

Immersive Learning: Characteristics of Development of VR Education Technology and the Practice

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Abstract: In recent years, the application of virtual reality (VR) technology has been witnessing explosive growth. In the field of education, VR provides the learning situations of “immersion”, “interaction” and “imagination” for modern education. Its application in education brings a series of actions that optimize conventional teaching concept and methodology, as well as a new perspective for future cultivation of teachers' ability. Researchers of educational technology need to rationally understand the potentiality of the application of VR in education, carry out in-depth analysis of the current application of VR in education, and specifically reflect on the existing challenges from the perspective of education. This article gives an overview of the development of VR educational technology, and summarizes the characteristics and practices of this technology.

1. Introduction

VR, also known as immersive multimedia or “computer simulated reality, is considered to be an important development discipline in the 21st century and one of the important technologies that affect people's lives. It is a new technology that combines achievements in many fields such as computer graphics, human-computer interface integrates the achievements in multiple fields including computer graphics, human-machine interface technology, sensor technology, and artificial intelligence technology, aiming to improve the function of human-machine interaction and achieve real visual, tactile, auditory, and olfactory experience effects. In exploration of remote education, VR has played an important role by providing satisfactory support to construction of construction of a remote education platform. At present, a key issue to be explored and studied is to strengthen the research of VR education technology, so that better application can be achieved in practice by giving full play to its characteristics.

2. Overview of VR Education Technology

VR is an extension of computer technology. In the interactive virtual world constructed by a computer, users can feel the virtual world with enhanced perception through sensory experience with relevant equipment, whereby their experience is improved in the virtual world^[1].

In education and teaching, VR can generate an immersive virtual world in which learners feel the fun of learning, thus facilitating the achievement of teaching objectives. It is fair to say that VR teaching is an extension and upgrading of multimedia teaching, being a novel teaching method in

current social development.

The VR-based immersive learning environment makes comprehensive use of stereoscopic glasses, data gloves and various tracking systems such as helmets and joysticks to make teachers and students feel completely immersed in the real scene to observe things. In a traditional classroom, students are not aware of molecules and their volumes in 3D space with the help of 2D graphics and teacher explanations, but by using a 3D virtual learning environment, students can easily understand that molecules are not flat. The 3D animation in the VR device allows students to better perceive the changes in molecular structure during a chemical reaction than in a 2D display, because students can pause or rotate the animation, move forward or backward to get a better view. The virtual classroom built by the immersive learning environment can facilitate students to ask more questions and enhance interaction with the teacher to some extent (As shown in table 1).

Table 1: Application cases of VR technology^[2]

No.	Core Techniques	Affiliated organization	Technology application	Application introduction
1	Virtual Reality	EON Reality	EON Virtual Trainer	Apply artificial intelligence technology to build Virtual Classroom
2		MIT&Smithsonian	Vanished	Real-world games to support collaborative learning
3		Pearson	Revel	Immersive digital learning tools

3. The Main Features of VR Education Technology

Burdea & Coiffet (1992) summarized the important features of VR as “3I”, namely immersion, interaction, and imagination (As shown in figure1).

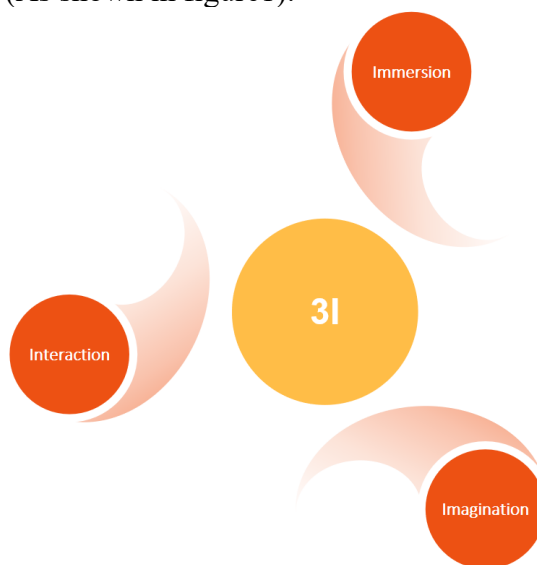


Figure 1: The important features of VR as “3I”

3.1 Immersion—provide an immersive experience

The main advantage of VR is that it allows users to be immersed, which is unmatched by other technologies. VR brings users into an immersive training environment, so that learners' knowledge

retention can be improved. According to the teaching theory, the knowledge acquired through experience is more firmly retained than that acquired through pure learning.

3.2 Interaction-improve learners' knowledge retention

Interaction: Interaction refers to user's perception and operation environment. The conventional human-computer interaction is an interaction with computers through the mouse and keyboard, while VR interaction is the most natural interaction with any object in the virtual environment through sensors. Users can operate and experience objects in the virtual environment as good as in a real environment. For example, user can truly feel the fall of an object and feel the gravity and grip when holding a virtual barbell.

Another advantage of VR is that it gives learners more experience through interaction. Although the experience is virtual, the learner's knowledge retention is improved. By generating a vivid three-dimensional multi-sensory environment through a computer, graphics workstations and other relevant equipment, VR makes participants feel being immersed. Meanwhile, the environment also produces corresponding feedback on their behaviors, so that in-depth integration and interaction between people and environment are achieved.

3.3 Imagination-providing curriculum teaching that is not feasible in reality

Imagination: Imagination, which also refers to creativity, means the users' ability to imagine the future through association, logical inference and other thinking processes based on their interaction with objects in a virtual environment. The virtual environment is also imagined by the designer, which can be the reproduction of real phenomena or the designer's own imagination.

VR education technology can provide learners with curriculum training whose practice and feasibility are hardly available in reality. In VR education technology, learners can be immersed in the teaching scene to make own exploration of teaching activities. They can experience experimental activities that may be dangerous in real teaching, interact with unknown creatures, and learn in scenes that are dangerous and not accessible in real life. Take chemistry teaching for example, teachers may teach dilution experiment of concentrated sulfuric acid. In VR scene, the serious consequences of experimental mistakes can be simulated, and learners can develop deeper understanding of the experiment through such experience; in medical teaching, learners can carry out simulated operation of radioactive machine without facing the threat of radiation^[3].

With the help of VR, learners gain immersive learning experience that is not easily available in conventional book teaching, thus improving knowledge retention. VR also brings changes to ways of learning, and lots of educational institutions have tried the application of this prospective technology. For enterprises, training with VR also brings great benefits. In the real-world scenes constructed with VR, trainees can make more practice and acquire the skills for working in a dangerous environment without risks.

4. Practical Application of VR in Teaching

4.1 Improvement of teaching efficiency

In practical teaching, VR can visualize some more abstract knowledge to allow learners to receive vivid experience, so that they develop more direct understanding. In classroom teaching, teachers can bring students to a virtual world created with VR, where students can simulate and verify the knowledge in textbook through immersive learning. Their enthusiasm for learning can be improved, which improves classroom learning efficiency and reduces the difficulties in understanding.

4.2 Improvement of students' imagination

In the teaching, students can breach the spatial limitation in learning with VR and display their ideas and ideas in the virtual environment. At the same time, in the demonstration of practice, they can always fine-tune and modify their ideas to develop the thinking ability. VR education technology can improve students' imagination and deepen their understanding of teaching content.

4.3 Improvement of interactivity of teaching

In the teaching, VR allows students to learn and interact in a virtual environment, and have communication and exchanges which are restricted in reality. Therefore, students can devote themselves to teaching interaction, deepen the understanding and research of knowledge through exchanges and activities, whereby the teaching is significantly improved^[4].

5. The Drawbacks of VR Teaching Technology in Contemporary Education Activities

5.1 High equipment price and prolonged preparation of teaching content

As often as not, VR equipment is expensive at market. It often sold at relatively high prices on the market. The comprehensive VR education will demand significant increase of education cost. Furthermore, the production cost of VR courseware is also very high with a long production cycle, and considerable occupation of memory. Due to high cost and low efficiency, many colleges and universities cannot select the teaching content based on their actual situations, but passively choose existing teaching resources. Since it's difficult to constantly update the content in VR teaching, the teaching efficiency is not very satisfactory. In addition, due to high requirements on professionalism of producers, there are also certain difficulties in content production in VR teaching. It takes professional a prolonged time to complete the production of teaching content, which is beyond current education situation in China. Therefore, VR technology cannot be fully popularized at present.

5.2 Proneness of causing students' addiction to virtual world

When VR teaching is adopted, students may easily get addictive to virtual world and fail to distinguish between virtual and reality if they are not properly guided. As a result of which, they will gradually lose enthusiasm for learning and become addictive to the virtual world. Even worse, some students who yearn for virtual world will invest a lot of money in purchase of virtual equipment, which will lead to a decreased learning efficiency.

5.3 Physical problems caused by excessive use of VR

The best imaging effect of VR is often achieved at a distance of 20—50cm from eyes. Long-term wearing of VR helmets will cause long-term tension of students' vision, which is harmful to eyes and easily induces myopia. In addition, the use of VR equipment also causes tension to students' brain. Some students will experience severe dizziness and even nausea and vomiting when using VR equipment. At present, VR equipment is mostly head-mounted, and high-quality equipment is often heavier, which can easily cause compression to students' cervical vertebrae.

6. The Development Orientation of VR Teaching Technology

6.1 Openness and sharing of VR teaching resources

The application of VR in teaching in an all-round way cannot be achieved merely relying on schools and enterprises. The government departments should also increase investment in VR education or formulate corresponding policies, so that enterprises, governments and schools can work together to lower the cost of introducing VR equipment and that VR can be better applied to teaching.

In addition, producers of VR teaching content should be encouraged to constantly update, enrich and improve the teaching content, so that VR teaching content can achieve higher use efficiency and stronger universality. With regard to VR teaching resources, a shared resources platform can be developed for unified planning and the construction of resources sharing database, thus bringing down the production cost and avoiding repeated development. In this way, VR teaching resources can achieve better coverage of teaching content.

6.2 Further integration of VR technology and teaching content

VR enables the expression of abstract concepts in teaching materials in a virtual environment, so that students can strengthen their understanding and memory of knowledge through rich experience and increase learning interest. However, additional teaching tasks are often added in VR teaching, which easily causes waste of time in learning. Furthermore, such irrelevant content is usually most attractive to students and easily make students addictive to the virtual world. Therefore, when adopting VR in teaching, teachers must clarify and highlight their teaching tasks and goals instead of casual VR display that allows students to experience in the virtual world at will.

6.3 Moderate use to avoid affecting the body

Since VR has great advantages in teaching and also appeals to students, teachers and parents they should conduct proper control over the times and duration of use of VR and actively guide students to use the equipment correctively, so as to prevent their addictiveness to the virtual world and the cause of myopia and cervical spine problems.

7. Conclusion

With rapid development of information technology, the effect of VR will be more significant in educational practice. It will not only improve the utilization of educational resources, but also enable the intensification, standardization and modernization of education, which is of great significance to the reform of education and the overall promotion of remote education. At present, VR education technology is still not mature with certain drawbacks. Therefore, more explorations should be made in the future to seek the solutions.

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