

# Research on the Application of Virtual Reality Technology in Medical Teaching

Yuying Wang<sup>1,2</sup>

<sup>1</sup> College of Information Science and Technology, Northeast Normal University, Changchun, China

<sup>2</sup> Modern Education Technology Center, Jilin Medical University, Jilin, China

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**Abstract.** With the continuous development of science and technology, virtual reality technology has attracted the attention of various industries. Virtual reality technology has been applied in medical teaching, rehabilitation and other fields, which provides a new opportunity for the development of medicine. This paper mainly discusses the deep integration and application of virtual reality technology and medical field from the aspects of psychotherapy, nursing and rehabilitation, medical training and teaching. The advantages of virtual reality technology in medical field are analyzed, including avoiding medical risks, Not limited by many aspects such as time and space and promoting the development of high-order thinking of operators or learners.

## 1 Introduction

After years of development, virtual reality technology has been successfully applied in many industries, providing the better opportunities for the development of various industries. With the rapid development of new generation information technology are used to generate a more realistic virtual environment. Users can operate the objects in the virtual reality environment drawing support from some head mounted display devices, data gloves, tactile feedback devices, etc. Due to the continuous development of digital technology, virtual reality technology has become an indispensable new way of treatment, teaching and training in the medical field. Virtual reality technology is widely used in medical teaching, rehabilitation treatment and simulation and has achieved good practical results, such as nursing, rehabilitation treatment, simulated surgery, skill training, teaching and so on. Users carry out corresponding operations in a risk-free environment. The whole process allows repeated and repeated operations and provides instant feedback. This makes some theoretical concepts more visualized, intuitive, three-dimensional and interactive, and makes virtual reality technology achieve good results in the field of medicine. The application of virtual reality can make the skill training and learning process repeatable, avoid some medical risks, bring flexibility and interest to medical research, training, teaching and nursing, and further improve the level of medical and health services.

## 2 The Application of Virtual Reality Technology in Medical Field

### 2.1 The Application of Virtual Reality Technology in Psychotherapy

Due to war, natural disasters, major accidents and other reasons, some people have the problem of post-traumatic stress disorder. Previous studies have proved that the use of virtual reality technology can effectively evaluate, understand and treat anxiety and depression, mental diseases and post-traumatic stress disorder (War psychological trauma). For example, virtual reality exposure therapy has achieved good results in intervening in post-traumatic stress disorder of veterans in Iraq and Afghanistan. [1,2] virtual reality technology can also be applied to the nursing and rehabilitation of stroke, and can also assist high-function autistic adolescents in virtual reality social, emotional and other cognitive training. [3, 4]

### 2.2 The Application of Virtual Reality in Nursing and Rehabilitation

Virtual reality technology can be applied to the gait training of special groups, which can guide

people to exercise learning, so as to strengthen the complex walking and reduce the danger of falls in patients with Parkinson's disease to a certain extent. [5] Virtual reality is used to detect navigation defects in cognitive aging and Alzheimer's disease. [6] Virtual reality technology can be used to intervene the decrease or loss of sense of direction in Alzheimer's disease. Rehabilitation therapy combined with virtual reality is more effective than standard methods in improving walking speed, balance ability and activity ability after stroke. [7] Virtual reality can also be used as an auxiliary non drug painkiller to treat acute burning pain in the medical process. [8] Burn patients report that in distracted immersive virtual reality, people's procedural pain is reduced by 35-50%. Other studies have shown that virtual reality technology is contribute to relieve the pain experience of cancer patients. [9]

### **2.3 The Application of Virtual Reality Technology in Medical Training**

For example, in the emergency treatment of patients with severe pneumonia and other scenes, virtual reality technology can be used to solve the problem that nurses cannot implement some operations in the real scene. Train nurses to complete the task of emergency treatment of patients through a complete and continuous knowledge system. In the virtual reality scene, patients are given corresponding symptomatic treatment in the emergency department of the hospital, treatment in ICU, correct administration and other operations, this can contribute to the continuous development of nurses' critical thinking and improve their ability to find, analyze and solve problems. Virtual reality technology allows for trial and error, and the operation can be repeated many times, which avoids risks and is more ethical and fuller of humanistic spirit. Other researchers have established cardiac medical assistance system, dental surgery simulation system and simulated appendicitis surgery based on virtual reality technology to provide complete and continuous comprehensive training for doctors, nurses and medical students, including basic training, surgical treatment, first aid, nursing, etc. [10,11]

### **2.4 The Application of Virtual Reality Technology in Medical Teaching**

The virtual anatomy table developed by Stanford University is equipped with a special display to display the scale of human body in the size of 1:1, which can help teachers better explain the adjacent relationship and structure of organs, so that learners can systematically learn anatomy in less time, which is easy to operate and can be operated through the touch screen. Learners can peel off the surface structure in a certain order to show the internal organs of the human body. It can intuitively and immersively learn the adjacent relationship of organs. This provides students with an immersive, interactive and experiential learning environment. It can fully stimulate learning interest and enthusiasm. Learners can practice and learn repeatedly in the immersive virtual training environment, so as to obtain the same experience as the real experiment. These virtual scenes can be repeated, trial and error are allowed, resources can be saved and cost can be reduced. [12]

## **3 The Advantages of Virtual Reality Technology in Medical Teaching**

The advantages of virtual reality technology in medical field are mainly discussed from three aspects: avoiding risk and promoting the development of high-order thinking of operators or learners. The advantages of virtual reality technology in the medical field are shown in Table 1.

Virtual reality technology is commonly used in medical teaching, which can repeat difficult experiments, avoid many risks and make up for the shortcomings of modern medical teaching to a certain extent. The operator or learner carries out practical operation in the virtual reality environment, which allows trial and error, repetition and reversibility. Operators and learners practice according to their own time and learning purpose. For example, in dangerous or nonrepeatable operations, it can help learners and operators accumulate and improve clinical experience and enhance learning effect. The application of virtual reality technology in training or teaching is conducive to the development of learners' high-order thinking.

**Table 1.** Advantages of virtual reality technology in medical teaching

Advantages	Main explanation
Avoiding risks and making up for the deficiencies in modern medical teaching.	The practical operation has repeatability and reversibility.
	More ethical and full of humanistic spirit.
The actual application is less limited by space-time.	This helps to improve the clinical experience of learners and operators and enhance the learning effect.
	This is more effective and economical.
It contributes to the development of learners' higher-order thinking.	This is conducive to mobilize learners' critical thinking and high-order thinking, and effectively stimulate their subjective initiative in learning.
	It is conducive to the cultivation of innovation consciousness and teamwork consciousness.

### 3.1 Avoiding Risks and Making Up for the Deficiencies in Modern Medical Teaching

The application of virtual reality technology in medical field can reduce the medical risks, make up for many shortcomings in modern medical teaching and save some educational resources. Learners can simulate the diagnosis and treatment of patients in real life in an environment without medical risk, and can better understand and develop the cognitive ability to solve professional problems on the basis of knowledge, experience and intuition. The learners are allowed to repeat exercises in the virtual reality learning environment, so that they can contact various patient situations and get immediate feedback. This is helpful to cultivate and advance the clinical practice ability of medical students. [13,14] Virtual reality technology helps learners transform abstract theoretical knowledge into specific application ability in the real world, and helps operators or learners find, analyze and solve problems.

### 3.2 The Actual Application is Less Limited by Space-time.

Virtual reality cannot be restricted by experimental specimens and reagents, break through the time and space constraints of traditional experimental training mode and teaching mode, and stimulate learners' subjective initiative. Learners can learn according to their own needs. The head mounted display device and operating lever (hand shank) adopted by virtual reality technology provide users with better immersive and interactive experience. Learners use visual, auditory and tactile senses to acquire the relevant information in the environment, and then act on learning resources through interactive functions through learners' information processing to form a closed loop of learning. Virtual reality technology can better show the difficult or dangerous learning tasks in reality, which can stimulate learners' interest in learning, improve their participation, and enhance learners' spatial ability and cognitive ability the cultivation of learners' spatial ability and cognitive ability. [15] This helps to enrich the clinical experience of learners and operators and optimize the learning effect.

### 3.3 Virtual Reality Technology Helps to Develop Learners' High-order Thinking

Higher order thinking is a kind of cognitive ability, which occurs in psychological activities at a higher cognitive level. Based on many years of classroom experience and observation of students' learning, teachers judge whether learners can make reasonable judgment on things or phenomena, have critical attitude and creative performance from the perspective of thinking level. We can effectively use virtual reality equipment or systems to carry out relevant teaching activities from a macro or micro perspective to realize the training or teaching contents that are not easy to repeat, dangerous or difficult to achieve in real life. Learners can conduct situational teaching and interaction through equipment and virtual reality learning environment, learning content and learning resources to promote meaningful learning. Immersive interactive experience and interesting operation are conducive to mobilizing learners' thinking and fully stimulating learners' subjective initiative. At the same time, it is also conducive to cultivating their sense of innovation and team spirit.

## 4 Conclusions

Virtual reality technology presents learning resources more intuitively, vividly and three-dimensional. It can provide learners with a more realistic and immersive learning experience and produce the feeling of operating in a real environment. It can promote learners' cognitive understanding of medical theory, the understanding and penetration of skills, the application of knowledge, the analysis and solution of problems, and the cultivation of thinking. The application of virtual reality technology in medical teaching, experimental operation and medical training enables learners to carry out multiple experiments in a risk-free environment. Rich technical tools not only change learners' learning methods, but also promote the renewal of teaching means and the reconstruction of curriculum.

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