The Application of Virtual Reality in Education

WENHAO GU

ABSTRACT

VR, virtual reality technology, is quite popular these days. Virtual realities artificially create sensory experience, which can include sight, touch, hearing, and smell. It has had a profound impact on education, changed some of the past teaching ideas and teaching models. This paper summarizes the advantages of virtual reality technology in teaching and its application in school education, discusses the problems of virtual reality in education and puts forward the corresponding countermeasures. Our research shows that with the guidance of modern teaching theory, virtual reality can make the learners learn actively and happily and improve the teaching efficiency.

KEYWORDS

Virtual reality, education, application.

INTRODUCTION

VR, virtual reality technology, is a computer technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment in a way that allows the user to interact with it [1, 2]. Virtual realities artificially create sensory experience, which can include sight, touch, hearing, and smell. VR has three characteristics: immersion, interaction, imagination. Immersion means the view that simulated by VR is so vivid that you cannot tell the virtual world from the real world. Interaction means the interaction between the user and the virtual world. Imagination means VR can create a hyper-reality feeling for the user.

VR is still an extremely popular technology these days though it has been promoted forty years ago [3]. VR was first promoted by Jaron Lanier in early 20th century who has first invented VR device [4]. During the last forty years, VR hasn’t developed very fast because of lack of technology while VR must have a perfect foreground for it will have broader prospects of development. Nowadays many high-tech giants have all invented and rolled out their own VR products to occupy the new market such as the Samsung Gear VR, Microsoft Hololens, and Facebook Oculus Rif and so on. VR now is mainly used in the entertainment field to give the players or the viewers a virtually real feeling especially via vision. And more and more systems are supporting VR device such as Windows and Android. Google, Oculus and specified systems for VR device are exploiting by Razer. More than that VR can be used in many kinds of fields right now and in the near future. In the field of industry, VR can be used to design and virtualize some new products before its production. In the field of education, VR can be a good tool to show the learners a vivid and virtually real model of what they are learning. Besides, VR may play a significant role in the field of medical science [5, 6].

Wenhao Gu, School of Physics and Astronomy, Yunnan University, Kunming 650000, China. 2361902221@qq.com
VR is a powerful tool that can be applied in many fields, including education, industry, clinical medicine and so on [7]. The paper reviews the applications of VR technology in education. In particular, combined with the examples in teaching, this paper summarizes the advantages of virtual reality in teaching, and sums up the application of virtual reality technology in school education. Meanwhile it points out the deficiencies of VR technology and relative modifications.

THE ADVANTAGES OF VR IN EDUCATION

Today, with the rapid development of information communication technology, the existing human education content and educational methods are become more and more diversified. Because of the characteristics of virtual reality technology, it has the unparalleled advantages of previous technology in education.

Developing the thinking and exploring ability of students

As one of the core contents of educational technology, the fundamental difference between VR and other teaching methods is that it breaks the teaching mode of traditional one-way imparting knowledge. This educational model provides a wealth of resources and convenient space for students to develop divergent thinking, maximizing their initiative and enthusiasm. VR combines students’ learning, practice and self-test to form a vivid, lively and active way of teaching, which is not accessible to any traditional way of teaching and has an irreplaceable function and role.

VR can combine text, image, sound and animation organically, so that the all-round and multi-perspective teaching scene will be presented in front of students. This kind of illustrious heuristic teaching method and situational teaching method constantly stimulate the students' senses, stimulate the students’ interest in learning and enrich the imagination of students, thus cultivating students’ divergent thinking, laying a good foundation for the cultivation of innovative thinking.

Differential treatment, improving the initiative of students

Because students have different social, cultural backgrounds, knowledge structures and personality characteristics, so the learning styles, thinking patterns are also significantly different. In the traditional teaching model, teachers cannot develop a personalized education program for each student. However, VR with characteristics of human-computer interaction is applicable to individualized education, achieving individualized learning, cultivating high-quality comprehensive talents.

VR is a high-level human-machine interface with immersion, telepresence and multidimensional sense, and students can interact with it in real time through a variety of sensory channels. Students interact with the computer through sensory, language, gestures, and even expressions that are "natural", and completely immersed in a "beyond real and immersive" comprehensive learning environment. In this new environment, students' autonomous learning space is more extensive, creative thinking is more active, learning effect is unprecedentedly improved.
Breaking the time and space constraints completely

The previous teaching exchange can only be limited between teachers and students, lack of collaboration between students, while virtual reality teaching overcomes the limitations of space and location, allowing long distance teachers or scattered students in a virtual space. In addition, virtual reality system can create a humanized learning environment by virtual characters, great people, celebrities, teachers, students, doctors and so on, so that distance education students can learn in a natural and intimate atmosphere. For example, in foreign language teaching, you can use the computer virtual students to foreign tourism situation, so that students and foreigners exchange ideas, experience the local customs, achieving the purpose of training students to speak. Another example, in the ideological and moral teaching, students can communicate with virtual advanced people (such as Lei Feng, Finsen Kong, Martin Luther King Jr.), to influence students through the words and deeds of advanced characters, realizing the ideological and moral education.

Obtaining tacit knowledge through virtual practice

Tacit knowledge can be expressed by behavior, rather than systematic description, formal transmission and reflection of knowledge. Due to the above characteristics of tacit knowledge, it is not often taken into account. However, this does not mean that tacit knowledge is of no value or insignificance in human practice. On the contrary, tacit knowledge is a very important type of knowledge. In fact, it dominates the whole process of people's awareness activities, and it is the "guide" that people get explicit knowledge.

Tacit knowledge is obtained through practice. However, in the traditional formal learning, people think that explicit knowledge is the whole of knowledge, only emphasize the grasp of explicit knowledge, and not fully aware the value of tacit knowledge. Under the pressure of knowledge explosion in modern society, people are increasingly focused on learning the text (explicit knowledge), while the practice is in a subordinate position. On the one hand is lack of understanding of tacit knowledge, on the other hand is the restrictions of objective conditions. The limitations of objective conditions include the following two points: 1. the practice is not easy to get; 2. in the pure natural state, the complex practical activities easily affect the learning effects. In the virtual environment, these problems can be resolved fundamentally. Because in the virtual environment, learners contact with the learning material is no longer purely symbolic knowledge, but with the practice of essentially related activities. As a result, learners learn tacit knowledge while learning explicit knowledge.

Making up for the lack of teaching conditions and avoiding danger

VR can solve the problems of lack of experimental equipment, models, and teaching funds and so on, and will help to solve the various dangerous problems brought about by non-visual, non-touch, or the real experimental operation. Students can do all kinds of experiments at home, getting the same experience with the real experiment, deepening the understanding of teaching content. In the past, for dangerous or harmful experiments to human bodies, we generally replaced the experiment by way of video recording, students couldn’t directly participate in the experiment. The use of VR for virtual experiments, you can avoid this concern. In the
Virtual experimental environment, students can do all kinds of dangerous or harmful experiments safely.

THE APPLICATION OF VR IN EDUCATION

Virtual reality campus

Virtual campus is the use of VR to create a virtual campus scene, it is earliest specific application of VR and network in the education. In the virtual campus scene, learners play a virtual student role. Learners can walk on virtual camps and talk to other virtual learners. In the virtual campus, the office manages learners’ information, the library provides learning materials for learners to inquire, the teaching building provides classrooms for learners; even a formal identity of the user can find an empty classroom and put his/her own preparation materials in the room, a new course is opened for learners to learn. If the classroom is not enough to use, the campus can also provide a new teaching building. Virtual campus will help the learners overcome the hindrance of distance.

Virtual reality entity

Virtual reality entity refers to the use of virtual reality method to show the actual objects that used in teaching. Students can move, rotate, or scale virtual entities according to their own ideas, completing the meaning construction of knowledge through the operation of virtual objects. Such as the chapter of "mechanical wave" of high school physics, if the teacher talks about the theory of the wave blindly, it is difficult to attract the attention of students. However, if we use VR to virtual flag, let the students flap the flags to watch the movement of flags; or we use VR to virtual lake, let the students drop stones to observe the ripples. It is easy to introduce students into the world of the wave and further into the sound waves, electromagnetic waves of these invisible things.

Figure 1. VR lab, Source: TED: Michael Baedeker: This virtual lab will revolutionize science class.
Virtual reality experiment

Virtual reality experiment is an experiment that may do serious harm to human life or cannot be performed normally under the existing conditions. According to the scientific theory, a virtual experiment is designed by virtual reality methods. Students can observe the experiment process through virtual experiment. Through the virtual experiment, students can observe the experimental process and understand the experimental results, completing the meaning construction of knowledge. Using VR to provide a virtual experimental environment, students in the virtual laboratory can complete all the experimental steps. The system provides experimenters a video window to observe the experimental process, the illustrated experimental knowledge, the rich and relevant experimental data, the flexible experimental interactive process, the timely and convenient experimental guidance, so that experimenters get a new feeling in the process of completing experiment. At the same time, the teachers don’t need to be present in the experiment, the experimenters can complete the experiment through their own efforts to meet the requirements of the syllabus, because the virtual laboratory has the aid features of navigation, self-test, self-evaluation.

Virtual reality role play

Virtual reality role play means that let student play a role in the virtual teaching situation, give full play to student’s initiative, enthusiasm and innovation, through collaboration, conversation and other learning methods, students can complete the meaning construction of knowledge. In the English language teaching, by the VR, students can chat with foreign friends cordially and feel the atmosphere of the US presidential campaign speech. When a student playing a role, VR can also serve to create a specific context. In the past, the role play of students could only be carried out in the classroom, but students cannot devote themselves to performance. However, VR can make students immersed in the teaching environment completely, which will improve the students' oral ability greatly.

DEFICIENCIES OF VR

Despite over forty years of development and the wide use of VR nowadays, VR technology still doesn’t mature and it still has several deficiencies. VR is now mostly applied in vision while it doesn’t mature in haptic and audition. In addition, VR now depends too much on the wearable-device in order to cover the real world. However, the inconvenient wearable-device may impact the experience of VR users. And the device can also be a threat to our health. For instance, the users may feel dizzy and queasy after they wear the heavy VR device for a long time.

Some modern technology such as auto stereoscopy technology, touch simulation technology and the Sound Retrieval System can modify the deficiencies.

CONCLUSION

The paper reviews the applications of VR technology in education. In particular, combined with the examples in teaching, this paper summarizes the advantages of
virtual reality in teaching, and sums up the application of virtual reality technology in school education. Meanwhile it points out the deficiencies of VR technology and relative modifications.

Although VR has some deficiencies, modern technologies are under development and they may help VR make a big difference in the near future. VR must be much more powerful and widely-used at that time.

REFERENCES