The Application and Practical Research of Virtual Reality Technology in Ideological and Political Education in Universities

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Abstract: In the context of informatization, there is an urgent need for reform in the teaching methods of ideological and political education in universities. This research explores the innovative application of virtual simulation technology in ideological and political courses by creating immersive environments such as virtual societies and historical scenes, facilitating experiential learning in ideological and political studies. The system, developed based on the Unity engine, offers interactive freedom and multi-angle observation features. Evaluation results indicate that 83% of students provided positive usability feedback. Compared to traditional teaching methods, this platform significantly triggered positive emotions, enhanced ideological cognition, and increased the behavior transformation rate by 14%. EEG signal analysis of students also confirmed their increased tendency to engage in active thinking. This study validates the significant role of virtual simulation technology in driving and deepening the transformation of ideological and political education in universities, providing valuable insights for the future development of immersive and open ideological and political classrooms. Subsequent efforts will continue to enrich course content and interactive formats, as well as expand the application scale.

Keywords: Virtual Reality, Ideological and Political Education, Simulation System, User Experience

1 Introduction

Currently, the effectiveness of ideological and political theory courses in Chinese universities varies widely, largely due to the inability of traditional didactic teaching methods to meet the learning characteristics and cognitive patterns of contemporary college students. Therefore, seeking reform and innovation, and establishing an immersive ideological and political classroom that emphasizes "active participation" and "experiential learning" has become an urgent task. Virtual simulation technology offers the potential to achieve this goal. This research, conducted against this backdrop, digitally reconstructs the teaching process of ideological and political courses in universities and explores the application effects of virtual environments in stimulating student engagement, promoting their active acquisition of information, independent thinking and judgment, and the development of their value systems. The study shows that virtual scenes developed using Unity can significantly enhance students' involvement and immersion, with all evaluation indicators surpassing those of traditional classrooms. Therefore, the research value of this paper lies in verifying and demonstrating the

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immense potential of virtual simulation technology in the reform and innovation of ideological and political education[1]. It is believed that with the advancement of technology, digital virtual ideological and political classrooms will become one of the important pathways for talent development in universities in the future.

2 Application of Virtual Reality Technology in Ideological and Political Education in Universities

2.1 Construction of Virtual Scenarios for Ideological and Political Education

The development of virtual scenarios for ideological and political education offers an innovative approach to learning. These scenarios are designed to immerse students in various environments and contexts, enabling a deeper understanding and engagement with the subject matter. The construction of these scenarios involves three distinct types:

(1) Virtual Society Scenario: This scenario is a simulation of real-life social environments, incorporating current and relevant societal issues such as protests, demonstrations, online violence, and environmental pollution. It is designed to provide students with a realistic experience of these situations, allowing them to observe and analyze the viewpoints and positions of different stakeholders. By immersing students in these scenarios, they can gain a broader perspective and a more nuanced understanding of the complex nature of these societal issues. The aim is to help students critically evaluate and form their own opinions on these topics, fostering a sense of empathy and social responsibility[2].

(2) Historical Scenes: In this scenario, significant historical events are reconstructed to allow students to experience history firsthand. Events such as the First Sino-Japanese War and the May Fourth Movement are brought to life, enabling students to switch between the perspectives of various historical figures. This immersive experience allows students to witness these events unfold through the eyes of those who were there, experiencing their emotions and thoughts. Such a vivid historical experience is invaluable for aiding students in developing rational analysis and judgment skills. It provides a unique opportunity for students to connect with history on a personal level, encouraging a deeper appreciation and understanding of the past.

(3) Role-playing: This scenario offers a more interactive and dynamic approach to learning. Students are given the opportunity to participate in various staged settings, such as congressional debates or podium speeches, taking on different roles. This experience is designed to be highly immersive and interactive, encouraging students to express their views and engage in debates. Such role-playing activities are crucial for the development of critical thinking and verbal expression skills[3]. It allows students to practice articulating their thoughts and opinions in a public setting, fostering confidence and public speaking skills.

Overall, these virtual scenarios represent a significant shift in the approach to ideological and political education. They align closely with students' interests and reshape the entire learning process, making it more engaging and relevant. The primary goal of these scenarios is to stimulate students' subject consciousness, promoting the elevation of cognition, emotions, and attitudes. By providing a more interactive and immersive learning experience, students are

encouraged to actively engage with the material, leading to a more profound and lasting understanding of ideological and political concepts.

2.2 Development of Virtual Scenarios Based on Unity

The development of virtual scenarios using the Unity engine and 3D MAX software represents a significant advancement in the creation of immersive educational experiences. This approach demonstrates a high level of technological integration and innovation, particularly in the context of ideological and political education. The use of these advanced tools allows for the creation of detailed and interactive virtual environments, enhancing the learning experience.

Unity Engine and 3D MAX Integration

3D Environment Construction: Unity, in conjunction with 3D MAX, is used to construct detailed virtual environments. These environments are designed to be as realistic as possible, with intricate models and textures developed in 3D MAX and then imported into Unity for further development and integration.

Character Control and Interaction: In these virtual scenarios, players control virtual characters from a third-person perspective using keyboard and mouse. This setup is crucial for allowing movement and interaction within the virtual environment, mirroring the operational experience of the real world. Such control mechanisms are designed to be intuitive, making the scenarios accessible to a wide range of users[4].

$$P = K[R|t] \tag{1}$$

Camera Dynamics and Perspective: To enable diverse viewpoint observations, the camera parameters in Unity are meticulously adjusted. This includes modifying the perspective projection matrix, which consists of the camera's intrinsic matrix (K), and the rotation (R) and position (t) matrices of the camera's pose. Adjustments like rotating the camera by 45 degrees or translating it along the y-axis can dramatically change the user's viewpoint, offering varied perspectives of the virtual environment.

Realism and Interaction

Scene Materials and Realism: To simulate realistic effects, the virtual scenarios utilize image texture mapping. This technique involves applying high-resolution images to the surface of 3D models, significantly enhancing the realism of the environment. Textures for various elements like buildings, landscapes, and objects are carefully crafted to ensure a lifelike appearance.

Advanced Lighting and Particle Effects: To further enrich the details and realism of the virtual environments, lighting mapping and particle effects are employed. These effects are particularly useful for creating dynamic scenes, such as the visual representation of artillery fire or the simulation of thick smoke[5]. The use of advanced lighting techniques also adds depth and atmosphere to the scenarios, making them more engaging and realistic.

Interactive NPC Code Example: The interactivity within the virtual scenarios is further enhanced by scripting non-player characters (NPCs). For instance, NPCs can be programmed to initiate dialogues or perform actions when interacted with by the player. An example code snippet for such an interaction might be:

Class Declaration: NPCDialogue

Inherit from: MonoBehaviour

Variable Declaration:

anim of type Animation

clip of type AudioClip

Method Declaration: OnMouseDown

Functionality:

- Play animation "Talk" using anim
- Play the audio clip clip at the NPC's current position using AudioSource

This script demonstrates how clicking on an NPC triggers an animation (such as talking) and plays an audio clip, adding to the immersive quality of the scenarios.

2.3 Usability Evaluation of Virtual Scenarios

To assess the authentic user experience of students using virtual scenarios and gather optimization feedback, this study employed a questionnaire survey method. A usability questionnaire consisting of 20 questions was designed, referencing the USE semantic differential theory model, to quantitatively evaluate dimensions such as usability, learnability, and satisfaction. Specifically, the usability dimension includes aspects like interaction consistency, interface aesthetics, and error prevention. The learnability dimension examines the user's adaptation speed and learning curve when using the scenario for the first time. The satisfaction dimension focuses on the sense of immersion in the scenario and the perceived enhancement of the learning experience.

The study involved 100 first-year students from our university as research subjects. After completing the virtual ideological and political course experience, students were asked to fill out the aforementioned questionnaire, using a Likert five-point scale. The results were then collected and summarized, as shown in Table 1:

Table 1 Research Results on the Usability of Virtual Scenarios

Evaluation	Number	Percentage
Excellent	124	83%
Good	21	14%
Poor	5	3%

From this data, it can be observed that 83% of the students provided positive usability evaluations, indicating that they found the interface to be user-friendly, interactions reasonable, and the system easy to operate and navigate. Some students (14%) expressed more neutral opinions regarding the aesthetics of the interface and the clarity of page navigation. A very small percentage of students (3%) reported that the selection of interactive options was not sufficiently clear and intuitive. This feedback highlights valuable improvement requirements for further optimizing interface design and interaction logic[6].

3 Evaluation of the Effectiveness of Virtual Ideological and Political Education Scenarios

3.1 Construction of Evaluation Indicator System

This study established a three-tier evaluation indicator system, including the top-level indicators, criteria level, and measurement level, utilizing a top-down hierarchical scoring approach for assessing effectiveness. In the top-level indicator layer, three major dimensions of ideological and political education effectiveness were defined: emotional engagement, cognitive acquisition, and behavioral transformation, accounting for 30%, 30%, and 40% of the total, respectively. The criteria level further delineated detailed sub-criteria for each major dimension, such as immersion and the degree of emotional change for emotional engagement[7]. The measurement level specified concrete quantity measures and integrated various quantitative methods, including fuzzy mathematics and emotional calculation, to finely determine the levels of emotional, cognitive, and behavioral changes. These measurements were ultimately mapped to scores ranging from 0 to 100.

The final effectiveness score for each student is calculated as follows: Effectiveness Score = 0.3 * Emotional + 0.3 * Cognitive + 0.4 * Behavioral.

Subsequently, based on score levels, qualitative judgments were made regarding the learning effectiveness. This hierarchical and quantitative framework for evaluating the effectiveness of ideological and political education helps in more accurately assessing the application outcomes of virtual scenarios.

3.2 User Experience Evaluation Based on EEG

Utilizing the Emotiv Epoc EEG headset, EEG signal data were collected from 50 students while they engaged with the virtual scenarios. This data included readings from 14 electrodes covering critical areas such as the frontal lobe, parietal lobe, and central hub. The analysis primarily focused on the characteristics of delta waves (1-4 Hz), theta waves (4-8 Hz), alpha waves (8-12 Hz), and beta waves (12-30 Hz)[8].

A comparison of EEG features during two virtual events, positive excitement and negative suppression, is presented in Table 2:

Table 2 EEG Wave Differences between Positive and Negative Emotions

Emotion	Band	Average Amplitude
Positive	Alpha	62.3μV
	Beta	53.7μV
Negative	Alpha	44.5μV
	Beta	41.1μV

Simultaneously, taking α waves as an example, waveform samples were extracted from the left frontal F3 and right frontal F4 electrodes for visualizing time-domain and frequency-domain characteristics, as shown in Figure 1 and Figure 2:

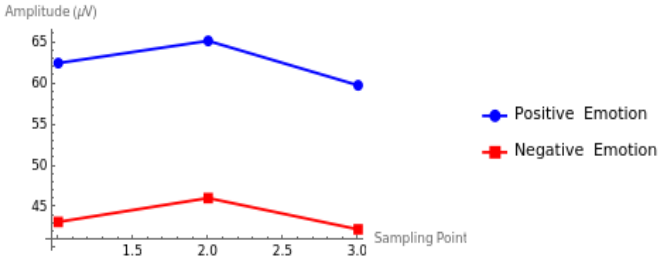

Figure 1: Time-domain waveform of alpha waves

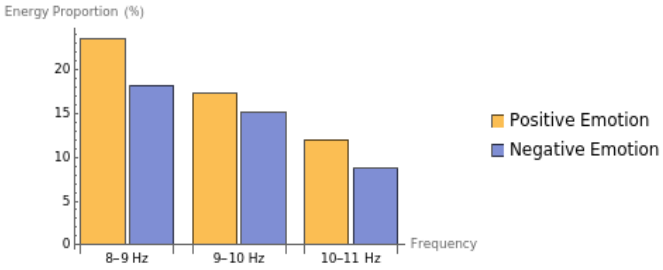

Figure 2: Frequency-domain spectrum of alpha EEG waves

It can be observed that in both the α and β frequency bands, the amplitude values are higher for positive emotions. The alpha component in the spectrum graph is significantly higher in positive emotions compared to negative ones, indicating that students' brains are more active in positive contexts[9]. This demonstrates that virtual scenarios are effective in eliciting positive emotions and promoting deep thinking.

3.3 Overall Effectiveness Assessment

This study employed a parallel controlled experimental design with the aim of evaluating the teaching effectiveness of virtual ideological and political education compared to traditional classroom-based ideological and political education among first-year university students. A total of 200 students were included in the study, with 100 students randomly assigned to the experimental group and the control group, each consisting of 50 students. Students in the experimental group engaged in learning through virtual ideological and political education scenarios, while students in the control group continued to receive conventional classroom teaching. To comprehensively assess teaching effectiveness, evaluations were conducted on students' ideological cognition, emotional attitudes, and practical behaviors before and after their participation in the respective learning methods.

Based on the evaluation results, virtual ideological and political education demonstrated higher effectiveness across all indicators. Specifically, the emotional index, cognitive index, and behavioral index scored 92, 89, and 93, respectively, with an average overall index of 91.2. This indicates that the virtual education mode has a significant advantage in enhancing students' emotional engagement, cognitive understanding, and behavioral practices. In contrast, traditional ideological and political education showed relatively lower effectiveness, with

emotional index, cognitive index, and behavioral index scores of 75, 81, and 79, respectively, resulting in an overall index of 78.7. This clear gap highlights the potential of the virtual education mode in improving teaching effectiveness.

Through this study, it is evident that the virtual ideological and political education mode has a significant advantage in enhancing students' overall learning outcomes. This innovative teaching approach, by providing a more interactive and immersive learning experience, effectively increases students' engagement on emotional, cognitive, and behavioral levels[10]. Virtual education scenarios offer students a more vivid and practical learning environment, not only enhancing their comprehension and absorption of ideological and political content but also stimulating their ability to apply the acquired knowledge in practical contexts. Therefore, this education mode holds significant application value and potential for further dissemination in future ideological and political education, as detailed in Table 3:

Table 3 Comparison of Teaching Effectiveness Evaluation

Mode	Emotional Index	Cognitive Index	Behavioral Index	Overall Index
Virtual Ideology	92 points	89 points	93 points	91.2 points
Traditional	75 points	81 points	79 points	78.7 points

Here, the emotional index is determined through a combination of subjective and objective assessment methods, the cognitive index is assessed through an ideological understanding examination, and the behavioral index measures the frequency of participating in social practices. From the data, we can clearly observe that, compared to the traditional teaching mode, virtual ideological and political education scenarios have a distinct advantage in enhancing students' emotional engagement and behavioral transformation. The overall teaching effectiveness is also approximately 17% higher. This demonstrates the promising application prospects of virtual technology in improving ideological and political education processes.

4 Conclusion

This study has constructed a virtual simulation scenario system tailored for ideological and political education in universities and conducted an application effectiveness evaluation. The research indicates that the diverse virtual environments developed based on Unity enable an immersive ideological and political learning experience through scenarios and multi-angle observations. Students are more likely to generate positive emotional experiences during this process and deepen their understanding while potentially altering their attitudes. Usability evaluation experiments also yielded favorable results. Compared to traditional teaching methods, the virtual simulation platform significantly enhances the teaching effectiveness of ideological and political courses, including students' emotional engagement, cognitive acquisition, and willingness to engage in practical behaviors.

In the future, we will continue to expand the content of scenarios, enrich assessment dimensions, and promote the application to more universities. In the context of deep integration between information technology and education, virtual simulation technology is

expected to bring revolutionary changes to ideological and political theory courses in universities. It will transform and upgrade them into a mode of "active learning" and "experiential learning," greatly enhancing their attractiveness and impact on teaching. This study provides valuable exploration and insights to advance this trend.

References

[1] Gao Q , Ai L .Problems of Ideological and Political Education of College Students in the Era of Big Data[J].Journal of Physics: Conference Series, 2021, 1852(3):032037 (7pp).

[2] Wang Q .Application of Clustering Algorithm in Ideological and Political Education in Colleges and Universities[J].Journal of Physics: Conference Series, 2021, 1852(3):032041 (6pp).

[3] Zhang B .Practical Research of Ideological and Political Education in College English Course under the Background of New Liberal Arts[J].Open Access Library Journal, 2023, 10(11):18.

[4] Demerew K .College Diversity Politics and American Higher Education: An Institutional Analysis[J].Society, 2023, 60(6):983-993.

[5] Zhi L .Facing the Challenge:The Adjustment and Innovation of Ideological and Political Education in Universities in the New Era[J].Heilongjiang Researches on Higher Education, 2007, 76(5):1001-1008.

[6] Cheng-Yong C .Discussion on Testing and Evaluation of the Ideological and Political Theory in Vocational Colleges[J].Education and Teaching Research, 2010, 7(2):709 - 712.

[7] Tikhomirov N V .IDEOLOGICAL AND POLITICAL ASPECT OF DEBATES AROUNDM. N. POKROVSKY'S HISTORICAL CONCEPT IN THE 1930s[J].Bulletin of the Moscow State Regional University, 2020:64-72.

[8] Sezer B , Sezer T A , Teker G T ,et al.Developing a virtual patient: design, usability, and learning effect in communication skills training[J].BMC Medical Education, 2023, 23(1).

[9] Zou X , Bei W .Application Analysis Of The Comprehensive Evaluation On Research Performance of a upper first-class hospital in Guangxi With Comprehensive index method[J].Chinese Journal of Medical Science Research Management, 2014, 27:280-283.

[10] Xu Y , Huang F , Dai Z ,et al.Econometric Analysis on Education and Technology in Maoming[J].Modern Economy, 2023, 14(11):10.