students can use modern information technology to learn curriculum content and carry out practical activities. Petra [3] thinks that based on virtual technology now psychology experiment teaching resources, help under the background of Internet explore new models of informatization teaching psychology experiment enriched the contents of the experimental teaching and improve students' ability of scientific research, practice, innovation and a batch of can't do that, in the traditional psychology laboratory or has a high risk and high cost of psychology experiment teaching program.

As a supplement to the experimental teaching of psychology majors in colleges and universities, the psychological experimental teaching system is a kind of software system that carries out psychological experimental project teaching with the help of computers. Zhao and Yang [4] think that it can enable students to complete the programmed operation of various psychological experimental projects more effectively and save teaching time. On the one hand, the birth of psychological experiment teaching system is the result of the progress of computer technology, on the other hand, it is the result of reflecting on the shortcomings of traditional psychological experiment teaching methods. The psychological experiment teaching system is widely used in many colleges and universities in China. However, the design requirements of the psychological experiment teaching system are constantly changing in the actual use process.

From the perspective of historical development, in the 1980s and 1990s, psychological experiment teaching often used a variety of specially made physical equipment to achieve limited experimental process demonstration or operation, such as dark adaptation instrument, sound-light

response time measurement instrument. Thatcher and Soukup [5] think that although this method is very important for the cultivation of hands-on ability, it is insufficient in meeting the efficiency of experimental teaching, expanding experimental teaching objects and making data collection precise. In the first decade of the 21st century, with the widespread use of computers, psychological experiment teaching began to be realized more by computer software system. This kind of psychological experiment teaching system of experiment item generally includes psychological physics experiment, the reaction experiment, perception experiment, memory, attention, the development of psychological experiments, the thought experiment, etc., they can meet the kind of general psychology, the teaching of experimental psychology, cognitive psychology, development and education psychology, engineering psychology, etc.

The early psychological experimental teaching system generally provides services for users through single machine or LAN platform. The installation and operation of the system and automatic data collection or analysis are all in the client. They can improve the efficiency of experimental teaching, meet the needs of large class teaching, and realize the automation and precision of data recording, which are not available in traditional physical devices. However, in the actual psychological experiment teaching, not all experimental items can be transformed into computer programs, such as those involving physiological indicators, eye movement data collection experiments, must use special equipment [6-7]. And overly depend on computer system for psychological experiment teaching, it is easy to make students lose oneself start work design experiment and production of laboratory equipment, prepare the experiment material, and even the opportunity to exercise of data processing for computerized test system includes experiment projects are generally not programmed in advance, students more play a subjects rather than the learners. In addition to experiencing the existing classical experiments and their design, psychological experiment teaching also needs to be student-centered and teach students to independently design new experiments and solve new problems. In order to overcome the above limitations, recent psychological experimental teaching systems begin to attach importance to the connection with peripheral physical devices and emphasize the addition or editing of independent experimental projects [8-10].

2 PRINCIPLES OF TEACHING SYSTEM DESIGN

Education is a complex system engineering, as a complete structure of virtual teaching system design, education is the fundamental attribute, in addition to the knowledge, computer virtual technology characteristics, scientific and artistic aspects must be considered. Therefore, the design of virtual teaching system must follow the following principles.

(1) Design principles guided by advanced educational learning theories. In the educational theory system, learning theory has experienced the evolution and development process from behaviorism to cognitivism, cognitivism to constructivism, and from constructivism to situational cognition and situational learning theory. All these learning theories have guided CAI writing in different periods and become an indispensable and important impetus for the development of CAI.

The essence of this research is educational, and the core is educational innovation. Therefore, the design of virtual teaching system must be guided by educational learning theory, otherwise the design of the system will become a water without a source, a tree without roots, and the system will lack the attribute of education. Through the analysis of educational learning theory, absorbing the beneficial experience of courseware writing and guiding the practice of courseware writing, the design of virtual teaching system can be more consistent with the law of education.

(2) The principles of human-computer interaction interface design. Interactivity is the most valuable application of VR in teaching. For a good virtual teaching system, human-computer interaction design is the key. The multi-sensory, immersive and visionary nature of virtual reality education is to produce effects through effective human-computer interaction. Students' participation, students' "role" playing and students' experience must be supported by interaction.

In the design of virtual teaching system, the principles of interface visualization, consistency, simplicity, ease of use, intuition, controllability and timely response should be considered, and the psychological and emotional needs of students should be fully considered. In order to adapt to the physiological and behavioral characteristics of students, the interaction design of the system is regarded as one of the most important contents of teaching design.

(3) The fourfold principle of virtual reality. The teaching system based on VR enables students to immerse themselves in the virtual teaching system through sensory stimulation, experience realistic situational teaching and actively use their brains and hands to participate in interaction, so as to achieve efficient learning and improve skills.

(4) Function modularization, improve the principle of reuse. The modular design of the system takes into account the individual needs of students and allows students to customize their learning content.

The design of the virtual subject should include: the design of the virtual classroom, the design of the virtual experiment, the design of the functional module of skill training, the design of the virtual situation and the design of the virtual role. The virtual design of classroom scene makes teaching break away from the traditional learning place and breaks through the limitation of time and space. Students can learn freely in the virtual classroom just as immersed in the real classroom, making teaching easy and effective. The design and establishment of virtual laboratory is an efficient and novel experimental way, which can not only avoid the safety risks of the experiment itself, but also save the experimental cost. Students can complete the experimental content anytime and anywhere without worrying about the experimental conditions, environment and time and space restrictions. The immersive and interactive nature of VR allows students to participate in the virtual learning environment as a role to try and experience situational learning activities, which is very conducive to the skill training of students. So that students can be tired of repeated practice, until the master of operational skills. It should be said that the most ideal learning is the learning that takes place in the real situation, but objectively speaking, the learning conditions of the real situation can be encountered but not found. Therefore, virtual design of the situation is a realistic choice. In the virtual teaching system, the creation of highly realistic virtual learning situations similar to the real situation, instead of the description of books or abstract language, so that the teaching process is similar to the real problem-solving process, which is conducive to stimulate students' perception, immersion and conception, so as to make learning happen effectively. Virtual roles support students to become "role players" in learning activities, and the learning process is an activity process in which the role participates. The creation of teaching situation should create a learning community and practice community conducive to the active exploration of "role", and support the construction of social cooperation of knowledge. Role players can experience situational teaching in a virtual situation. They can freely and actively interact with virtual objects and construct meaning through cooperative activities and conversational communication, which accords with the learning concept of constructivism theory.

In the virtual reality technology, based on the article imitation of real time function, show the real features, the students can use like a real operation item within the virtual space data, is not subject to the constraints of time and space and other reality and equipment performance, through the virtual equipment freely in the virtual space development, improve their ability of creativity and imagination.

In teaching, due to the influence of time, space, teaching facilities and other realities, teachers cannot obtain enough rich teaching materials, which greatly limits the play of students' creativity. In the virtual teaching system, the relevant learning materials, such as ancient and modern, Chinese and foreign, astronomy and geography, etc., are laid out and rich resources are established, which can make teachers more proficient in curriculum setting. The students will be rich enough material for links to the collision of knowledge, combine learning, practice, testing and receiving enough wealth of knowledge input, better able to stimulate their inspiration, will expand

the space of thinking, the thinking activity, to cultivate learners' divergent thinking, for the improvement of creativity to lay a good foundation.

The virtual reality teaching system is centered on students' individuality. In the teaching process with individual differentiation, the virtual reality system can provide learning content suitable for different students and conduct individual analysis for students' personalized learning process, and evaluate the learning effect of each student individually. In this way, each student is in an environment conducive to their own learning and growth, enhancing their learning confidence, thus developing a variety of problem-solving ideas, improving their creativity, and realizing the innovation in gestalt learning theory. The index versus item is shown in Figure 2.
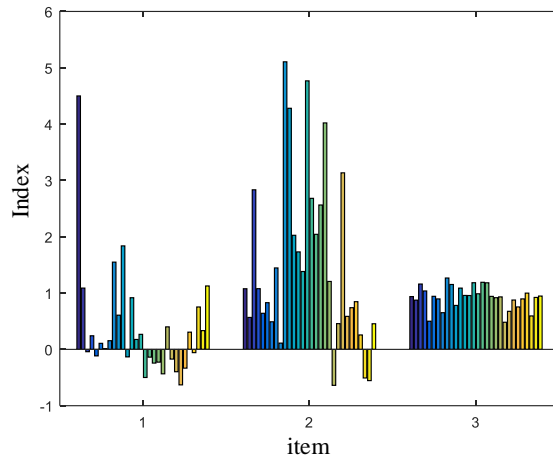

Figure 2: Index versus item.

3   DESIGN OF VIRTUAL PSYCHOLOGICAL EXPERIMENT

Virtual reality teaching technology has the characteristics of two-way interaction is suitable for differentiated and personalized education. Because each student comes from different growth environment, family cultural background, existing knowledge structure and personal characteristics are not the same, so each student's learning interest, learning methods and thinking mode are also very obvious differences. Under the previous traditional education methods and teaching mode, it is basically impossible to make a personalized education plan for each student. However, in the virtual reality teaching system, because "the virtual reality scene has such a man-machine interface that can bring immersion, multidimensional sense and sense of presence, students can use a variety of sensory channels autonomously when interacting with their natural senses in real time", students can based on their own unique characteristics, Through gestures, posture, eye contact, language, expression and other specific interaction method and the virtual reality teaching system of information, interaction, which meet the personalized knowledge and their personal learning and development skills, change of the content of the abstract and dull in traditional education in order to adapt to student learning absorption form, Fully exposed to a customized learning environment, students greatly improve their learning initiative, enhance their understanding and knowledge grasp depth and breadth. The more accurate the knowledge point is, the more comprehensive the knowledge area is, the easier it is to realize the knowledge transfer in gestalt learning theory. The psychological experiment designed in this paper is as follows:

3.1 Boundary Advantage Effect in Spatial Location Learning

In this study, the role of landmarks and boundary cues in location learning was studied using the masking paradigm. Doeller et al. 's study showed that humans processed landmark cues and

boundary cues differently in spatial navigation. The processing of landmark cues (referring to separate small objects) conforms to the behavioral association learning principle, and the processing mechanism is in the dorsal striatum. The processing of boundary cues (extended vertical planes) is consistent with the principle of accidental learning. The processing mechanism is in the hippocampus, and the boundary cues mask the landmark cues. This experiment is a repetition of Doeller et al. 's study, aiming to explore how individuals use spatial cues for spatial positioning. Figure 3 shows the effect of virtual reality effect by the subjects in the experimental project "Boundary dominance effect in Spatial Location Learning", including landmark cues and boundary cues. The teach effect with time shows the validation of the proposed method.
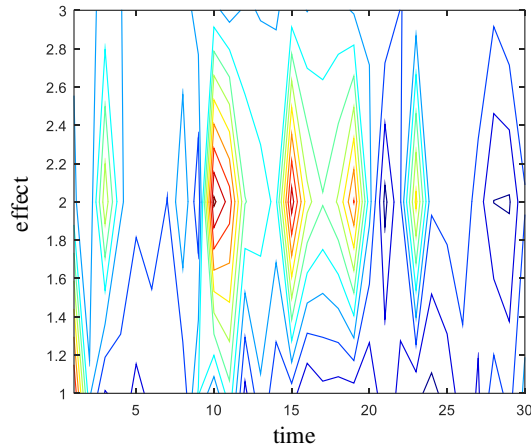
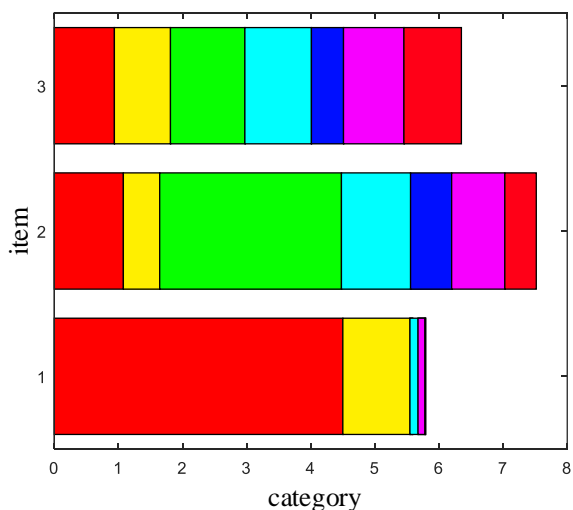**Figure 3:** The teach effect with time.

3.2 The Role of Geometric Cues and Path Integration in Human Spatial Navigation

It mainly studies how individuals use various cues to achieve spatial navigation. In nature, spatial location recognition is very important for all animals (including human beings). After being disoriented in an unfamiliar environment, the observer may need several kinds of cue information, including information in the environment or his own internal sense, i.e., landmarks, geometric cues and path integration, in order to determine his position. The purpose of this experiment is to study how individuals integrate and utilize environmental cues and path integration information in spatial relocation. Figure 4 shows data of the virtual reality processed by the subjects in the experimental project "The role of geometric cues and path integration in human spatial navigation", which includes landmark cues and geometric cues.

3.3 Virtual Psychological Consultation and Treatment Experiment

Application of virtual reality in social anxiety intervention. This paper mainly studies how to apply virtual reality technology in the treatment of social anxiety. Social anxiety refers to the emotional reactions and avoidance behaviors of individuals who have strong anxiety, nervousness or fear about interpersonal situations. In recent years, many foreign studies have applied virtual reality technology to study social phobia. The current technology can set up a variety of different social situations, such as interview situation, party situation, dating situation, meeting room situation, auditorium situation, etc. The purpose of this experiment is to explore the influence of different variables on the anxiety level of the subjects. The role of virtual reality public speaking training in reducing individual social anxiety. This paper mainly explores whether virtual reality scenarios can improve individual social skills, and then reduce individual anxiety in the social process. Social

skills training is one of the social anxiety intervention methods, its theoretical basis is the underlying cause of the individual to certain or a variety of interpersonal situation have intense anxiety or emotional reactions, born of fear and avoidance behavior, because they lack the necessary social skills, if the individuals familiar with the basic social skills, can make the individual's social anxiety level reduced. The purpose of this study was to focus on the impact of three factors of public speaking on anxiety: audience size, audience-speaker gender consistency, and distance between audience and speaker.

Figure 4: The teach effect with time.

It is necessary to add imitative editing or innovative design modules on the basis of demonstrative operation to the psychological experiment teaching system based on virtual reality technology, but they still lack in connection with peripheral experimental instruments. Especially in recent years, the practice of psychological experiment teaching with the help of various physical instruments is no longer limited to the traditional small experimental equipment, such as frame bar instrument, tachometer, mirror drawing instrument, etc., and peripheral equipment such as eye tracker, physiological feedback instrument and electroencephalograph widely used in the subject research also needs more learning. In psychological education system, researchers have been trying to blend in eye movement about experimental teaching program; this program is still not only effectively connects with common eye movement apparatus, the main reason is that the experimental teaching system of eye movement teaching program is still not have eye movement data collection and analysis function, the function by the eye still own software to perform. The requirement of teachers is that when learners operate the eye movement experimental teaching program, the program must be compatible with the software of the eye movement instrument and run synchronally, or directly integrate the acquisition and analysis module of eye movement data in the cloud system. This design idea can also be applied to other devices, such as physiological feedback and electroencephalograph. In recent years, some mobile eye tracker, electroencephalograph and wearable devices that can sense physiological signals or environmental information of human body are increasingly used in psychological research. These "behavioral and environmental information and physiological signals acquired by mobile sensing devices can also be transmitted to data storage servers in real time through the mobile Internet, and they are changing the research objects, ideas and methods of traditional psychology". Mobile phone, tablet, high-speed wireless network, mobile sensing devices and the cloud psychological experiment system using wireless Internet data transmission technology, can form a new type of psychological

experiment teaching chain, makes the traditional psychological experiment teaching can consider more ecological experiment effect, achieve some of the items in the lab was unable to complete the teaching. The processed data is shown in Figure 5.
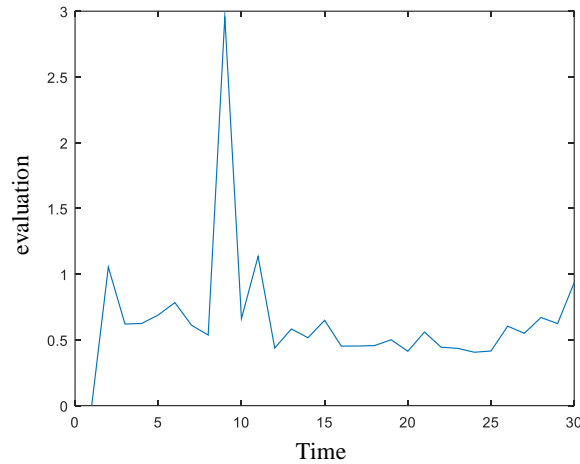

Figure 5: Processed data.

In terms of data collection and analysis, the psychological experiment teaching system based on virtual reality technology still focuses on proving the causal relationship between variables, and the sample size is limited to small samples, which is also the basic feature of traditional psychological experiment. The emergence of network big data analysis technology is a large sample of psychological experiments. First of all, the introduction of online learning resources should be simple and clear, so that learners can clearly judge whether it is suitable for them, so that they will not find it unsuitable on the way to learn and give up halfway. Secondly, the perfect student support service system is an effective factor affecting students' learning attitude. It is suggested to answer questions 24 hours. If 24 hours of Q&A is not available, it is recommended to specify the Q&A time distribution interval. Third, effective reward mechanisms. The reason why many students fail to complete an online course is that they feel that online learning lacks teachers' attention and encouragement, as well as the recognition of emotional communication between teachers and students in traditional courses, which leads to the inhibition of expression of students and causes them to give up learning online courses. Finally, there is external monitoring. Internal monitoring belongs to metacognitive category, learners' self-management and self-restraint belong to internal monitoring. For students with inattention, the reminder function brought by external monitoring provided by the platform is an important factor related to the overall quality of online learning. It is suggested that the platform provide some reminders for courses with long duration. For example, the prompt window "Don't skip!", through similar words or small test activities to relieve the learning fatigue of learners, improve the intentional attention. A text message or other contact information is a good idea when a class starts, resources are updated, and meeting times are available. For learners who can timely check resources and actively answer questions, they can be rewarded with visual numerical methods such as increasing experience value or increasing expressiveness, and they will be rewarded in kind at the end of the term. Th teaching effect is shown in Figure 6 and Figure 7.
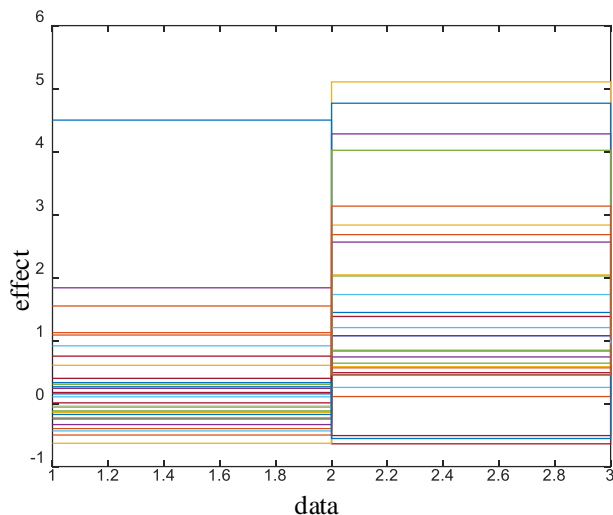
Figure 6: Teaching effect in line plot.
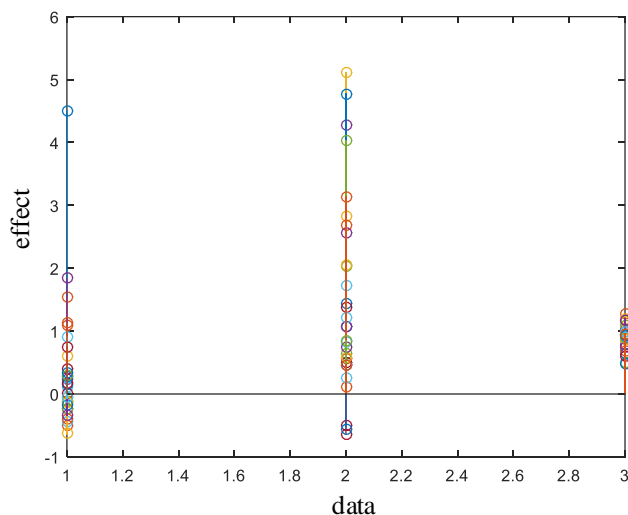
Figure 7: Teaching effect in point plot.

4   CONCLUSION

From the perspective of teaching, the big data provided by the psychological experiment teaching system based on virtual reality technology is not limited to the experimental data of each experimental project, but also provides information about the experimental projects and operation habits of users. In this way, it can help to optimize experimental teaching projects, track the cutting-edge problems of experimental teaching content, and predict the educational effects of using psychological experimental teaching system on learners.

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