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Path Analysis of Unity3D Virtual Reality Technology to Enhance the Effect of Ideological and Political Education

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ABSTRACT
In the context of the innovative development of Civic and Political Education in the new era, virtual reality technology provides a new path to break through the traditional teaching mode. This study focuses on the characteristics of virtual reality technology of Unity3D engine, and systematically explores its empowering mechanism and practice path in Civic and Political Education. By deconstructing the three educational characteristics of immersive experience —interactive design and multimodal integration —the study proposes three-dimensional enhancement paths for content reconstruction, method innovation, and emotional identity, revealing the unique value of technology application in the restoration of historical scenes, the simulation of values, and the deepening of subjective participation.

KEYWORDS
Unity3D; Virtual reality technology; Ideological and political education

1 Introduction

At present, ideological and political education, as the main link in the realization of talent cultivation, is faced with the double impact of the impact of the concept of globalization and the transformation of the digital era, and the traditional teaching mode is unable to satisfy the interactive and contextualized learning style of the contemporary youth, and needs to deepen the strength of the education of values and concepts through technological means. At the same time, with the development of VR technology, it has gradually infiltrated teaching and will likely promote a deeper, organic combination of teaching and learning. From the perspective of the development of teaching technology, VR technology has been updated from a technical support for teaching to a cognitive framework [1]. In contrast, early multimedia teaching focused on unidimensional hearing expansion, the new VR technology can synthesize a variety of perceptual channels and spatial narratives, and reshape the base of the knowledge system. However, the digital transformation of ideological and political education also suffers from the need to transform abstract, significant concepts into sensory and concrete experiences. The elimination of the distinction between historical events in time and space, as well as excessive technological thinking, will face the danger of thin thinking and loose values. In short, as virtual reality evolves from a tool to the essence of education, it is necessary to consider in-depth integration with ideological and political education from both technical and value perspectives simultaneously.

2 Immersive experience

The Unity3D engine constructs a virtual educational field with a deep sense of presence through high-precision spatial computation and dynamic environment rendering technology. Its core technology utilises the principle of binocular parallax and six-degree-of-freedom position tracking, enabling learners to produce the illusion of spatial existence across physical space and time. In the application of ideological education, this feature can reconstruct the real situation of historical events, such as the construction of the virtual Long March scene. When the learner climbs over the virtual Jiajin Mountain from the first perspective, the blurring effect of the virtual character's field of vision due to the lack of oxygen is rendered in real time by a post-shader. This multi-sensory, immersive experience transforms the extreme environmental challenges faced by revolutionary martyrs into a perceptible, embodied cognitive expertise [2]. The learner is transformed from a historical spectator to a situational experiencer. In the interaction between physical perception and spatial displacement, the abstract revolutionary spirit is internalised as a deep emotional memory, contributing to a paradigm shift in ideological education from symbolic transmission to subjective construction.

2.1 Interaction design

The interaction architecture of Unity3D relies on the rigid-body dynamics simulation of the physics engine and the decision logic framework of the behavioural tree to build a two-way feedback intelligent education system. The breakthrough lies in transforming the traditional one-way information transfer into a dynamic learning closed loop based on contextual response. For example, the construction of the May 4th Movement virtual scene involves learners picking up a virtual placard through gesture recognition technology. The physics engine calculates air resistance and moment of

inertia in real-time when the placard is waved, and the controller transmits the corresponding force feedback synchronously. When the learner chooses the parade route in front of the virtual Tiananmen Square, the system dynamically generates changes in the military and police defence and the emotional fluctuations of the crowd based on the reinforcement learning algorithm, forming a multi-branch historical deduction path. The non-player character adopts semantic understanding module to drive the growth of dialogue tree, for example, when conversing with the virtual Chen Duxiu, the system parses the semantic focus of the learner's question through the intent recognition engine, and calls the historical literature database to generate a dialectical response in line with the character's stance.

2.2 Multimodal fusion

Unity3D's multimodal fusion technology builds a holographic cognitive delivery system by synergistically mobilizing human sensory channels. In the figurative presentation of Civic and Political Education, the visual channel, with the help of dynamic particle system and real-time shader technology, transforms abstract political concepts into observable spatial forms, for example, the dissemination process of socialist core values is interpreted as a dynamic spectrum of golden light streams intertwined and extended on the virtual map of China. The auditory dimension relies on a three-dimensional sound field reconstruction engine to achieve accurate simulation of sound source positioning in the historical scene restoration: when learners are in the South Lake Red Boat Conference, they can identify the differences in the timbre of the speakers in different seats of the cabin, and the reverberation effect of the distant thunderstorm changes in real time with the interaction outside the window, so that the spatial and temporal depth of the historical scene can be audibly manifested. The haptic feedback mechanism further bridges the boundary between reality and reality, simulating the physical properties of historical objects through programmable force feedback devices: the roughness of paper transmitted by the palm when holding the virtual Communist Manifesto, or the increasing damping coefficient of the trigger when operating the anti-war rifle all constitute the medium for generating muscle memory [3].

3 The path of unity3D VR technology to enhance the effect of civic and political education

3.1 Teaching method path

The core of technology-driven teaching paradigm innovation lies in the construction of a distributed cognitive ecosystem and the deconstruction of the traditional classroom's unidirectional indoctrination structure. In the virtual learning field, knowledge acquisition is reconfigured as a contextualised negotiation of meaning: students digitally intervene in the climate crisis of the 'Community of Human Destiny' and naturally internalise the logic of global governance through multimodal collaboration with transnational teams in solving the urgent task of virtual sea level rise. The role of the teacher is transformed into a cognitive conflict designer, stimulating dialectical thinking through open-ended situations, such as in the 'reform and opening-up decision-making sand table', students need to compare the real-time data flow of the virtual special zone construction with historical image archives, and weigh the environmental costs of investment policies in multiple dimensions [4]. The accuracy of the teaching intervention stems from the behavioural topology analysis of the engine: the system generates a cognitive tendency map by continuously capturing hidden parameters, such as the user's trajectory, object interaction hotspots, and decision-making hesitation times in the virtual scenario, providing a neurobehavioral basis for value guidance.

3.2 Emotional identity path

The deep activation of emotional identity relies on the synergistic effect of the mental simulation mechanism and the transfer of cross-situational experiences. In the Jiao Yulu spirit experience scenario, learners are given the virtual identity of the secretary of the Lankao County Party Committee, and the intermittent vibration of the shovel transmitted to the palm when treating the wind and sand, and the flow of sand particles in the field of view that subsides with the progress of the treatment, jointly induce first-hand experience-type moral emotions. The spatial and temporal extension of the consequences of decision-making strengthens the internalisation of values. When students encounter public opinion crises in the virtual community, their choices to delete or clarify posts trigger real-time fluctuations in the curve of citizens' trustworthiness. The social cohesion light effect derived from positive decision-making constitutes a positive feedback loop in behaviour. At the same time, the crisis response mode formed in the virtual scene will penetrate the judgment framework of real social events through the extractive activation of contextual memory. For example, after completing the virtual rehearsal of 'anti-epidemic material distribution', learners will unconsciously invoke the principle of collective priority in the virtual scenario when facing the problem of resource allocation in reality.

4 Implementation challenges

4.1 Technology application challenges

The introduction of virtual reality technology into the Ideological and Political Education scene faces the dual constraints of technological maturity and adaptability in teaching. There is a physiological tolerance bottleneck at the hardware level, and some users are prone to triggering motion perception disorders during long-term immersion experiences, which leads to the forced downgrading of the hasty march simulation to a slow displacement in the revolutionary history scene, weakening the real sense of oppression in the war environment. Content production is caught in the paradox of high-precision restoration and educational effectiveness: the scanning of architectural timber textures to reproduce the old Zunyi Conference site improves visual realism, but crowds out the development resources that should be used in the logical interaction design of the conference debates, so that the pedagogical value of the key historical decision-making stays at the level of scenario viewing.

4.2 Educational integration challenges

The dilemma of integrating virtual reality with the traditional Civics classroom is a cognitive conflict in the educational paradigm shift. Teachers face digital immigrant identity barriers, and when operating virtual scene editing tools, their traditional teaching experience is challenging to translate into cognitive guidance strategies in three-dimensional space, resulting in the VR session being reduced to a flashy variant of knowledge indoctrination. In addition, the existing evaluation criteria cannot effectively capture students' implicit learning behaviours in the virtual scene, for example, the length of time spent flipping through the virtual copy of the Communist Manifesto may be interest-driven, or it may reveal the interface operation barriers; the silent participation in the group collaboration to solve the climate crisis may be either in-depth thinking or cognitively disjointed. This assessment blind spot further disrupts the closed loop of instructional design. When students return to the real classroom from the Lankao Sand Rule VR scene, teachers often lack the tools to transform their in-person experience into a theoretical framework, leaving the virtual experience as a fragmented island of teaching and learning. This ultimately results in a significant disparity between technological input and educational output.

4.3 Ethical cognitive challenges

The ethical dilemmas triggered by virtual reality, as well as Ideological and Political Education, focus on the ambiguous zone of value-guided boundaries and cognitive safety mechanisms. In simulating historical events, a dilemma arises between the degree of historical accuracy and the educational goal. If the complete presentation of war's bloody scenes may trigger psychological trauma, then excessive sanitization weakens the profundity of historical materialism education. In addition, when students repeatedly 'participate' in the May 4th demonstration in the VR environment without having to bear the real consequences, it may weaken the sense of reverence for the real social movement. At the same time, users in open scenarios may intentionally engage in destructive behaviours. Although the system can technically prohibit such behaviours, it cannot solve the original problem of distorted value perceptions.

5 Response strategies

5.1 Technology optimization strategies

In response to the challenges of technology application, it is necessary to build a lightweight and sustainable VR education technology ecosystem. Reduce terminal hardware dependence through WebVR and cloud rendering technology, allowing ordinary mobile devices to run basic teaching scenes smoothly and easing the pressure of equipment procurement. Adopting a modular development framework, the Civic and Political Education Scenario is disassembled into reusable, standardized components (e. g., historical character model library, event interaction templates), which support teachers in quickly combining and generating personalized content according to curriculum needs, thereby reducing the development threshold. Establish an open-source resource-sharing platform and encourage universities to jointly build a red culture digital asset library to prevent the waste of resources caused by repeated development. A forward-looking technology-compatible design needs to be incorporated into the development specification. The core of technology optimization lies in balancing performance and cost, and building an open and flexible technical support system to provide sustainable power for VR of ideological education.

5.2 Educational collaboration strategy

To address the educational integration dilemma, it is essential to establish an interdisciplinary collaboration mechanism and a progressive transformation pathway. Set up a composite curriculum development team of 'ideology

and politics experts + educational technology team + history scholars' to ensure the organic unity of the virtual scene between political orientation, historiographical accuracy, and technical performance. Implement a tiered training program for teachers' technological empowerment. The basic tier focuses on mastering the operation of VR teaching equipment and utilizing ready-made resources. The advanced tier learns to use modular content editing tools, and the expert tier participates in interdisciplinary curriculum design. Reconstructing the teaching evaluation system, integrating process behavioural data (e.g., decision paths, frequency of interaction) with summative cognitive tests, and developing machine learning-based emotion-attitude analysis models to capture the trajectory of students' value changes in virtual environments. Implement the mixed teaching mode of 'VR assistance + traditional classroom', and utilize virtual practice as an extension of theoretical teaching. For example, after teaching Marxist philosophy, observe the process of surplus value generation through a virtual factory scene, and then return to the classroom for a dialectical discussion.

5.3 Ethical safeguard strategy

The prevention and control of ethical risks require the construction of a safeguard system that includes content review, process guidance, and data security. Set up an interdisciplinary ethical review committee, formulate the 'Ideological and Political Education VR Content Development Specification', and conduct a double audit on the degree of historical scene restoration, the presentation of values, and the boundaries of technology application. In the teaching design, it is mandatory to embed a mechanism for connecting virtual and real cognition: after each VR teaching unit, a reality reflection session is set up to guide students to compare the differences between virtual decision-making and real situations, for example, after completing the virtual practice of 'poverty alleviation', field research is organized to verify theoretical cognition. In terms of data security, a de-identified behavioral data storage scheme is established. Sensitive information, such as eye movements and physiological signals, is encrypted, and the data is strictly limited to use only for the analysis of teaching effects. Develop an intelligent intervention system for value guidance that automatically triggers NPC-guided dialogues or typical case studies when students' decisions deviate from the mainstream ideology, thereby avoiding the solidification of cognitive biases.

6 Conclusion

This study systematically demonstrates the innovative value and practical applications of Unity3D virtual reality technology, empowering Civic and Political Education, and revealing the deep coupling mechanism between its technical characteristics and educational goals. By reconstructing the cognitive scene through immersive experiences, activating subject participation through interactive design, and strengthening emotional resonance through multimodal fusion, VR technology provides a new paradigm for overcoming the time-space limitations and cognitive gaps of traditional Ideological and Political Education. At the same time, the application of technology faces three key challenges: hardware cost, educational adaptation, and ethical risk. The key to overcoming these challenges lies in constructing a synergistic development system of 'lightweight technology, mixed teaching and institutionalized ethics'.

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