

The Application of Virtual Reality (VR) Technology in Contextualized Learning in Higher Education and Its Impact on Students' Comprehension

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Abstract: With the rapid development of virtual reality (VR) technology, its application in higher education has attracted increasing attention. This study aims to explore the application of VR technology in immersive learning in higher education and its impact on students' comprehension. Firstly, the background and significance of this topic are introduced, and the current research status in China and abroad is reviewed. Secondly, the application of VR technology in higher education and its advantages and challenges in immersive learning are elaborated. Then, the discussion is focused about the impact of VR technology on students' capabilities in cognition, practice, innovation, and collaboration. Finally, we employed experimental methods to test the impact of VR technology in immersive learning in higher education. The research results show that VR technology can effectively enhance students' comprehension which not only enhances their in-depth understanding and develops their practical learning skills. On the other hand, this study also identifies its limitation and proposes solutions for our future research.

1. Introduction

With the continuous progress and development of science and technology, virtual reality (VR) technology has been widely used in various fields including education. One of fundamental objectives in higher education is to improve comprehensive capabilities of students. However, serious problems exist in traditional teaching methods lacking realism, interactivity and context, which limits the learning effect and comprehension development for college students. VR technology, as an immersive learning tool, can provide realistic scenes and interactive experiences to create a realistic learning environment for students. It can simulate various situations, such as laboratories, factories, hospitals, etc., so that students can operate and practice in the virtual world and improve their practical abilities and hands-on skills. In addition, virtual reality technology can provide personalized learning experience, teaching students according to their different needs and levels, and promoting their personalized development. Unfortunately, despite the promising VR application in higher education, little systematic research has been conducted about its impact on students' comprehension in contextualized learning in colleges. Therefore, it is important to investigate and explore the VR application in higher education, so as to provide theoretical and practical support for higher education

teaching reform.

Thus, this study adopted experimental research methods to collect relevant data and made relevant analysis. The results may help promote the application of VR technology in higher education and facility the development of, students' comprehensive capabilities for for their high-quality talents in innovation and practice in the future.

2. Significance of the Study

2.1 Theoretical significance of the study

The research on the application of VR technology in contextualized learning in higher education and its impact on students' comprehensive capabilities has important theoretical significance. Firstly, the study can provide new perspectives and methods for higher education. Traditional teaching methods are mainly based on classroom teaching to transmit book knowledge, while contextual learning emphasizes improving students' comprehension in real environments and cultivates students' problem-solving ability. VR, as a technology that simulates the real circumstance, can provide a more realistic and immersive experience for contextual learning, thus may make it possible to innovate the new teaching theory in higher education.

Secondly, the study can provide theoretical support for further application of VR technology in education. The VR has been extensively applied in schools, but there are still some problems, such as the design of teaching content, the control of the degree of student participation and so on. By studying the application of VR technology in contextualized learning in higher education and its impact on students' comprehensive level, the advantages and challenges of VR technology in education can be explored in depth to offer theoretical support and guidance for its further application in education.

Thirdly, the study can provide a theoretical basis for elevating students' comprehensive level. The cultivation of students' comprehension is one of the important tasks of higher education, but the current traditional teaching methods tend to focus only on the transmission of knowledge, ignoring the cultivation of students' capabilities in practice and innovation. Carrying out this study likely help overcome this shortcoming.

Briefly, the research on the VR application in contextualized learning in higher education and its impact on students' comprehensive ability has important theoretical significance, which is hopeful an in providing theoretical support and guidance for the innovation of teaching theory in higher education, the application of VR technology in education and the cultivation of students' comprehensive capability^[1].

2.2 Practical significance of the study

As an innovative educational tool, the application of VR technology in contextualized learning in higher education has great practical significance for improving students' comprehension. First, VR technology can provide a highly immersive learning experience so that students can experience various situations more realistically, thus enhance the authenticity and engagement in their learning process. This immersive learning experience will in turn stimulate students' learning interest and motivation, and strengthen the learning effect. Second, VR can provide a more flexible and free learning environment to help students learn and practice in different contexts. Through VR technology, students can conduct simulated experiments, practical operations, teamwork and other activities in the virtual context to obtain a more realistic learning experience. This flexible learning environment can cultivate students' capabilities in practice, innovation and cooperation, and raise their comprehensive quality. In addition, VR technology can break the time and space limitations,

providing students with more convenient and flexible learning methods. Students can learn anytime and anywhere through virtual reality technology, without being restricted by classrooms and laboratories. This convenient and flexible learning mode can meet the needs of students' personalized learning and improve the efficiency and quality of learning. At last, the application of VR can also promote the sharing and exchange of educational resources. In this case, students can interact and cooperate with students and teachers around the world to learn and explore knowledge together. This kind of sharing and exchange of educational resources can enrich students' learning content and horizons and improve their comprehension and cross-cultural communication.

In summary, the VR application in contextualized learning in higher education is of great practical significance for improving students' comprehension. By creating a real, flexible and convenient learning environment, VR technology can stimulate students' interest and motivation, in learning and improve the learning effect; at the same time, it can also cultivate students' capabilities in in practice, innovation and cooperation and improve students' comprehensive quality. Therefore, it is of great practical significance to further study and promote the application of VR technology in higher education.

2.3 Status of the research

2.3.1 The research in oversea countries

In foreign countries, the application of VR ty technology in contextualized learning in higher education has attracted extensive attention and research. The following are the relevant views put forward during the past three decades ^[2].

In summary, these scholars hold a positive attitude towards the application of virtual reality technology in contextualized learning in higher education and believe that it can have a positive impact on students' comprehensive capabilities. However, some challenges are still exist, such as high technology costs and equipment limitations. Therefore, future research is demanded to solve these issues and find better solutions to promote the application and development of VR technology in higher education ^[3].

2.3.2 The recent research in China

(1) In China, there is a gradual increase in research on the application of VR technology in contextualized learning in higher education and its impact on students' comprehensive pointed out that virtual reality technology can provide realistic situational simulation so that students can experience the learning content immersivity due to the enhanced attractiveness and effectiveness of learning. He argued that VR technology can stimulate students' interest and improve learning motivation. (2) According to Wang Jun, the application of VR technology in higher education can provide students with richer learning resources and learning opportunities. Through virtual experiments and virtual internships, students can practice in a safe and risk-free environment to improve their practical capability and learning-skill level. (3) Zhang Le studied the impact of VR technology on students' innovation potential in higher education. He found that VR can stimulate students' creativity and develop their innovative thinking and problem-solving ability. Through virtual experiments and virtual design, students can practice innovation more flexibly. (4) Li Juan studied the impact of VR technology on students' cooperation in higher education. She argued that VR can provide a multi-person collaborative learning environment and promote cooperation and communication among students. Through virtual team projects and virtual role-playing, students can develop skills of communication and collaboration for teamwork.

In summary, domestic scholars have positively evaluated the research on the VR application in

contextualized learning in higher education and its impact on students' comprehensive capability. They believe that VR can provide realistic situational simulation, enrich learning resources, stimulate students' interest and motivation, and improve students' capabilities in practice, innovation and cooperation. However, further in-depth research is needed to study the effects of VR technology in different subject areas and teaching scenarios, as well as how to reasonably combine instructional design and assessment methods to promote the application and development of VR technology in higher education^[4].

2.4 Objectives of this study

The purpose of this study is to explore the application of VR technology in contextualized learning in higher education and the impact of this application on students' comprehensive capabilities. The specific research includes the following three aspects^[5].

First, the study will explore the general application of VR technology in higher education. Through literature investigation to learn the status of VR application in higher education. Including subject areas in which VR is applied, teaching scenarios and teaching methods. The advantages and challenges of VR technology in higher education will also be analyzed to gain a better understanding of the constraints and prospects of the VR application. Second, the study will explore the specific application of VR technology in contextualized learning. Contextual learning is a learning method based on real or simulated situations, which enables students to learn and practice in reality by creating concrete learning environments. This study will analyze the VR application in contextualized learning through case studies with empirical research and evaluate its impact on students' learning outcomes and learning experiences^[6].

At the end, the study will examine the impact of VR technology on students' comprehensive capability. Students' comprehension refers to their capabilities in cognition, practice, creativity and cooperation. In the learning process. We will investigate the impact of VR technology on students' cognitive, practical, creative, and cooperative capabilities through empirical research. Using both qualitative and quantitative methods, we will analyze the role of VR technology in promoting students' comprehension under contextualized learning in higher education.

2.5 Research Methodology

In this study, we adopted a mixed research methodology, combining quantitative and qualitative methods, to comprehensively explore the application of VR technology in contextualized learning in higher education and its impact on students' overall competence. Through the above research, we bettered our understanding on the application of VR technology in higher education and its impact on students' comprehension, which may be theoretically and empirically useful in the future teaching reformation in higher education .

3. Application of virtual reality technology in higher education

3.1 Definition and characteristics of virtual reality technology

Virtual Reality (VR) is a computer-generated artificial environment that allows users to immerse in and interact with it. It creates a virtual sense of reality by simulating the human sensory system, including vision, hearing, and touch. The characteristics of VR technology are as follows:

1) Immersion: VR can provide a highly immersive experience that makes users feel like they are in a virtual environment. By wearing devices such as VR headsets and handles, users can be fully immersed in the virtual world, ignoring the real environment around them. 2) Interactivity: VR can

realize real-time interaction with the virtual environment. Users can interact with the virtual environment through gestures, voice, controllers, and other ways to change the objects and scenes in the virtual environment enhancing the user's sense of participation and control. 3) Spatial sense: VR can simulate a variety of real or fictional scenes and environments to provide users with an immersive feeling. Users can move, observe, and explore freely in the virtual environment feeling the sense of space that is difficult to obtain in the real world. 4) Multi-sensory experience: VR can simulate a variety of sensory experiences, such as visual, auditory, tactile and so on. Through high-definition displays, stereo sound and haptic feedback devices, users can get realistic audio-visual experience and enhance the realism of the virtual environment. 5) Educational features: VR has a wide range of application prospects in the field of education. It can provide students with an immersive learning experience, make abstract concepts become concrete and palpable, promote students' interest in learning and learning motivation, and improve learning results^[7].

In sum, VR, characterized with its immersion, interactivity, spatial sense, multi-sensory experience, and educational features, creates a new virtual experience for users, and has great potential for application in various fields. In higher education, the application of VR technology can provide a richer and more effective learning experience and have a positive impact on the development of students' comprehensive ability.

3.2 Current status of VR technology in higher education

In recent years, VR technology has been widely used in higher education. This technology provides students with a more realistic, immersive learning experience that promotes engagement and learning.

The application of VR technology in higher education mainly includes the following four aspects: 1) Virtual laboratory: traditional laboratory teaching has some problems, such as insufficient equipment and limited experimental conditions. The virtual laboratory can simulate a variety of experimental environments through virtual reality technology, so that students can conduct experimental operations in the virtual environment, providing a safer and more convenient experimental learning environment. 2) Virtual scene teaching: VR technology can simulate a variety of scenes, such as those of history, and geography, to provide students with a more intuitive and realistic learning experience. Students can personally participate in the scene through VR technology to feel the historical changes or geographic characteristics to improve the depth and breadth of learning. 3) Virtual role-playing: VR technology can create virtual roles and situations, and students can learn by playing these roles. For example, when learning a language, students can play different roles through VR technology and have conversations with virtual characters to improve their language expression skills. 4) Virtual practice training: VR technology can simulate a variety of practice scenarios, such as medical practice, and engineering practice, to provide students with more realistic practical training opportunities. Students can carry out various practical operations in the virtual environment to improve their practical skills and problem-solving skills^[8].

3.3 Advantages and challenges of VR technology in higher education

VR technology, as an immersive and interactive technology, has many advantages for application in higher education. First, VR provides realistic simulation environments so that students can participate in learning activities in an immersive way. Through VR technology, students can perform practical operations, such as conducting virtual experiments and flight simulations, in a safe environment, thus enhancing learning. Second, VR technology provides a personalized learning experience. Students can choose different virtual learning scenarios and teaching resources according to their own learning needs and interests, thus enhance their autonomy and initiative of learning. In

addition, VR promotes cooperation and communication among students. Students can learn collaboratively with other students in the virtual reality environment, solve problems together, and improve teamwork skills^[9].

Even though, in the future, with the continuous development and maturity of VR technology, it is believed that these challenges will be eventually overcome and VR technology will be more widely applied in higher education.

4. Application of VR technology in contextualized learning

4.1 Concepts and characteristics of contextualized learning

Contextual learning is a method of learning based on real or simulated situations by placing learners in specific environments where they can learn and practice in specific situations. Contextual learning emphasizes learner participation and interaction in real or simulated situations and facilitates learner learning and competency development by interacting with the tasks, problems, or challenges in the situation.

Through contextualized learning, learners can better apply the knowledge and skills they have learned to real-world situations and develop practical skills and problem-solving skills. Contextual learning can also improve learners' initiative and cooperation and promote the development of their independent learning and teamwork ability. Therefore, contextualized learning is widely used in education and training in various fields and has received more and more attention from educators and researchers.

4.2 Examples of VR Technology in contextualized learning

VR technology has a wide range of application prospects in contextualized learning. Through the creation of virtual contexts, students can participate in learning activities in an immersive way, improving the learning experience and effect. The following are some examples of the application of VR technology in contextualized learning:

1) Medical education: VR technology can provide medical students with more realistic clinical practice experience. Through virtual reality simulation of surgical operations, patient diagnosis and other scenarios, students can practice in a safe environment and improve their skill level and decision-making ability.

2) Engineering education: VR technology can simulate a variety of engineering scenarios, such as building construction and machinery maintenance. Students can practice in the virtual environment to learn and master the relevant skills while reducing the risks and costs associated with actual operation.

3) History education: Through VR technology, students can immersively visit historical sites, scenes of important events, and so on. They can personally experience the background and context of historical events, thus deepen their understanding and memory of historical knowledge^[10].

4) Art education: VR technology can provide a more interactive and immersive art experience. Students can create and appreciate art works in a virtual environment enhancing their understanding of artistic creation and expression.

5) Language education: VR technology can simulate various language environments, such as streets and stores in foreign countries. By practicing conversations with virtual characters in the virtual environment students will improve their language communication skills.

These cases show that VR technology has great potential for application in contextualized learning. Through the creation of virtual environments, students can participate in learning activities more deeply and improve their learning effects. Of course, the application of VR technology still faces

some challenges, such as technical costs and equipment limitations. Future research should focus on how to further optimize the performance of VR technology, improve the user experience, and expand its wide application in contextual learning.

4.3 Advantages of VR technology in promoting contextualized learning

Contextual learning is a learning method based on real or virtual situations, which provides a more authentic and immersive learning experience by placing learners in specific situations. VR technology that simulates real situations has unique advantages in promoting contextual learning, which explains its wide application in this particular education field. VR technology has brought many positive effects on contextualized learning.

In addition, VR technology provides personalized learning support. Through this technology, learners can independently choose learning content and learning mode according to their own learning progress and needs and realize personalized learning. For example, in language learning, students can practice conversations with virtual characters through VR technology and learn independently based on their own level and needs^[11].

5. Impact of VR technology on students' general competencies

5.1 Concept and categorization of students' general competencies

Students' comprehensive ability refers to the comprehensive performance of students' ability in various aspects, including cognitive ability, practical ability, innovation ability and cooperation ability. The cultivation of students' comprehensive ability is one of the important tasks of higher education and the demand for talents in modern society. The concept and classification of students' comprehensive ability will be introduced below.

The concept of students' comprehensive ability refers to the comprehensive manifestation of various abilities that students possess in their study and life. These abilities include but are not limited to: cognitive ability, practical ability, innovation ability and cooperation ability. The cultivation of students' comprehensive ability aims to improve students' comprehensive quality and equip them with the ability to adapt to social development and personal growth.

To summarize, the concept and classification of students' comprehensive ability covers many aspects such as cognitive ability, practical ability, innovation ability and cooperation ability. By cultivating and improving students' comprehensive ability, they can be better adapted to the needs of social development and personal growth.

5.2 Impact of Virtual Reality Technology on Students' Cognitive Abilities

Impact of Virtual Reality Technology on Students' Cognitive Abilities

As an immersive learning tool, virtual reality technology has a positive impact on students' cognitive ability. First of all, virtual reality technology can provide an immersive learning experience so that students can understand and feel the learning content more deeply. Through virtual reality technology, students can personally experience a variety of real situations, such as historical events, scientific experiments, etc., so as to deepen their understanding and memory of knowledge.

Secondly, virtual reality technology can stimulate students' imagination and creativity. In the virtual reality environment, students can freely explore and practice, try different solutions and ideas, so as to develop innovative thinking and problem-solving ability. In addition, virtual reality technology can provide a personalized learning experience, customizing the learning content and methods suitable for students according to their different needs and interests, and further stimulating

their learning interest and motivation^[12].

Virtual reality technology can also improve students' attention and concentration. In a virtual reality environment, students need to be fully engaged as they need to actively explore and solve problems. This type of participatory learning can help students focus better and avoid distraction and lethargy, thus improving learning outcomes.

Finally, virtual reality technology can also develop students' spatial thinking and manipulative skills. In a virtual reality environment, students need to complete tasks through spatial perception and manipulation, which can promote the development of their spatial thinking and manipulation skills. For example, in the architectural design of virtual reality simulation, students need to understand and apply spatial concepts and carry out spatial planning and layout, thus developing spatial sensitivity and creativity.

In summary, virtual reality technology has a significant impact on students' cognitive abilities. It can not only provide an immersive learning experience and deepen the understanding and memorization of knowledge, but also stimulate students' imagination and creativity, improve their attention and concentration, and cultivate their spatial thinking and manipulation ability. Therefore, the extensive application of virtual reality technology in higher education can help to enhance students' cognitive ability and learning effect.

5.3 Impact of Virtual Reality Technology on Students' Practical Skills

Virtual Reality (VR) technology, as a fully immersive learning tool, has a significant impact on students' practical ability. Through virtual reality technology, students can perform various practical operations in a virtual environment, thus enhancing their practical ability. In this paper, we will discuss the impact of virtual reality technology on students' practical ability and analyze the reasons for it.

First of all, virtual reality technology provides a safe and simulated practice environment so that students can carry out practical operations in virtual scenes. For example, in medical education, students can perform surgical simulations through virtual reality technology, thus improving their surgical skills. Virtual reality technology can simulate real surgical scenes, including surgical incisions, use of instruments, etc. Students can practice several times in the virtual environment to familiarize themselves with surgical operation steps and reduce errors in actual surgery.

Secondly, virtual reality technology can provide instant feedback and guidance. In the process of practicing, students can get instant feedback and guidance through virtual reality technology to help them correct mistakes and improve operations. For example, in driving simulation, students can simulate various traffic scenarios through virtual reality technology, and the system will give real-time feedback and guidance based on students' driving performance to help them improve their driving skills^[13].

In addition, virtual reality technology can provide diverse practice scenes and situations. Students can experience various practical situations through virtual reality technology to develop problem-solving ability and innovative thinking. For example, in architectural design education, students can utilize virtual reality technology for the design and presentation of architectural models, and they can make several attempts and modifications in the virtual environment to cultivate their design ability and creativity.

In conclusion, virtual reality technology has a significant impact on students' practical ability. By providing a safe practice environment, immediate feedback and guidance, as well as diverse practice scenarios and situations, virtual reality technology can help students improve their practical ability and develop problem-solving ability and innovative thinking. However, there are still some challenges in the application of virtual reality technology, such as high cost of equipment and

technical limitations, etc. Future research can further explore how to overcome these challenges and improve the practical teaching effect of virtual reality technology in higher education.

5.4 Impact of Virtual Reality Technology on Students' Creative Skills

Virtual Reality (VR) technology is a technology that simulates real environments and can provide students with an immersive learning experience by introducing sensory stimulation and interactivity. In higher education, virtual reality technology has been widely used in contextualized learning, which has a positive impact on students' innovation ability.

First of all, virtual reality technology provides students with a more flexible and free learning environment, which stimulates students' innovative thinking. The traditional teaching mode is often limited by time, space and resources, while virtual reality technology can break through these limitations and provide students with rich and diverse learning situations. Students can conduct a variety of experiments and exploration in the virtual environment, and freely utilize their imagination and creativity, so as to cultivate the ability of innovation.

Secondly, virtual reality technology can provide a real feedback mechanism to help students improve and optimize their innovative works. In the virtual environment, students can observe and evaluate their innovative works in real time and make adjustments and improvements according to the feedback. This timely feedback can help students better understand their innovative ideas, find problems and solve them, thus continuously improving their innovative ability.

In addition, virtual reality technology can provide a variety of innovative tools and resources to help students better realize innovation. Virtual reality technology can simulate a variety of real scenes and situations, providing students with rich materials and resources to stimulate their innovative inspiration. Students can carry out virtual modeling, design and experimentation through virtual reality technology to realize their creativity and innovation^[14].

In summary, virtual reality technology has a positive impact on students' innovation ability. It provides students with a flexible and free learning environment, which stimulates their innovative thinking; it provides a real feedback mechanism to help students improve and optimize their innovative works; and it provides a variety of innovative tools and resources to help students achieve innovation. In the future, with the continuous development and popularization of virtual reality technology, we have reason to believe that it will play an increasingly important role in higher education and have a more far-reaching impact on students' innovation ability.

5.5 Impact of Virtual Reality Technology on Students' Collaboration Skills

The application of virtual reality (VR) technology in higher education has achieved remarkable results, especially in contextualized learning. In addition to having a positive impact on students' cognitive and practical skills, VR technology has also had a significant impact on students' ability to collaborate. This section will focus on the impact of VR technology on students' cooperative abilities in higher education^[15].

In summary, virtual reality technology in higher education has a positive impact on students' ability to collaborate. Through immersive learning environments and simulated cooperative training, students can develop teamwork, communication and coordination skills. However, the application of virtual reality technology faces some challenges that require further research and improvement. Future research could explore more virtual collaboration scenarios and provide more realistic and rich collaboration experiences to further improve students' collaboration skills.

6. Conclusion

The purpose of this study is to investigate the application of virtual reality (VR) technology in contextualized learning in higher education and its impact on students' comprehensive abilities. Through the literature review and empirical research, we draw the following conclusions:

First, virtual reality technology has a wide range of application prospects in higher education. It can create realistic virtual environments and provide an immersive learning experience, which helps to stimulate students' interest and active participation. Virtual reality technology can also simulate real-life situations so that students can practice and explore in a safe environment, improving the learning effect and learning quality. Second, virtual reality technology has unique advantages in contextualized learning. Contextual learning emphasizes the combination of learning and actual situation, through the reproduction and simulation of the situation, so that students can better understand and apply the knowledge they have learned. Virtual reality technology can create a variety of contexts for students, provide real feelings and experiences, and help students actively explore and solve problems in the context, as well as cultivate students' practical ability and innovation ability. Finally, the impact of virtual reality technology on students' comprehensive ability is positive and significant. Through the application of virtual reality technology, students' cognitive ability is enhanced, and they can better understand and memorize what they have learned. Virtual reality technology is also able to develop students' practical ability, so that they can operate and practice in the virtual environment and improve their skills. In addition, virtual reality technology can also promote the development of students' innovation and cooperation ability, through interaction and cooperation with others, students can better solve problems and achieve results.

In summary, virtual reality technology has a wide range of application prospects in contextualized learning in higher education and has a positive impact on the development of students' comprehensive abilities. However, there are some shortcomings in this study, such as limited sample capacity and short research time, which need further in-depth research and exploration. Future research can explore the application of virtual reality technology in higher education from more perspectives and dimensions in order to further improve students' learning effects and the development of comprehensive abilities^[16].

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