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Research and analysis of virtual reality in different fields

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Abstract. Virtual reality technology is an emerging technology has been used in many fields. Because of its unique multi-perception, interactivity and autonomy, can enable users to obtain an immersive experience, enrich the sense of experience, VR is promoting the development and creation of multiple industrial fields with high speed. This article partly summarizes the application of VR technology in medical, educational and cultural fields. This paper analyzes the application characteristics and status quo of VR in the medical field, and discusses the progress and advantages of VR in education. It also summarizes the related technology of VR in culture. With the successful research and development of 5G technology, VR technology will also be improved, so VR technology will also be more widely used in various fields and promote the development of various fields.

Keywords: Virtual reality, medical field, educational field, cultural field.

1. Introduction

Virtual Reality Technology (VR) is a computer simulation system that can create and experience a virtual world, using computers to construct a simulated environment that immerses users in it. Through the use of electrical signals produced by computer technology, virtual reality technology combines real-life data with a range of output devices to create a phenomenon that can be felt by humans and conveyed through a three-dimensional model. Them may have a real-life experience in the virtual reality world, and it would be difficult to tell the difference between the actual world and the simulation, which gives users a sense of immersion; In addition, virtual reality has a super simulation system that truly realizes human-computer interaction, allowing users to operate at will and receive the most accurate feedback from their surroundings while doing so. Virtual reality has all the perceptual functions that humans have, including hearing, vision, touch, taste, smell, and other perception systems. Due to a characteristic of VR technology that allows for the creation of a 3D visualization environment, the user may have an immersive experience. Numerous industries have benefited from the widespread usage of VR technology, which has helped to innovate, advance, and improve those fields. Certain of the usage could enhance the user experience, lower some costs, or aid in technical advancements. Today, VR technology is employed in fields including medicine, gaming, and education. This review is made in the hope that it can serve as a useful resource in the future when VR technology is used in related cultural industries. With the advent of the 5G era, VR have ushered more opportunities and broader development platforms, and the future application of VR technology will also have more possibilities.

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The relevant content research is not enough comprehensive and need to further analysis and discussion. This article partly summarizes the application of VR technology in the medical treatment, cultural, and education and make a conclusion.

2. Main body

2.1. The application of VR technology in medical treatment

2.1.1. Medical teaching. Using Virtual Surgery system don't need to go through real surgery to help Assist the doctor to see all the structures of the material collection site and perform complex operations. Repeated anatomical training and training in rare cases. In addition, VR technology is gradually applied to clinical research and practice, making surgery procedure become more and more elaborate. These studies benefit medical students to combines theory and practice and strengthens surgeons' tactile ability. The three-dimensional anatomy model of the human body by entering the image data into the virtual reality system and integrating it can provide medical students with a more vivid and repeatable virtual anatomy environment.

For examples, apply VR technology in nursing education can promote students' clinical thinking, save costs and reduce resource waste. By using VR technology to teach midwives to neonatal resuscitation, allowing them to complete the learning on a zero-risk basis, skilled technicians can greatly reduce the accidental injuries caused by direct manipulation on newborns. PR is a skill that is in demand for full adoption, and needs to be mastered by every medical student. If students with lack opportunity to care for patients in emergency situations, it is difficult to cultivate their rescue ability. To this end, many countries have developed some emergency software that can simulate thousands of cases, which greatly improves the emergency judgment ability of students, such as simulating the software system for emergency patients, which allows students to provide full care for emergency patients; Nove's Microsim Medical Simulation Training System can be used by creating realistic urgent Simulation cases help students consolidate and review theoretical knowledge. The development of the software system is to enable students to master the relevant skills, reduce the number of operations directly on the patient, thereby improving the accuracy and comfort of various operations, so that patients can receive the higher quality of treatment and care [1].

2.1.2. Application in therapy

- Virtual surgery

Many clinical surgical operations require doctors to have accurate and skilled ability, some special cases due to the lack of case samples which can be used for practice may lead to doctors' mistakes in surgery. Some procedures such as encephalocele, fractures, burns and traumatic infections is time-consuming and risky, so the medical department needs to prepare in advance.

with the VR technology combined on surgical operations, the actual situation will be made into 3D animations, and through other devices to simulate the pressure sensation brought by hand operations and other feelings to make doctors immersive to the surgical environment. By predicting the possible situation under each operation of the doctor, the doctor will be familiar with the unexpected situations that may be encountered on the operating table, improve the proficiency and accuracy of the doctor, and better ensure the smooth progress of the operation [2].

- Medical treatment

According to the World Health Organization (WHO), about a quarter of the world's population suffers from some form of mental disorder. The medical community is increasingly using virtual reality to treat mental illness. At present, virtual reality technology is mostly used to treat post-traumatic stress disorder (PTSD), paranoia and depression. For example, some hospitals in California have successfully implemented a virtual reality program that allows people to swim in the sea with dolphins in a virtual environment to help people with depression soothe their emotions [3].

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During the recovery process, patients lack contact with the outside world, and the influence of the surrounding population will be infinitely magnified. In this environment, patients will focus on the doctor's point of view, the demeanor and actions of relatives and friends, and will seek negative information from a negative perspective. VR technology can divert the patient's attention and create a different life and recovery scene. Such a design will have a positive impact on medical rehabilitation [2].

2.2. The application of VR technology in education.

2.2.1. The application of VR technology in science teaching. The virtual learning courseware system for middle school students introduces VR technology, which provide a fully functional virtual learning environment. For example, in the study of biology, the human body can be more comprehensively and vividly displayed through 3D modeling functions, besides it can also a show local human tissue for students. as shown in Figure 1.

Figure 1. Human tissue learning courseware.

In the learning of physics, build a virtual mechanical assembly component object by VR and AI technology, these objects can be generated using Maya software, it can render video after generation. Complete mechanical assembly in the virtual environment can achieve teaching scene immersive, interactive, experiential, further improve the vividness and image of physics for children [3-4].

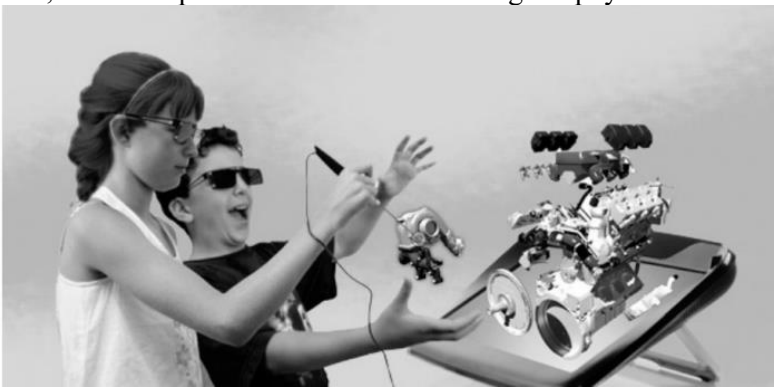

Figure 2 Teaching process of physical and mechanical assembly courseware

The interactive experiment on microscopic particles developed by SuCai's team at Beijing Normal University is mainly a study of the remedial learning effect of augmented reality-based learning tools in the middle school chemistry curriculum. The experimental design consists of four sections as shown in Table 1.

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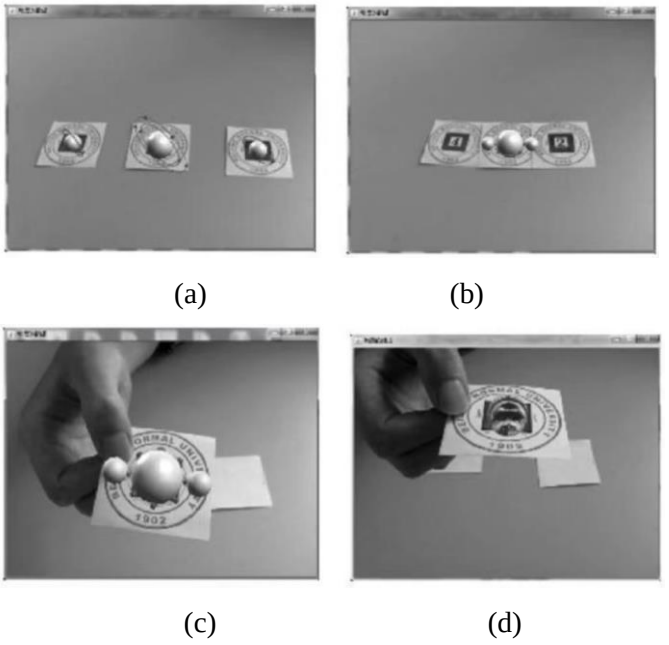
Table 1 The experimental design consists of four sections

Experiment content and method	The source of measurement tools
Pre-test：Each student completes a test paper.	The test paper was prepared by a teacher from a middle school in Shenzhen.
Randomly divide the class into three groups. Ask each group of students to use VR tools to complete the content on the learning activity sheet.	The learning activity sheet is designed by the researchers and its content is in line with the characteristics of the software and learning objectives
Post-test: Repeat the same test as the pre-test	The test paper is the same as the pretest
Students completed questionnaires	The questionnaire consists of four parts: learning attitude, satisfaction with the software, cognitive usefulness and the ease of use.

The software was created using the Java programming language along with the packages Ny Ar Toolkit, Java3D, and JMF (Java Media Framework). By capturing the label's position, you can display numerous atomic combinations and structural levels. Two hydrogen atoms and one oxygen atom are positioned in the screen, as seen in Figure 3(a). As seen in Figure 3, a water molecule is created when two hydrogen atoms are gradually brought closer to the oxygen atoms (b). As seen in Figures 3(c) and 3, students can pick up the water molecule close to the camera to examine its structure, and if they raise the label upward, a drop of water will emerge on the screen (d) [5].



(a) (b) (c) (d)

Figure 3. Numerous atomic combinations and structural levels.

2.2.2. VR Application in vocational school curriculum. Apply VR technologies in the repair and installation course, student's behavior will be monitored and analyzed by video analysis software, and warning instructions are issued when violations are found, preventing installation errors and excessive force from causing damage to the equipment.

In the marketing training class, the product update iteration is fast, and it is difficult to achieve synchronous update. Practical simulation using VR, VR immersion, 3D, interaction, and other characteristics. Students can feel immersed. Software in a VR system allows you to construct a perspective effect that allows you to see the internal structure of the product. With the software editable

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function, you can change the appearance of the product and other highlights and buying points. Product functionality can be realized by using the ability to interact. Simulate product introductions in a virtual environment to exercise students' ability to explain product introductions. The use of AI technology in the VR environment can explain the knowledge and, in the assessment, and simulation training can be achieved through the AI system to guide, simulate the customer and evaluate the function [6].

2.2.3. VR application in book. One of the earliest examples of virtual reality in education was the Magic Book, produced by Billinghurst. It is made into 3D scenes and animations based on the contents of the book, and with a special glass, children can see the combination of virtual and real, as shown in Figure 4.

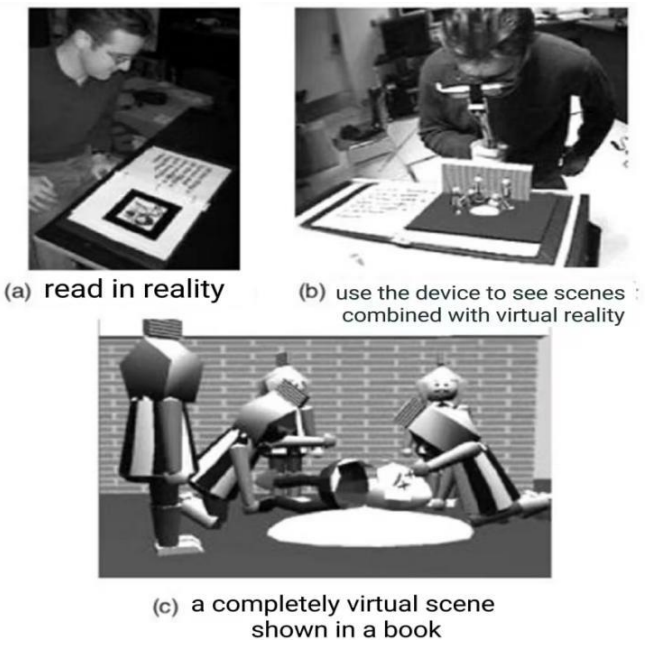

Figure 4. Magic Book.

Fables are used as a vehicle by Dunser and Hornecer to carry out the demanding tasks posed by the narrative through reading, monitoring, and assessing kids' learning behavior. According to the report, most kids think the AR environment is interesting and are interested in it. In 2010, SuCai, QianSong, and YaoTang suggested the design of the augmented reality learning environment, and on the basis of this, they created the Book of the Future, an augmented reality concept demonstration book. In order to illustrate the impact of fusing the virtual and physical worlds, the book uses experiments like the single pendulum and Newton's law in physics, as seen in Figure 4. Future Book, the first augmented reality book published in China, took part in the 17th Beijing International Book Fair in 2010 and won the praise of the participants [5].

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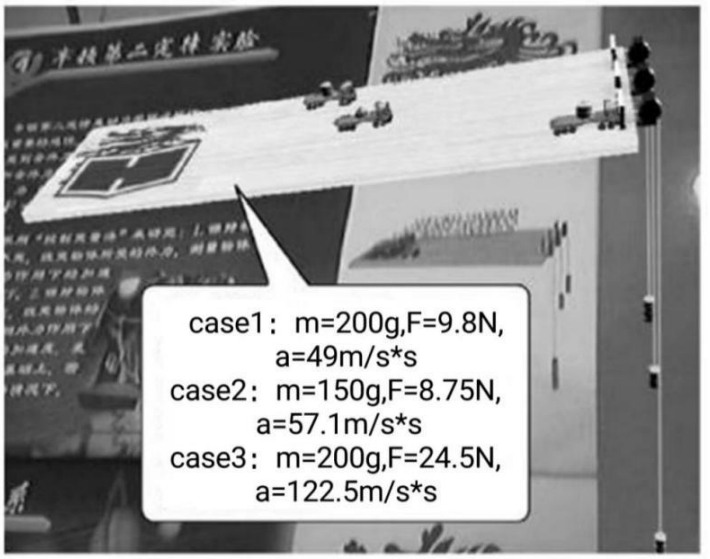

Figure 4. A three-dimensional simulation of Newton's second law on the book

2.3. The application of AI and VR technology in cultural field.

2.3.1. 3D modelling. Using 3D CAD software to draw the surface of the product to complete the three-dimensional product modeling, the texture of the ancient ceramic sheet can display the material and build a ceramic model, creating a 360° panoramic viewing effect. Subsequent restorations can be made according to the model and the 3D model allows the public to "visit" the artifacts online. The same technology can also be borrowed from the restoration of other types of cultural relics to restore the original appearance of cultural relics more realistically and reduce the workload of cultural relics restorers.

The use of 3D modeling and 3D printing for the creation of modern art can allow designers to more intuitively feel the actual effect of the finished product and reduce the cost of trial and error. Applying 3D modeling and printing to the production of artworks can promote the commercialization of designs that can be more accurately restored and production costs reduced [7].

Figure 5 Rhino+Grasshopper modeling with 3D printing example [8].

2.3.2. Motion tracking system. Film virtualization production technology based on LED background wall (LED virtualization production) refers to the display of the rendered picture to the LED background wall at the shooting site, through the camera tracking system and the real-time rendering engine, the actors perform in the environment formed by the LED background wall, to achieve "compositing" during shooting. This technology greatly improves the efficiency of virtualized production, reduces

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shooting risks, gets rid of many restrictions in the traditional shooting process, and creates a more friendly creative environment for creators in different fields such as film and television shooting, live event broadcasting, advertising production, and large-scale performances. The real-time rendered virtual background is displayed directly and recorded synchronously by the camera, making coordinate system matching between the virtual scene and the real scene more important, so the motion tracking system is the key to implementing this technology.

Due to the epidemic prevention and control stage of the Spring Festival Gala in 2021, in order to achieve the complete program effect of the artist being in a different place "on the same stage", the AI+VR production system (camera tracking system) was used to successfully complete the program. The method is: through the object space motion tracking subsystem to track the camera position, can synchronously receive lens control parameters, and through real-time transmission to the multi-LED screen stitching control rendering subsystem, through the projection transformation real-time rendering to the screen, the background content according to the scene channel machine drainage machine several lens information presented on 3 large screens to make the artist and the virtual scene content interaction more natural. In terms of visual presentation, the dynamic perspective effect of the scene is realized through the camera tracking system and the VR rendering engine, so that the virtual world and the real space are perfectly integrated (Figure 6).

Figure 6. Schematic of the camera tracking system.

2.3.3. Cultural relics exhibition. The production will be damaged due to time, temperature, humidity and other factors with the continuous development of information technology, the digitization of cultural relics has also been put into operation and born. In the dynamic version of "Qingming Upper River Map", the Song is integrated

The folk customs of the generations created a happy mood for the people of the Song Dynasty Life scenes, while highlighting the authenticity, also pay attention to improvement the experiential nature. allows consumers to immerse themselves in it and feel the cultural atmosphere of the generation, which is the successful integration of science and technology and cultural heritage cases. Dynamic version of "Qingming River Map" since 2010 Launched in many places, it has been toured in many places in China, and the digital Qingming is on river Chart has also been launched on several digital media platforms, including abroad the YouTube website also has a video of the dynamic Qingming River Map. Digital display breaks through the limitations of space and time, so people all over the world can see the paintings [9-10].

3. Conclusion

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This article reviews the application of VR technology in three fields: medical, education, and cultural industries. Among them, there are problems in the medical and education fields that require doctors and teachers to have computer levels. And in almost all VR application areas have the problems that long-term use of VR devices may cause physical discomfort such as vertigo and large initial capital investment. But with the advent of the 5G era, the improvement of AI and deep learning which use in VR technology may solve the above problems. With the improvement of VR technology, VR technology will be more widely used in various fields.

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