VR Technology in Building Environment and Energy Application Engineering Major Education

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Abstract. As a new science and technology, VR technology occupies a pivotal position in social development and progress. It is an indispensable link in the current college teaching field. This article elaborates on the connotation and characteristics of VR technology, analyzes and discusses the necessity of VR technology in building environment and energy application engineering major education, and VR technology application in the major.

1. Introduction
With the development of smart construction and smart cities with 5G, virtual reality technology is frequently coming into people's eyes. VR technology (Virtual reality technology) is an emerging technology that combines computer technology and simulation technology. With its multi-sensing, interactive, immersive and other characteristics, it can simulate the real environment or things and present them to user. In college teaching, VR technology can provide users with a virtual learning environment, provide rich sensory stimulation and natural interaction methods, and bring an immersive learning experience effect.

Building environment and energy application engineering is a typical engineering major. The introduction of VR technology into the classroom teaching can enable students to deepen the learning of knowledge and stimulate their creative thinking; it can help to solve the problems in teaching and improve the quality of professional personnel training in major.

2. Classification of virtual reality
VR is divided into non-immersive virtual reality and immersive virtual reality. Non-immersive virtual reality is also called desktop (windowed) virtual reality, which is to generate a windowed virtual reality environment on a computer screen, generally using three-dimensional glasses. Immersive virtual reality requires a "virtual reality head-mounted display." VR now refers to immersive virtual reality systems.

For building environment and energy application engineering major, the current three-dimensional 3D visualization modes are: (1) BIM (Building Information Modeling) 3D visualization (2)VR(Virtual Reality virtual simulation) (3)AR( Augmented Reality augmented reality virtual simulation) (4) BIM+VR virtual simulation[1].
3. Application of virtual reality

The application of virtual reality in the building environment and energy application engineering professional classrooms is mainly divided into two categories: courses involving danger and courses requiring large-scale scene simulation.

Introducing virtual reality technology into these courses is an experiential teaching mode. Through the simulation of a variety of real-world scenarios, students can experience a variety of problems firsthand, exercise their ability to practice and overcome difficulties, and improve their ability to cooperate with others. At the same time, this experiential teaching method can enhance discussion with each other. Students should pay attention to their own integration into the activity, rather than observing others as a bystander to get feelings, so that they can get a more real experience, and deeply appreciate the meaning of this learning method, and can significantly improve their knowledge[2].

Table 1. Application analysis of virtual reality technology

| Included courses                      | Application prospects                      |
|---------------------------------------|-------------------------------------------|
| (1) Disaster Prevention and Mitigation Project | (1) Not limited by time and space          |
| (2) Gas Transmission and Distribution Project | (2) Real-time learning                     |
| (3) Boiler and boiler room equipment   | (3) Safety assessment                      |
| (4) Heat and mass exchange theory and equipment | (4) Realistic rescue and self-rescue experience |
| (5) Heat transfer                      | (5) Improve curriculum design              |
| (6) Engineering                       |                                           |
| (7) Thermodynamics                    |                                           |
| (8) Fluid mechanics                   |                                           |

4. Advantages of virtual reality

One of the great advantages of virtual reality is that it can create fantastic virtual reality works by using computer image modeling technology, which can break the limitations of time and space, and construct the real world which is almost impossible to complete, or is not available in real life, high-cost and difficult to build realistic scenes.

Carrying out virtual reality teaching in this major will bring the following advantages: (1) A simulation and interactive teaching environment can be created, without considering the area of the laboratory, equipment investment, maintenance costs, etc., which greatly reduces experimental expenses. (2) Able to show the most cutting-edge technology of this major and expand the experimental projects of the course. (3) Expand classroom content and depth, and break through the difficulties of classroom teaching. (4) Training can be repeated to provide a platform for students to learn independently, increase learning interest, and promote active thinking[3].

Table 2. Features of Virtual Reality Technology[4]

| Features      | Connotation                                           |
|---------------|-------------------------------------------------------|
| Immersion     | Give people an immersive feeling                      |
| Interactivity | Interaction with sensing devices                      |
|               | Acquire new knowledge                                 |
|               | Improve perceptual and rational understanding          |
|               | Deepen concepts and germinate associations             |
|               | Inspire creative thinking                              |


5. Disadvantages of virtual reality

Virtual reality technology has relatively high requirements for hardware equipment, and immersive virtual reality is still in an immature stage. Some key technologies are being studied, improved and perfected.

Virtual reality equipment (computers and VR kits that run fast and display high image quality) is still relatively expensive and requires a lot of financial support.

When users experience virtual reality works, they need to wear a helmet, which is almost isolated from the real world. Only through the eyepieces can they experience roaming in the virtual space. The user roams in this environment, the eyes are prone to fatigue, and they feel dizzy and dizzy over time. Negative effects such as headaches. After roaming in the virtual environment for a long time, you may not be able to distinguish objects in the real world from the virtual world.

Table 3. Virtual reality technology development issues

| Issue               | Connotation                                           |
|---------------------|-------------------------------------------------------|
| Poor realism        | (1) Cable connection, restricted activities            |
|                     | (2) Equipment blocking communication                   |
|                     | (3) Limited sight range                                |
| Lack of uniform     | (1) The standards of products produced by different    |
| standards           | manufacturers are different                            |
|                     | (2) Application software and virtual reality works     |
|                     | cannot be used in common                               |
| Make people          | Improper lens movement will cause discomfort to users |
| uncomfortable       |                                                       |

6. Conclusion

Virtual reality technology will eventually become an important teaching method for higher education. VR technology will also promote the development of the teaching of building environment and energy application engineering major. How to reasonably combine virtual reality technology with traditional
classroom teaching and how to use this technology. Bringing it into full play will be an important part of the teaching reform of the building environment and energy application engineering major in recent years.

As a new type of teaching media, VR technology will be widely used and play an important role in the teaching process of building environment and energy application engineering with its strong teaching advantages and potential.

References:
[1] Intelligent building, reasonable application analysis of "virtual reality" technology [EB/OL], 2020, 9.
[2] Yingying Bi, Research on the impact of VR technology on construction safety education and teaching [J], Construction Safety, 2018.
[3] Yuying Sun, Jingdong Liu, Wang Wei, Wu Xu, Hong Yang, Application of virtual simulation technology in the experimental teaching of Building Environment and Energy Application Engineering [A]. Education and Teaching Forum, 2016 (5): 106-107.
[4] Xiaqian Zheng, Application of VR technology in college teaching [J], Education Communication, 2019.