Application of 5G+VR technology in training and teaching of integrated wiring technology

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Abstract: The successful research and development, promotion and application of 5G technology in the new era will have a huge impact on the various industries in society. The development of computer and network technology plays an important role in promoting the practical training. VR technology is one of the important products of information and network technology. It takes multimedia technology as the core and presents knowledge to students more vividly in an audio-visual way, which can help students better understand. The paper analyzes the application of 5G+VR technology in the training and teaching of integrated wiring technology in detail, and aims to provide help for better application of 5G+VR technology.

1. Introduction
The growing development of information technology has led to changes in the education industry. At present, the form of education is constantly evolving towards diversification. VR is a kind of virtual reality technology, which displays classroom activities and extracurricular practices in a specific image. It is convenient for students to perceive and understand. 5G technology with its faster, stronger and more comprehensive characteristics also has a huge impact on the education industry [1]. There are plenty of scenarios where 5G can react chemically, like robots, autopilot, cloud computing and so on, but they are not mature enough. In contrast, the realm of VR technology will become explosive. The application of 5G+VR technology to the integrated wiring technology classroom can ensure that the VR image is clearer, the display and switching are smarter and more convenient. It will have a profound impact on the training of practical and compound talents, and the transformation of educational concepts.

Figure 1. 5G VR technology field experience
2. Development analysis of VR technology

2.1 VR technology
VR (virtual reality) technology is an application technology developed on the basis of multimedia technology, and it is one of the multimedia application forms. VR technology combines information with software and hardware technologies, and realizes a number of key technological developments with the help of sensing, artificial intelligence and robotics technology. VR technology is supported by professional equipment such as stereo glasses and data gloves, which can simulate three-dimensional reality and create a real world of three-dimensional vision, hearing, and touch for individuals. It can set the interaction between people and information with facilities through the natural behavior [2].

2.2 Development of VR technology
VR technology began to appear in the 1940s. At that time, it was a new concept supported by graphics and simulation equipment technology by computer. Through the combination of screen display, panoramic scene generation was produced for simulated flight for training method. By the 1960s, the concept of virtual world window observation was proposed, and the embryonic form of virtual reality technology began to appear [3]. In the late 1960s, helmet-type three-dimensional display devices began to appear. After a period of practice, by the 1980s, simulation sensing equipment, data gloves, stereo headsets and other equipment had been mature to realize the popularization and application of VR technology.

3. Advantages of 5G VR technology in practical training teaching of integrated wiring technology
VR technology has been developing for a long time and is relatively mature and stable. In recent years, both its activity and market scale have been steadily increasing. In addition, VR technology also has urgent practical demands for 5G. Due to communication needs, it provides good conditions for 5G. 5G is also a key catalyst for VR to make breakthroughs. The implementation of 5G+VR technology into practical training is inseparable from the following three types of technical support. They are three-dimensional positioning and tracking, three-dimensional real-time graphics display and intelligent imitation and sensing technology.

Various technologies cooperate with each other to enable the user to use information equipment to integrate into the virtual environment, produce real touch, sight, and hearing, and combine their own ideological fantasy to build a complete virtual world (5G+VR technology system composition is shown in table 1).

| 5G VR technology systems | Content | VR content |
|--------------------------|---------|------------|
| Platform                 | Rendering, fluidization, trans-coding, storage, coding for VR |
| Network                  | Cloud VR, large bandwidth and low delay transmission |
| Terminal                 | VR presentation, provide users with network access and authentication functions |

3.1 Interactive advantage
5G+VR technology provides students with a behavioral response that can manipulate and interact with objects in the virtual world. Supported by data sensing equipment, they can directly operate on objects and control the display operation of wiring technology[4]. In addition, professional data sensing equipment will also bring real touch and effects to people, and objects in the virtual world will also follow the movement of students to produce corresponding changes.

3.2 Outstanding reality
5G VR technology brings students the reality of virtual world, simulates the real wiring operation environment for students, makes it difficult to distinguish between true and false, takes practical
training seriously, and devotes himself to the three-dimensional virtual world of computer, thus indirectly realizing ‘real view, real listening, real feeling’. All the wiring related equipment, item size and function contacted by students in the virtual world correspond to the real content. This 5G VR technology with outstanding reality brings students real learning experience, which is convenient for students to understand the and reduce the error rate in the real operation.

3.3 Conceptualized
In the virtual multidimensional world created by 5G+VR technology, students can still complete a series of operations according to their own perception and cognition. Students can use their own subjective initiative, acquire knowledge and familiarize skills, and find the real answers to problems through experimental operations. 5G+VR technology can greatly improve the visualization and operability of integrated wiring teaching, making teaching content and mode design have a larger design space, which is convenient for displaying real teaching, intuitively explaining the key points of wiring, and avoiding the threat of lives of students.

4. Practical application analysis of 5G+VR technology in integrated wiring teaching
The virtual platform framework supported by 5G+VR technology is designed according to the requirements of integrated wiring teaching. Its system is divided into work area subsystem, wiring subsystem, trunk subsystem, equipment room subsystem, management subsystem, and building group subsystem, as shown in the figure 2.
The virtual platform framework is shown in figure 2. It is divided into working area subsystem, distribution subsystem, trunk subsystem, inter-equipment subsystem, management subsystem and building group subsystem.

4.1 Realize reasonable observation of integrated wiring structure by 5G+VR technology

Comprehensive wiring teaching requires students to understand the details of specific wiring, and learn the structure design and layout. However, the structure of wiring and the understanding of theoretical knowledge are more inconvenient. The connection between the two tends to be abstract, relying on traditional explanations is not conducive to students’ learning. Therefore, 5G+VR technology can be used in practical training. According to the students' personality and learning level, it can set up targeted training so that students are more easy to form three-dimensional ideas, form an overall idea for wiring design with more unique handling of wiring details opinion. The addition of 5G technology to VR technology makes the performance of VR more ideal, and students can see the wiring composition. In addition, the interaction of various lines and the switching of scenes are relatively smooth, forming a comprehensive wiring layout. This technology can facilitate students to observe the comprehensive content of wiring, so that students have a deeper understanding of the structure. Besides, when teaching involves the actual operation of integrated wiring, teachers can also use 5G+VR technology to allow students to truly participate in the operation, move the line by hand, and repeatedly observe the composition and design of the line. Teachers design courses can support VR technology, use 3Ds Max to make models of scenes, equipment, tools, and consumables, and restore colors and materials 1:1 according to the actual ratio. The platform implements virtual roaming and interaction with unity 3D, and publishes it to the Internet.

4.2 Fully improve the effect of comprehensive wiring training with the advantages of 5G+VR technology

In the traditional wiring practice teaching, the teacher explains the knowledge one to many. Some details easy to make mistakes would make the student cannot understand the operation skill very well. Students are likely to encounter various difficulties in the practical operation of integrated wiring. In order to facilitate students' understanding and strengthen the teaching effect, various measures should be taken to optimize the practical training classroom. In the actual operation of the specific integrated wiring, students need to clearly understand the steps and operational details of the integrated wiring. The first of the integrated wiring operation decomposition and connection can be finally connected to achieve mastery. For example, through 5G+VR technology, it can simulate the practical operating platform of comprehensive cabling. When teachers explain difficult details, it can let students operate in the virtual environment built by 5G+VR technology, so as to know what kind of operation is prone to make mistakes and what kind of operation is needed to avoid making mistakes. Through the cabling design and practical operation training, students can repeatedly practice a cabling structure design that they are not familiar with to realize that practice makes perfect.
In the VR virtual environment, students can repeatedly observe the effects of correct wiring, and calculate from back to front, and have their own unique insights into the operation of integrated wiring. VR technology is supported by PC and V-helmet. It adopts C/S architecture. Students access and operate through the PC client to simulate each link of actual wiring. The software is supported by VR technology to reproduce the real training scenes and immerse students in among them. UI design and logic implementation need to reflect good interaction and operability, and realize virtual roaming, so that students can have more experience in a limited time. It can make full use of the interactive and realistic characteristics of 5G+VR technology to more clearly express the wiring structure design. For some actual operations that have safety risks, operation in a virtual environment will not cause danger. Repeated practice can reduce consumables, and it is also convenient for teachers to correct students' movements and help students master operational skills faster.

For example, a comprehensive wiring training simulation system is constructed through VR technology, as shown in Figure 4.

![VR generic cabling training simulation system](image)

Figure 4. Integrated wiring training simulation system

As shown in figure 3, the system includes fiber fusion splicing, crystal head pressing, video teaching and printing results. Among them, fiber fusion splicing and crystal head suppression belong to the training operation. Video teaching assists students to better understand, and the printed result is an evaluation of the student’s training result. The VR scene constructed by the training is shown in figure 4.

![VR integrated wiring training scene](image)

Figure 5. VR integrated wiring training scene

In this VR teaching, students mainly practice the production of network cables. They can use crimping pliers to complete the network cable step-by-step operation according to the prompts on the test bench screen. Students make corresponding operations, and the VR scene will also show correct operations and errors. The different effects of the operation let students know where they have done wrong, and they can re-practice by withdrawing the operation. VR integrated wiring training can also realize remote immersive teaching. Students download the corresponding VR courseware and practice wiring operations by themselves with their respective VR equipment.
4.3 Attach importance to the innovation of 5G+VR technology development and improve the effect of technology simulation

In order to give full play to the value of 5G+VR technology in the practical teaching of integrated wiring, it is necessary to optimize and innovate 5G+VR technology and actively develop it against the background of the constant development of the times, and introduce the cutting-edge advanced technology to improve the practical operation ability with better simulation effect. The application value of integrated wiring knowledge in mechanical engineering, construction and material engineering is more outstanding, and the practical value of integrated wiring operation technology is higher. Software selection is the core of the technology application, request content conform to the specifications for design of integrated wiring systems engineering GB50311, the acceptance of integrated wiring systems engineering GB50312 technical requirements. The training module, assessment module and cognition module are designed through the software to provide students with more itemized training methods, such as crystal head making, cabinet installation, wire slot fixation, bottom box installation, optical fiber fusion and so on. If students make mistakes in training, the system will remind them in time. In order to facilitate students to master wiring knowledge, 3d model technology should be added to the involved tools and equipment in the virtual environment so that students can have a 360° view. In addition, in the context of the continuous development of society, the market economy is fiercely competitive, and its requirements for technical talents are becoming more and more stringent. Students are required not only to have superb professional operating skills, but also to be able to associate their skills with their jobs to quickly adapt to the working environment. Therefore, when cultivating talents, colleges must also recognize the changes in society’s demand for talents, actively incorporate post practice and training of students' professional qualities in teaching, develop and innovate 5G+VR technology, and build a virtual environment for real post work. Students can feel the working atmosphere of the company when they study in college, and carry out pre-job and operation skills training to establish correct professional values.

5. Conclusion

In summary, 5G+VR technology has its own advantages, and its integration into various industries has great development potential. For education, the use of 5G+VR technology to carry out integrated wiring and operation teaching can allow students to feel the real integrated wiring operating environment without leaving the campus, allowing students to be exposed to the knowledge and skills of integrated wiring in a virtual environment. It can greatly improve the effect and quality of comprehensive wiring training and teaching. The application of 5G+VR technology in teaching enables more practical skills and experience to be integrated into the classroom in a better way, which helps colleges to update teaching concepts and transform teaching models. In the new era, 5G+VR technology can also be fully integrated with situational teaching, game teaching, project learning and other methods to promote the long-term development of education and teaching.

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