



Virtual Reality Technology in the Context of 5G to Improve the Quality of Mental Health Education in Universities

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Abstract. With the vigorous and efficient development of 5G Internet era, virtual reality technology provides a new channel for the innovation of mental health education model in colleges and universities. Based on 5G technology, virtual reality technology is combined with cloud rendering technology, causal brain network, and EEG analysis method to provide virtual reality learning scenes, establish VR deep learning models, and solve the problem of delay in online classes through cloud rendering technology for mental health education in colleges and universities. This makes college mental health education enter a new era, and the teaching quality and management level are significantly improved.

Keywords: Virtual reality technology · mental health education · cloud rendering technology · EEG analysis method · digital modeling

1 Introduction

Students tend to be rational and mature in terms of knowledge, intelligence, and interpersonal skills, but the pressure of the environment and the lack of personal real-life experiences make them psychologically vulnerable, and some studies show that poor psychological quality can cause psychological distress and thus have a negative impact on academic performance and even affect physical condition. In the design of mental health education courses for college students, there is no connection between professional knowledge and students' real-life situations, which leads to low interest of students in learning. The application of virtual reality technology to mental health has been available in foreign countries since 1993, and it has gradually started in China. As "5G + VR" is widely used in mental health education in colleges and universities, it is conducive to improving the teaching quality of mental health education and students' interest in learning.

2 Virtual Reality Technology Based on 5G Era

5G, the fifth generation mobile communication technology, is a new generation of broadband mobile communication technology with high speed, low latency and large connection characteristics, and is a network infrastructure to realize the interconnection of people, machines and things. 5G technology can make VR terminals more miniaturized, lightweight, and wireless through ultra-high-capacity cloud storage and high-speed, stable data transmission, leaving some data and computing tasks to the cloud.

2.1 Virtual Reality Technology

Virtual Reality (VR) is a new technology developed in the 1990s with computer technology at its core. VR systems have three basic characteristics, namely immersion, interactivity and imagination, emphasizing the dominant role of humans and processing information according to human needs. VR allows users to immerse themselves in a computer-generated simulation by building an interface for human interaction environment and interacting with it to create a sense of immersion [1]. Depending on the degree of immersion, virtual reality technologies can be divided into four categories: desktop virtual reality, immersive virtual reality, augmented virtual reality, and distributed virtual reality [2]. The static 3D digital modeling method is used to complete the goal of constructing 3D virtual reality models for running scenes, which can be used to complete the 3D outline of psychological scenarios as a whole through the arrangement of various realistic scenes and improve the authenticity of 3D model construction. The data interface is reserved on the model, which can realize the task of information data interaction between historical database and real-time database, and ensure that the staff can make effective monitoring of student psychological index parameters and state data, etc. As in Fig. 1. The use of virtual reality means has been able to achieve psychological scenario experiments, in this premise through the simulation to obtain a high degree of accuracy of the scene effect. For example, with certain models checked, it is possible to arrange the scenes on specific model positions, so as to fully coordinate the mutual position of scenes and characters.

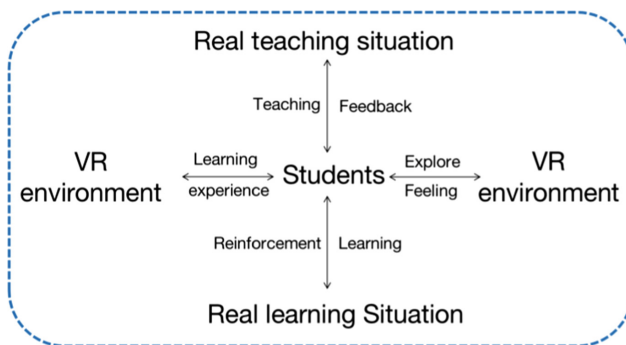


Fig. 1. VR scenario of students learning interaction in virtual and real situations

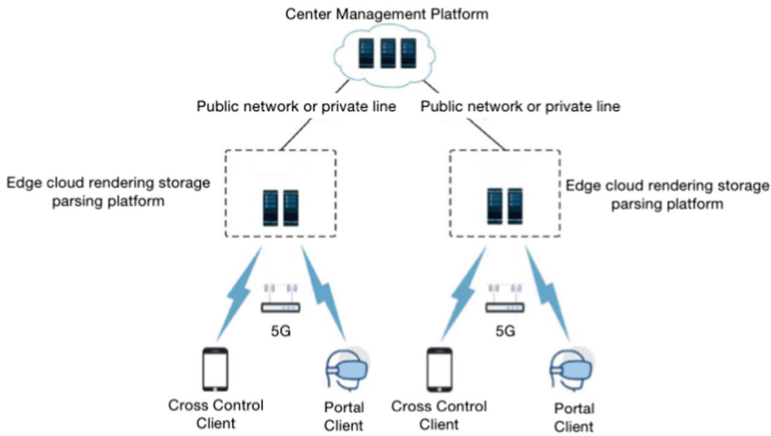


Fig. 2. Model architecture diagram

2.2 VR Technology Based on Cloud Rendering Technology

The performance of cloud computing on the rendering field is called cloud rendering technology, which means that the application that performs the rendering task is run on the cloud server, and the process of splitting one or more rendering tasks into several parts and putting them into the simultaneous rendering of each rendering node using the high-performance computing power and graphics rendering capability of the cloud server, cloud rendering technology can shorten the production cycle and improve the overall efficiency. On the basis of 5G network, the cloud rendering technology is migrated to the edge end near the user end, so that the data does not need to be transmitted to the cloud for processing, but only needs to be calculated and rendered at the edge end and then transmitted back to the user end, which greatly reduces the network time delay to a certain extent and effectively solves the problem of video lag and non-fluidity during the VR experience of mental health teaching in colleges and universities, which is conducive to improving teaching quality and teaching experience, as shown in Fig. 2 [3].

2.3 VR Technology Based on Learning Analytics

Learning analytics technology is a kind of big data technology, which is a research object of students and learning environment, and aims to analyze huge amount of educational data to understand potential problems, optimize learning methods, and predict students' progress and performance in learning through modeling. The data underlying the student learning analytics technology model begins with the collection, storage, analysis, and evaluation of student data (including social software, mobile terminals, PLE, LMS, and other data) to predict and adjust student learning behaviors. In addition, intelligent data will be collected, including live scenes, audio-video, teaching interaction behaviors and process evaluation, as shown in Fig. 3. Learning analytics technology combined with VR technology is beneficial to improve the accuracy of mental health teaching [4].

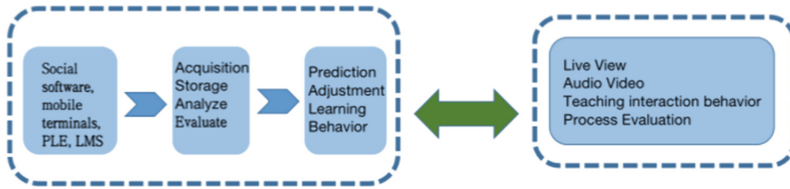


Fig. 3. Student Learning Analytics Technology Model

2.4 VR Technology Combined with Causal Brain Networks

Artificial Intelligence (AI, for short), is a new technical science that studies and develops theories, methods, technologies, and application systems for simulating, extending, and extending human intelligence. AI can be a good way to compensate for deficiencies in VR operations, such as tracking objects, creating detailed models of the 3D world, by understanding the characteristics of these models, and making judgments about them making judgments. The functional areas of the brain for emotional expression are the prefrontal and frontal parts, and the visual functional area of the brain is the occipital area. Since the virtual reality scenes will stimulate emotional changes in the subjects and also for the visual brain function of the brain, the correspondence table of electrodes and cortical areas, placed in the cerebral cortex are left and right symmetrical, according to our above selection finally determined the following six electrodes, as the nodes of the brain network: Fp1, Fp2, F3, F4, O1, O2 correspond to the prefrontal, frontal and occipital regions, the results of the final selection of the brain network regions of interest, as shown in Fig. 4.

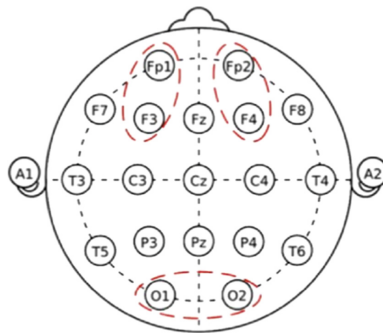


Fig. 4. Neuronal structure diagram

2.5 VR Technology and EEG Analysis Methods

In the scenario of using virtual reality technology, EEG analysis was used to further observe students' EEG in depth to analyze the psychological condition of college students and to examine the effectiveness of VR technology.

1) Establishing Granger Causality.

According to Granger causality, X and Y vary according to time, and the association between the two is judged by this. Hypothesis 1: There is no Granger causality between X and Y. Then an autoregressive model is established for X and Y as follows.

$$X_t = \sum_{(i=1)}^p A_i X_{(t-i)} + CZ_t + \varepsilon_t$$

$$Y_t = \sum_{(i=1)}^p B_i Y_{(t-i)} + C'Z_t + \varepsilon'_t$$

where p is the regression order of the autoregressive model, A_i and B_i are the autoregressive coefficients of X and Y variables, respectively, Z_t is the exogenous variable, and ε_t and ε'_t are the residuals. Hypothesis 2: There is Granger causality between X and Y. Then, a joint regression model of X and Y is established as follows.

$$X_t = \sum_{(i=1)}^p A_i X_{(t-i)} + \sum_{(i=1)}^p B'_i Y_{(t-1)} + CZ_t + \mu_t$$

$$Y_t = \sum_{(i=1)}^p A'_i X_{(t-i)} + \sum_{(i=1)}^p B_i Y_{(t-1)} + C'Z_t + \mu'_t$$

where p is the regression order of the joint regression model, A_i and B_i are the joint regression coefficients of the X and Y variables, respectively, and μ_i and μ'_i are the residuals. In both regression models, when either A_i and B_i is zero, it means that there is no establishment of Granger causality between X and Y variables, and the VR scenario can be examined for its application to students' mental health by this model.

2) Multi-channel Granger Causality.

In real life, the influence on variables may be multifaceted more than two channels, and the same difficulty of the influence of virtual reality technology on students' psychology comes from multiple sources, so a multi-channel regression model is needed. The following equation establishes a Granger causality regression model with n channels [5].

$$Y_{1t} = \sum_{(i=1)}^p A_{11}^i Y_{1(t-1)} + \cdots + \sum_{(i=q)}^p A_{1n}^i Y_{n(t-1)} + C_1 Z_t + \varepsilon_t$$

$$Y_{nt} = \sum_{(i=1)}^p A_{n1}^i Y_{1(t-1)} + \cdots + \sum_{(i=q)}^p A_{nm}^i Y_{n(t-1)} + C_n Z_t + \varepsilon_t$$

Y_1 - Y_n represent the n-channel data, A_{11} - A_{nn} represent the autoregressive coefficients, A_{i12} represent the Granger causality coefficient of Y_2 on Y_1 , A_{i1n} represent the Granger causality coefficient of Y_n on Y_1 , and A_{in1} represent the Granger causality coefficient of Y_1 on Y_n . The model is used to determine whether there is a causal relationship between the variables based on whether the Granger causality coefficients are zero, and to examine the application of VR scenarios to students' mental health.

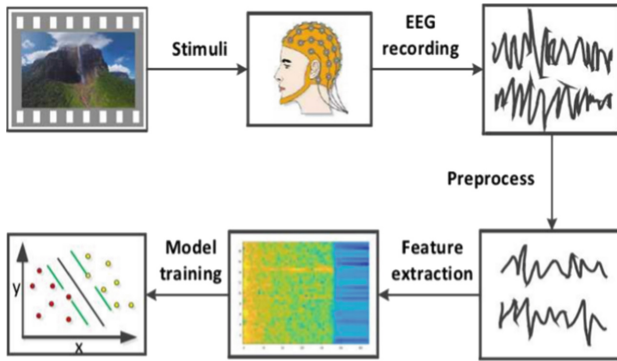


Fig. 5. Processing flow chart

3 The Application of VR Technology in Mental Health Education in Colleges and Universities

3.1 VR Integrated with Mental Health Classroom Teaching

Mental health classes for college students are a critical part of mental health education. In psychology classes, it is now common for teachers to use images, videos and other materials to depict complex psychological problems or phenomena on the screen and convey them to students as intuitive and stimulating feelings with the aim of enhancing their emotional experiences. Flat and dynamic information delivery methods can be good for attracting students' attention, but they do not enable students to have a deeper emotional experience because they receive indirect information.[6] Virtual reality technology can enable direct emotional experiences as well as virtual processes that realize the activity of psychological cognitive abilities, deepen the understanding of three-dimensional structures by constantly manipulating objects and changing the way they are presented, thus facilitating the perception and understanding of psychological issues. Virtual reality technology not only visualizes and three-dimensionalizes the process of mental cognitive activity, but also ensures that students actively interact with the cognitive objects, thus increasing their interest in learning.

3.2 Emotion Recognition with Virtual Reality Stimuli

Through the application of VR technology, students in VR scenarios using EEG technology obtained information on neuronal activity in different regions of the brain, using the useful information obtained for pattern recognition and classification, different emotions will activate different brain regions EEG, which is used to determine the emotional changes of students in VR scenarios to further examine the students' psychology, the process is as Fig. 5.

3.3 Granger Causality Calculation

In the VR scenario, after establishing the regression model for the student EEG signals, the Granger causality was calculated through the Granger causality matrix as follows,

RACI MODEL

ROLE \ TASK	Human Resources	Product Manager	Marketing Manager	Quality Control Manager	Logistics Manager
Task1	R	C	C	I	C
Task2	A	R	R	A	I
Task3	R	I	C	I	I
Task4	A	R	C	I	A
Task5	R	C	C	R	I



Legend	
R	Responsible
A	Accountable
C	Consulted
I	Informed

Fig. 6. Raci model

according to whether the value of each element inside the array is greater than 15, and if it is greater than 15, the element will be set to 1, otherwise it will be set to 0. After completing the above processing, the directed causality brain network was constructed, and the causality analysis was used to examine how multiple factors in the VR scenario affect college students' psychological and the mechanism of the effect of multiple factors on college students' psychological and electroencephalographic production was investigated through causality analysis, as Fig. 6. [7].

4 Countermeasures

4.1 Build a Professional Teaching Platform for Mental Health Education

Based on the 5G network, the university builds a professional mental health education teaching network platform, establishes psychological files for each college student, pays attention to college students' mental health in a timely manner, classifies college students' mental health problems for assessment, realizes real-time monitoring of college students' mental health pairs, and conducts timely will health intervention guidance. This is important for creating VR virtual reality scenarios that fit the actual students. Students can use the rich mental health education resources in the online education platform for targeted pre-study and review at any time, so that they can learn the theoretical knowledge of the books and deepen their understanding through case studies to help their own mental health assessment and improvement.

4.2 Building a Virtual Reality Psychological Experience

The theory of Museum Learning is that the museum is a second educational system outside of the school. Compared with classroom lectures, the museum has richer learning freedom, more relaxed learning environment and more flexible time arrangement, which can provide students with a relaxed, free, self-directed and unstructured way of learning.

By creating realistic scenarios, the virtual reality psychological experience hall effectively addresses the requirements of a learning environment that integrates reality and reality in schools. It not only enriches the means of psychological counseling, but also enhances the experience of students and their initiative. In the virtual reality psychological experience center, students can be in the virtual environment, visit, experience, and conduct various psychological behavior training in a real-time interactive way, so that a large number of students can get an immersive feeling. Virtual reality psychological experience museums will gradually become a new form of resources in mental health education [8].

5 Conclusion

With the rapid development of 5G technology and the development of 6G technology, the application of virtual reality technology in the mental health education of college students has a lot of room for development, especially when combined with AI and AR technology, and schools should establish a perfect psychological information technology management system. Teachers should change their teaching concept from “indoctrination” to “interactive” teaching, and the curriculum should pay more attention to creating students’ independent learning environment and effectively extending classroom teaching [9]. Effective use of VR technology for mental health education teaching can guide students to change from “passive learning” in the classroom to “active learning” after class [10], deepen their knowledge and understanding, and contribute to physical and mental health.

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