

Research on VR Technology Innovation in Teaching of Mechanical Manufacturing and Design Major

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Abstract. The structure of mechanical equipment is compact and complex, the traditional teaching methods are not easy for students to grasp the structural principle as soon as possible, virtual reality solves this problem with its realistic effects, high timeliness, and safety and economy. This paper applies virtual reality technology to the course teaching, and comprehensively uses virtual reality technology; database technology and image processing technology construct a vivid virtual teaching scene, according to the requirements of the teaching curriculum, this paper designs and develops the fully functional "virtual teaching system". Practice has proved that the application of virtual teaching method in the teaching of mechanical course teaching has high guiding significance and practical value.

Keywords: virtual reality; machinery manufacturing and design, teaching.

1. Introduction

Mechanical engineering is the most basic industry in China's national economy and the cornerstone for supporting the rapid development of other industries and the national economy. Under the development background of intelligent manufacturing and industry 4.0, the training mode and curriculum system of traditional mechanical engineering discipline must be properly reformed and adjusted with the rapid development of the economy to meet the talent demand of the modern machinery industry. VR technology is applied to the mechanical engineering discipline, which can manifest value in machinery manufacturing and design, performance analysis, functional experience, operation training, assembly and installation, supervision and management of manufacturing processes, and can guide students to carry out engineering system learning, and has the characteristics of cost saving, operational safety and intelligent management and maintenance. The VR technology can effectively promote the reform and innovation of the existing machinery manufacturing and design major, and explores new teaching modes that conform to the law of machinery manufacturing and times characteristics.

2. Virtual Reality Technology

2.1 Connotation of Virtual Reality Technology

Virtual reality (VR) takes computer simulation as the primary condition, comprehensively utilizes simulation technology, computer network, computer graphics, artificial intelligence, which make people to communicate in a virtual environment through language, limbs, etc., virtual reality technology is now used in all walks of life, for example: communication, manufacturing, entertainment, teaching, etc. Virtual reality technology is equivalent to a graphics workstation; its application prospects are very promising. The earliest application of virtual reality technology was in the aerospace field in the 1970s, it was used to train astronauts, it was praised as the "safe, effective, and save money" training method. In recent years, virtual reality technology has approached entertainment, culture, education, building, industry and other aspects. The key technologies of virtual reality technology can be divided into: (1) environmental modeling technology, (2) stereo synthesis, stereo display technology; (3) haptic feedback technology (4) interactive technology, (5) system integration technology.

Virtual Reality (VR) is proposed by American Jaron Lanier in the 1980s, which uses computer technology construct three-dimensional digital entities with sound, light, and electricity technology

creates a virtual three-dimensional environment where people can swim in a virtual world like in the real world, operate and communicate in the digital entities of the virtual environment, highly immersed in a virtual environment. Virtual reality technology can be used to create a virtual atmosphere, simulate system by aid of microcomputer. Virtual reality sets up human-computer interaction, which is widely used in various fields. Interactivity, immersive feature and extended endless associations are all integrated into virtual reality. The system supports interaction and manifests the value of the subject in the real atmosphere. Virtual reality is increasingly being emphasized in the field of technology.

2.2 Strong Points of Virtual Reality Technology

The virtual reality technology can be used to construct a curriculum system that allows students to immerse themselves in the virtual atmosphere created and imitate reality. The teaching ways of virtual reality eliminate the dependence on textbooks and break through the regular form of class explanation. The original two-dimensional classroom is expanded and the new three-dimensional atmosphere is added. After such improvements, interactive learning has replaced the original rigid passive cognition and assisted students to understand the deep teaching connotation. The potential cognitive autonomy is mobilized in the maximum range. Moreover, virtual reality has helped to develop a higher level of hands-on skills and added innovative content. The selected course content adds authenticity, flexibility and vividness. In detail, virtual reality highlights the following new advantages: first, it adds a new connotation to teaching, the experimental teaching draws the following conclusion: the class means selected by virtual reality screening creates a more realistic and novel atmosphere, and enhances the teaching effect, second, the practice process is simulated, third, it has aroused a strong interest in cognition, fourth, virtual teaching fits the distance lectures in the current form.

3. The Teaching Problems in Mechanical Engineering Courses

Colleges and universities in order to cultivate a higher level of talents majoring in machinery manufacturing and design, only rely on the creation of a new system. The venues and equipment in universities are generally limited, Students have less hands-on opportunities. The purchase of equipment costs a large amount of capital and the categories of equipment are more. Technology is increasingly updated, and the equipment selected has not kept up with this trend. Moreover, there are still many potential risks for workshop teaching. If the control is wrong, it is very easy to suddenly fail and is dangerous. The subjects set by the mechanical major are related to a larger scope and contain more contents. Through virtual reality technology, students can understand the structure of various types of machinery. Teachers can improve class explanations that are not suitable and add new contents.

4. Build Teaching System based on Virtual Reality

4.1 Functions of Virtual Reality

The daily explanation of the mechanical course is to analyze the structure of equipment framework, the structure of the equipment, etc.; on this basis, make students controls the normal operation mechanism of various components, and familiarize sudden common faults and choose the most appropriate means to solve problems. Regular teaching follows a boring process, abstract mechanical content is analyzed. The students lacked interest and failed to improve their ability. With the help of the class analysis, students did not grasp everything that was drawn up in the outline. For daily faults, the traditional lecture simply describes the fault pattern in the hypothesis. In contrast, virtual reality relies on advanced supporting means to simulate and face the failure of a component. It can be seen that virtual reality is more likely to deepen the original cognitive impression.

4.2 Features of Virtual Reality

The system under virtual reality technology shows interactive attributes and three-dimensional characteristics, which conforms to the teaching of mechanical curriculum. From an interactive perspective, the daily training of virtual forms can adopt immersive methods, enhancement and desktop methods, and common distribution modes. After measured the combined cost, the course system is set to desktop. Virtual reality still follows the original outline system and combines the current state of teaching. For the supporting hardware in the interaction path, the human-computer interaction can select the trackball, the handle and the mouse. The console is equipped with the necessary input interface for communication, which is convenient for expanding the original virtual performance of the system. The microcomputer simulates a complex scene with a large scale and three-dimensional state, and the virtual training has better reliability and stability.

5. Application of Virtual Reality Technology in Classroom Teaching

Traditional mechanical design is equipped with a prototype model and optimization and simulation eliminates tedious redundant steps. In allusion to the designed assembly layout, virtual reality properly evaluated the movement space and got rid of the original limitations. The virtual environment is built on the technology of virtual reality, and the design of product follows the same process. The actuator can be selected to model and set up the simulation analysis in real state. This integrates the teacher's guidance and student acceptance, the digital model follows the motion simulation, and then the existing simulation scheme is corrected. The mechanical course focuses on the analysis of existing designs and design analysis. However, due to the limitations of the site and other factors, the traditional technology failed to clarify the architecture and operational characteristics of the machinery. The interactive technology that virtual reality equipped has the characteristics of rendering, transform the angle of view to facilitate observation. Teachers and students are immersed in the situation, and can understand deep operational processes and loopholes and then improved.

Mechanical design and manufacturing are major with strong practice, this course is limited by the teaching environment and teaching facilities and teaching venues, etc., students often cannot go to the mechanical factory for an internship visit, which cause students to cannot really understand and integrate. In the mechanical design and manufacturing major, the application teaching of virtual reality technology can solve the problems of poor learning efficiency and low absorption of students, present the components and parts that have been imagined in mind in front of the students in a more visual way, make students understand the parts more intuitively and positively, their assembly relationship, and the design process, and the distance between the textbook and the actual distance can be shortened. Students take different learning methods in different situations, get rich classroom and off-class knowledge, operation is easy, and error rates is reduced. Virtual reality technology can help and guide students to complete their own learning content.

6. Advantages of Virtual Reality Technology in Teaching

6.1 An Environment that can Create a Rich Learning Atmosphere

Virtual reality technology can build a production scene that makes students feel real. Students can use the input device to carry out arbitrary operations on the virtual equipment, the settings can be entered into the interior of the virtual equipment to observe its composition and working process, this is completely impossible to achieve at the production site. of. This form of teaching truly reflects that the student is the main body. Students are fully involved according to their own imagination and needs, and greatly motivate students' enthusiasm, initiative and creativity, and naturally students will achieve good learning results.

6.2 Completely Break through Traditional Teaching Methods

Through virtual reality technology, a stereoscopic, intuitive and realistic scene is created, and the content that cannot be expressed by traditional teaching is presented in front of the students, which reduces the learning difficulty, improves the students' learning enthusiasm, and naturally improves the learning effect.

6.3 Put the Training Effect into Practice

For machinery manufacturing students, major is closely related to employment. Students must not only master the basic theories of the major, but also the practical hands-on skills that the corresponding positions require, the practical training through virtual reality technology makes the students' skills certificates no longer a piece of paper, but actually useful things.

6.4 Effectively Solve the Problem of Insufficient Teaching Funds

Mechanical manufacturing equipment, especially CNC machining center equipment, is often expensive, there are not many opportunities for students to directly operate, and the establishment cost of virtual equipment is much lower than the actual equipment, and the maintenance and operation costs are also small, which can solve the shortage of teaching funds.

In addition to making students more understand content of major, the application of virtual reality technology can also reduce the school's capital investment in teaching equipment and solve the problem of insufficient updating of teaching equipment. In the mechanical design and manufacturing major, students will consume a lot of raw materials during the practice, problems such as machine wear appear, and the application of virtual reality technology does not require this expenditure. Open virtual resources can be reused, and the cost of secondary development is relatively low. The development of virtual resources has far-reaching significance for the teaching of mechanical design and manufacturing major, it plays a very important role for the teaching environment, students' ability and resource sharing.

7. Conclusion

With the development of virtual reality technology, its application in the teaching field of mechanical manufacturing and design can not only change the traditional form of relying on books and teachers, but also make the expressions in the classroom more visualized through virtual reality technology, it is easier and simpler for students to master, but the technology is not very skilled, its research and development need to be further strengthened. When the technology develops to a certain level, the cost will decrease, and virtual reality technology will be widely used in the classroom, it will become an inevitable trend as a teaching method and plays a vital role in the whole education field.

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