Exploration of Strategies to Stimulate Student Interest in University General Courses Using VR Technology

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Abstract. With the development of information technology, the limitations of traditional university general courses have become evident, such as low student engagement. However, the immersive and interactive advantages of VR technology offer a promising solution to these challenges. This study intends to first review the current teaching situation and problems of university public courses, then deeply analyze the advantages and potential of applying VR technology to public courses. After that, combined with teaching objectives and content, it will explore specific strategies for integrating VR technology into public courses to stimulate students' interest. Research demonstrates that VR technology can enhance student engagement and interest in general courses, improve knowledge retention, and cater to individual learning needs through personalized interactive scenarios. However, challenges such as high costs, poor adaptability, and insufficient teacher training hinder its widespread application, requiring collaborative efforts from multiple stakeholders.

1 Introduction

1.1 Research background

In today's rapidly advancing information technology landscape, traditional university general courses suffer from monotonous teaching methods and dull content, leading to insufficient student interest and low engagement. VR technology, with its immersive and interactive advantages, can break this dilemma. Many universities have already experimented with integrating VR technology into public courses to stimulate student enthusiasm and improve teaching efficiency. However, strategies for leveraging VR to stimulate interest in university public courses remain unclear and urgently require systematic research.

1.2 Review

In recent years, VR technology has emerged as a prominent research focus in educational technology due to its immersive and interactive capabilities. Studies indicate that VR can

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simulate the original historical contexts of knowledge creation, constructing a dynamic virtual world where students gain full sensory engagement akin to real-world experiences, thereby significantly enhancing classroom participation [1]. For example, in specific disciplinary applications, VR technology provides new avenues for science education such as meteorology, geophysics, and geology [2]. Furthermore, VR's contextualized learning environments can transcend the temporal and spatial limitations of traditional classrooms. For example, Tan et al. proposed using VR technology to enhance practical training in engineering disciplines [3]. Despite its immense potential, VR technology still faces numerous challenges in real-world applications. High costs and limited accessibility of equipment are the primary barriers. From a technical standpoint, universal standards remain underdeveloped, and its application scope is constrained, making widespread demand difficult to anticipate [4]. Second, the impact of individual differences among students on learning outcomes cannot be ignored. For example, some students experience interrupted VR sessions due to motion sickness or unfamiliarity with operation, which instead diminishes their learning interest [5]. Furthermore, due to the lack of shared teaching frameworks and systematic analysis of its applications, the potential and limitations of VR in enhancing learning outcomes remain understudied [6].

1.3 Research objectives

Current research highlights two major gaps in VR application studies for university general courses: first, existing interest stimulation mechanisms overly focus on technical attributes, lacking systematic exploration of pedagogical strategy integration (e.g., resource adaptation, activity design). Second, existing studies primarily focus on case experiments and fail to deeply analyze the differentiated needs of various disciplines and student groups. This research aims to construct an integrated "technology-content-pedagogy" framework and explore VR-based interest-stimulating strategies tailored for university public courses through systematic investigation.

2 Research Objects and Research Procedures

2.1 Complexity of VR Technology Diminishes Student Interest

2.1.1 Student Perspective

VR technology, with its immersive and interactive advantages, can instantly capture students' attention and stimulate their desire to explore new knowledge and experiences [7]. However, as a complex emerging technology, VR has some problems in practical applications, making it difficult to sustain students' interest. At the operational level, VR systems have specific operation methods that are quite different from the operation methods of conventional devices and software that students usually come into contact with [4]. When using VR devices for the first time, students require time to adapt to their unique controls. Without prior professional or systematic training, students are prone to encounter operational difficulties and inefficiencies during the learning process. For instance, during VR simulations, students often struggle to master controller operations precisely, leading to incomplete tasks and missed key concepts. These operational challenges can evoke frustration, thereby diminishing enthusiasm for VR-enhanced learning.

2.1.2 Teacher perspective

Teachers' technical proficiency and teaching skills significantly influence student engagement. If teachers lack proficiency in VR technology and adequate training, they may struggle to effectively guide students in using VR devices or explaining related content during lessons. When teachers frequently make operational errors or fail to answer students' questions while instructing them on VR device operations, students will encounter frequent obstacles and difficulties during their learning process. For example, if teachers using VR to recreate historical scenarios in teaching fail to effectively guide students in exploring and learning within the virtual environment, students may lose confidence in this teaching method, leading to a gradual decline in their learning interest.

2.1.3 VR product limitations

Furthermore, most VR products currently on the market have limited scalability, which also to some extent hinders students' enthusiasm for learning. When using VR devices for study, students often desire to make appropriate modifications and adjustments to the content according to their preferences and learning needs. However, most existing VR products lack customizable features, forcing students to passively consume pre-set content. This rigidity in the user experience creates inconvenience during practical use, ultimately dampening students' enthusiasm for actively utilizing VR technology in general courses.

2.2 Discipline-specific adaptability challenges

2.2.1 STEM courses

The applicability of VR technology exhibits marked differentiation due to disciplinary characteristics [8]. In science and engineering public courses, VR technology demonstrates significant strengths. Taking the College Physics Experiment course as an example, traditional physics lab teaching is often constrained by limited equipment availability, insufficient lab space, and material shortages, making it difficult to meet all students' hands-on learning needs. In contrast, VR technology can accurately simulate experimental procedures, offering students diverse virtual scenarios and repeated hands-on opportunities. Students can repeatedly conduct experimental operations in a virtual environment, observe phenomena, and gain profound insights into physical principles, effectively addressing the limitations of traditional lab equipment.

2.2.2 Humanities and social sciences

The application of VR technology in humanities and social sciences courses faces significant challenges. For example, in a university's attempt to use VR to recreate historical events for teaching Outline of Modern Chinese History, students were visually immersed, but due to weak narrative logic in the virtual scenarios, they struggled to form deep emotional connections. This resulted in feedback such as "the scenes were visually impressive but led to limited knowledge retention. Humanities and social sciences courses emphasize the cultivation of students' emotions, values, and critical thinking. Mere scene reconstruction through VR technology struggles to meet teaching requirements, necessitating a deeper exploration of integration points between content and technology.

2.2.3 Interdisciplinary courses

With the advancement of higher education, interdisciplinary general courses like *AI Ethics* have become increasingly vital in university curricula. This course integrates knowledge from computer science, ethics, sociology, and other fields, with multifaceted teaching objectives that require not only technical demonstrations but also critical discussions. The former aims to visually demonstrate AI algorithms and their application scenarios, helping students grasp technical fundamentals. The latter focuses on topics like privacy violations and ethical responsibilities to cultivate students' critical thinking and deep analytical skills. However, mainstream VR tools currently prioritize intense sensory stimulation, leveraging immersive audiovisual environments to engage users—a strategy that excels in VR tourism and gaming but struggles to foster higher-order thinking required for ethical debates. However, when applied to interdisciplinary courses like AI Ethics, VR technology exposes limitations—it struggles to guide students toward in-depth thinking and dialectical analysis, failing to effectively cultivate higher-order thinking. This mismatch between technology and course content leads to significant variations in VR's application outcomes across disciplines: while performing well in fields emphasizing sensory experiences, it falls short in realizing value or achieving desired teaching effects in interdisciplinary contexts.

3 Unique Advantages of VR Technology in Stimulating Student Interest

3.1 Exploratory interest ignited by VR immersive experiences

3.1.1 Sparking students' strong exploratory interest

The immersive nature of VR technology is one of its defining features, setting it apart from traditional teaching methods. VR technology can transcend the temporal and spatial limitations of traditional classrooms, transforming how knowledge is delivered to spark students' curiosity. For instance, in a biology class case study, Xu, Sun, and Deng observed that VR devices provide students with a deeply immersive experience, making them feel as though they are physically present within the learning environment [9].High school biology knowledge often exhibits strong abstractness, such as cell structures, cell division processes, and gene expression mechanisms. In the past, teaching relied on two-dimensional visuals like textbook illustrations and microscopic observation images. While this approach conveys basic knowledge, it lacks vividness and hinders students from developing intuitive and profound understanding. The application of VR technology has transformed this situation by converting abstract biological concepts into vivid 3D virtual scenes, bringing knowledge to life. When students wear VR devices, they feel as though they are immersed in a microscopic cellular world, freely observing internal cell structures and experiencing the dynamic process of cell division. This immersive experience enables students to better grasp abstract concepts.

3.1.2 Maintaining learning enthusiasm

Moreover, the immersive experiences created by VR technology help students sustain their enthusiasm for learning. In traditional classrooms, prolonged exposure to textbooks and blackboards often leads to fatigue and disengagement. In VR's virtual environments, students are constantly immersed in novel experiences, with their curiosity continually sparked. They transition from passively receiving knowledge to actively exploring and discovering. For example, in VR simulations of ecological systems, students can observe interactions between organisms and investigate the mechanisms of ecosystem balance. This active, exploratory approach enhances engagement and improves learning outcomes.

3.1.3 Natural interaction with the environment

Additionally, in VR simulations, students can naturally interact with the environment. For instance, during interactive sessions, students can use VR devices to engage with virtual objects, such as clicking on specific organelles in a cell model to learn about their functions. This interactivity not only sparks students' interest but also deepens their understanding by integrating theory with practice, enhancing both comprehension and retention of knowledge. Perhaps more significantly, VR technology also possesses the capacity to integrate knowledge, rapidly synthesizing content across textbook chapters to help students construct systematic knowledge frameworks and stimulate divergent thinking. For example, in biology courses, VR technology can integrate knowledge from different chapters—such as cellular structures, metabolic processes, and genetic variations—into a single virtual scenario. This allows students to discover intrinsic connections between concepts during exploration, fostering a more comprehensive understanding of the subject. Furthermore, as technology evolves and curriculum design improves, plans include incorporating additional topics to further broaden students' perspectives and deepen their learning.

3.2 VR simulations enhance comprehension

3.2.1 Collective learning

In an era of ongoing educational innovation, VR technology has emerged as a powerful means to ignite students' enthusiasm for hands-on learning through its unique appeal. Compared to traditional teaching methods, VR simulation experiments transcend the constraints of time and space, allowing students to engage in diverse immersive scenarios anytime, anywhere. Through VR devices, students are transported into highly replicated historical scenarios, enabling them to grasp the historical significance behind the principles. Taking the Situation and Policy course as an example, Xu and Chang showed that VR technology helps students understand the Party's theoretical and practical achievements [10]. By integrating the Party's pivotal historical milestones—from the *Red Boat Spirit* originating at South Lake in Jiaxing to the groundbreaking reforms of the new era—into an expansive VR environment, students can virtually retrace history, immersing themselves in the social contexts and pivotal events of different periods. This experiential approach allows them to witness the Party's arduous struggles and monumental achievements firsthand, solidifying their commitment to the "Four Confidences" (confidence in the path, theory, system, and culture of socialism with Chinese characteristics). Compared to traditional text-and-image-based instruction, this immersive learning method enables students to grasp the context, progression, and impact of historical events more profoundly, fostering stronger alignment with the Party's theories and policies.

3.2.2 Personalized learning

Furthermore, VR technology holds immense potential in creating personalized learning experiences. On one hand, it allows the design of virtual history tasks with tailored difficulty levels. For students with weaker foundational knowledge, simpler tasks—such as chronologically organizing major historical events—can be assigned. For students with stronger academic foundations and advanced abilities, more complex tasks—like analyzing the interplay of multiple factors within specific historical periods—can be implemented.

4 Challenges and Strategies for VR in Stimulating Student Interest in University General Courses

4.1 Cost and accessibility challenges of VR technology

The high hardware costs of VR devices remain a primary barrier to widespread adoption. For example, establishing a VR lab capable of accommodating 40 students simultaneously at a university in Shanxi Province requires an investment of approximately 2 million yuan, whereas traditional multimedia classrooms typically cost between 200,000 to 500,000 yuan. Such a significant cost disparity imposes a heavy financial burden on many institutions. To reduce equipment costs and enhance efficiency, leveraging the extensive coverage of 5G networks, we can utilize increasingly common mobile terminals such as smartphones as teaching devices. This approach not only meets the teaching demands when student numbers increase but also reduces expenses associated with purchasing high-cost terminal devices. At the same time, people can use VR technology to construct various classroom scenarios and apparatuses, create customized virtual environments tailored to different disciplines, and implement centralized management through 5G networks—thereby minimizing human resource management costs. In terms of operation, maintenance, and updates, teachers and students can easily access immersive classrooms via 5G networks, while technical staff periodically update virtual scenario devices. Given the virtual nature of these systems, repair costs for equipment malfunctions are relatively low. Furthermore, promoting the interdisciplinary integration of scenario devices across different fields can significantly enhance overall operational efficiency [11].

4.2 Lack of systemic pedagogical integration

The low systemic integration of VR technology in teaching strategies is primarily reflected in the lack of unified planning for VR application across teaching stages, the rigid integration of teaching resources with course content, inconsistent teacher training in VR pedagogical practices, and a reliance on individual teacher experimentation rather than a standardized instructional framework. For instance, VR exploration modules independently designed by teachers, due to their lack of integration into the curriculum evaluation system, make it difficult to quantitatively assess students' learning outcomes. This prevents accurate judgment of teaching effectiveness and hinders instructional improvement and optimization. To address these issues, comprehensive VR teaching integration plans should first be formulated. Based on teaching syllabi and students' cognitive patterns, VR technology should be phased and tiered into the curriculum system to ensure that VR applications across knowledge points form an organic whole. Second, strengthen the development and curation of VR teaching resources by establishing a curriculum-aligned resource repository through industry-university collaboration, ensuring resources meet practical teaching demands. Concurrently, build a comprehensive teacher training system that offers regular, progressive training—from basic operations to advanced pedagogical applications—to enhance educators’ proficiency in utilizing VR technology, thereby enabling efficient and systematic integration of VR into teaching practices [12].

4.3 Content innovation and health concerns

VR technology still lacks visual and tactile feedback; when users wear VR headsets, they struggle to perceive their real-world surroundings. Therefore, virtual reality (VR) technology urgently requires the addition of visual or haptic feedback mechanisms to inform users about real-world conditions [4]. Furthermore, health risks remain a concern. Studies indicate that prolonged use of VR headsets may lead to a range of health issues, such as motion sickness, fatigue, and nausea. Therefore, the development and implementation of efficient learning monitoring and assessment tools become critically important. Several learning monitoring tools and technologies have already been applied in VR educational settings. For instance, eye-tracking technology captures learners' eye movement trajectories to analyze their focus points and visual preferences, thereby determining their learning engagement. In practical applications, it can effectively monitor students' areas of focus in virtual environments, providing a basis for adjusting teaching strategies. However, it faces technical bottlenecks in real-time data processing and accuracy in complex scenarios. Additionally, physiological signal monitoring technology can collect data such as heart rate and skin conductance response to assess learners' emotional states and cognitive load. To address student health concerns, this technology can promptly detect physiological anomalies caused by academic stress or VR-induced discomfort—such as early signs of motion sickness—and intervene through content adjustments or rest reminders. However, challenges remain, including the comfort of wearable devices, the complexity of data interpretation, and the need to resolve compatibility and cost issues when integrating into existing VR systems. These tools not only enable real-time tracking of learners' behaviors, progress, and status in virtual environments but also, through data analysis, can detect potential issues in a timely manner—such as early signs of motion sickness. Consequently, corresponding countermeasures can be implemented, including adjusting motion variables in virtual scenarios and providing rest reminders, to mitigate the interference of motion sickness and other adverse situations on learning.

5 Conclusions

The application of VR technology in university general education classrooms has both advantages and limitations. On one hand, it demonstrates unique strengths: creating immersive experiences to ignite students' exploratory interest, maintaining learning enthusiasm through natural environmental interactions, enhancing comprehension abilities, and enabling personalized learning. On the other hand, it also faces significant challenges. From a technical standpoint, complex operations, low teacher proficiency, and poor scalability of VR tools contribute to diminished student engagement. Additionally, the adaptability of VR technology varies across disciplines—while it performs well in some fields, its effectiveness remains limited in humanities, social sciences, and interdisciplinary courses. Additionally, challenges such as high equipment costs, low systematic integration of teaching strategies, and difficulties in content innovation and personalized customization restrict its widespread adoption. To address these challenges, strategies include adopting mobile devices to reduce costs, formulating comprehensive instructional plans, enhancing resource development and teacher training to resolve pedagogical issues, and developing learning monitoring and assessment tools to tackle health risks and content innovation challenges. These measures aim to promote the effective integration of VR technology in university general courses, stimulate student engagement, and elevate teaching outcomes.

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