Construction of VR Learning Environment Based on Embodied Cognitive Theory

Junjie Yang[1, a], Xiaoxia Wang[2, b] and Chengyao Shi[1, c]

[1]Tianjin University of Technology and Education, Tianjin 300222, China;

[2]Jie Shou NO.1 Middle School, Jieshou 236500, China.

[a]986222703@qq.com, [b]243347505@qq.com, [c]470375801@qq.com

Abstract

Embodied Cognition and virtual reality are hot topics in the development of contemporary cognitive science and information technology innovation. Research on VR learning environment and construction is of great significance. In this study, the cognitive theory of the body is expounded and the concept of virtual reality is defined. The relationship and coupling degree of the cognitive and VR technologies are discussed. The VR learning environment is constructed. The HoloLAB Champions are introduced in detail. In the typical case, the author concludes that the construction of the VR learning environment should pay attention to the following four aspects: one is to combine the immersion of VR technology; the other is to create a virtual environment with rich interaction and multi-perception; the third is to design a personalized learning environment; The fourth is to stimulate the imagination of the learner. Based on this research, we propose the direction of multi-person collaborative virtual learning environment.

Keywords

Physical cognitive theory,Virtual Reality,Learning environment.

1. Introduction

When the cognitive theory of the body is not proposed, the design of the learning environment is mainly based on theories of behaviorism, cognition, constructivism and connectivity, especially the most important theoretical foundation for constructivism design. These theories are not well integrated with the modern learning environment characterized by deep immersion, rich interaction, and imagination. However, the cognitive theory of the body thinks that “physical and mental unity” can better build knowledge, and VR technology is more It is characterized by 3I, and the two can be well integrated. Therefore, this paper studies how to build a VR learning environment.

2. Embodied Cognition Theory and VR Technology

2.1 Embodied Cognition Theory

Embodied cognition is an emerging field of research in psychology. It was first proposed by the psychologist James J. Gibson in 1979. The two basic ideas put forward are environmental. The innate instinct of providing and perceptual reflection provides a theoretical basis for the introduction of “informed cognition”. The biologist and neuroscientist Varela, the philosopher Thompson, and the cognitive scientist Rosch are equal to the 1991 issue of "Physical and Mental Intelligence: Cognitive Science and Human Experience". [1]. Varela and others believe that when individuals are active in the environment, actions affect perception, and perceptions will influence future actions. Future actions then determine new perceptions, and so on, forming a “perception-motion cycle” [1]. It can be seen that "ecological perception theory" and "physical and mental wisdom" both emphasize two points: First, the formation of perception depends on the environment; second, the environment can affect perception.

In China, Wang Yangming's view on "integration of knowing and doing" is to verify the relationship between environment and cognition. "The eyes, eyes, noses and legs are all in the body, and the body is also. The non-heart can listen to the rhythm? The heart and the mind are audible, and there are no ears, nose and mouth. It can't be. Therefore, if you don't have a heart, you don't have a body. If you don't have a body, you don't have a heart." ("Biography"). The heart is the master of the human ear, the mouth, the mouth, the nose and other sensory organs, and through them to contact with the outside world, resulting in emotions such as joy, sorrow, love and evil. Therefore, the heart and the body are interdependent and inseparable, and the heart here refers to cognition, and the body refers to the external environment.

It can be seen that our brain and body behavior interact with each other. The brain can influence behavior and behavior can also affect our brain cognition. This is a further proof of Wang Yangming's theory of knowing and doing.

2.2 Virtual Reality Technology

VR (Virtual Reality, VR for short) is based on computer technology and head-mounted display technology. It integrates sensors, eye trackers, data gloves and big data to generate and view a range of real environments. A highly approximate digital environment with touch and other aspects, and human-computer interaction through handles, data gloves, etc., to achieve the technology that can expand the perception boundary effect of humans [2]. As a computer simulation technology that can create and experience virtual worlds, VR technology can meet the needs of VR applications for network bandwidth and delay, and can truly achieve immersiveness, combined with the current 5G technology with peak transmission rate of 10Gbps. The VR platform is considered the next generation computing platform, and VR glasses are also considered to be the last screen of humans.

In 1994, Burdea et al. [3] summarized the basic characteristics of VR with 3I (Immersion Interaction Imagination) in "Virtual Reality Technology". From the three basic characteristics of virtual reality, it can be seen that immersiveness: the experiencer is virtual The three-dimensional environment can produce a feeling of approaching reality, thus deceiving one's own brain, thinking that it is in a real environment, which is the best effect of virtual reality in order to achieve; interactivity: between the experiencer and the three-dimensional environment Direct or indirect contact, the environment and the experience of the person's dialogue; imagination: the process of cognition, the existence of association and creation. It can be seen that immersion is the premise, interactivity is the process, and the final result is imaginative.

3. The Role of VR in Constructing Embodied Learning Environment

3.1 The Coupling of Embodied Cognition in VR Technology

In the 21st century, technology is everywhere, and it always affects our lives. The American philosopher Don Ihde puts the relationship between man and technology into the consideration of personal cognition, and proposes that technology is the medium for people to perceive the outside world, and also the structure of the environment [4]. It can be seen that people are in an environment of technological composition. Ihde pointed out that the relationship between people and technology is divided into four types: the first is "personal relationship", that is, "(I-technology)->world", in this use situation, the individual is in a special way. Incorporating technology into one's own experience, individuals use technology to perceive, and thus transform the individual's perception and body feeling; the second is "interpretation relationship", that is, "I-> (technology-world)", refers to people Using technology to gain an explanation of the external world [4]; the third is "it's different relationship", that is, "human-> technology - (world)", referring to the relationship between technology and the external world, technology can enter various freedoms In the combination, it constitutes activities such as games, art or sports [4]; the fourth is "background relationship", and the technology gradually degenerates into an undetected life background and becomes a part of people's life [4].

VR technology takes 3I as the basic feature, and the highest level of achievement is “background relationship technology”, which makes VR technology gradually degenerate into an undetected life background and become a part of people's life. The cognitive theory emphasizes the relationship between environment and cognition. The relationship needs to be real, but the body does not perceive its existence, that is, the non-existence of technology [5].This achieves a VR environment.

3.2 Embodied VR Learning Environment

Jonassen (1999) argues that the learning environment is a space for learners to learn together or support each other. Learners control learning activities and use information resources and knowledge building tools to solve problems. Jonathan believes that the learning environment is supported by technology. In the process of learning, technology is a tool for learners to explore, construct reflection and learning, put forward the importance of cognitive tools and learning strategies, and consider the support factors of social background. [6]. Compared with the ordinary learning environment, the VR learning environment is characterized by digital, virtual, open, immersive, interactive, and imaginative. The VR learning environment adds VR elements to the normal learning environment. But it is not limited to simple superposition, it is a multi-factor integrated, new learning environment.

With the gradual popularization and maturity of VR technology, the VR learning environment has great advantages: First, it is more immersive in the learning environment. As the technology matures, the virtual learning environment is more realistic and can be Create multiple virtual environments for learners to choose from, to suit the learner's different learning styles, cognitive habits, emotional structure, existing experiences, and so on. Although the traditional learning environment is in it, the environment is not easy to change once it is formed. This limits the creativity of learners who want to experience multiple learning environments. Over time, there will be annoying emotions. Second, the diversity of interactions, along with VR hardware equipment eye tracker, data gloves, etc. are constantly updated, can simulate real-life interactions, such as vibration, sound, gaze, hug and other physical movements, can achieve the effect that the real world can not achieve; third is rich imagination, this It is the most important feature of the VR learning environment. In the case of immersive and interactive, the learner will generate knowledge transfer, which is also the optimal learning effect; the fourth is the learning experience created by hands-on [7], if the experiencer has a certain modeling and programming foundation, you can build a personalized learning environment according to your actual situation, in order to achieve the purpose of knowing its root cause.

4. Construction and Application of a Embodied VR Learning Environment

The VR learning environment is a computer-supported virtual learning environment constructed using virtual reality technology [8]. This environment combines virtual 3D objects to create a learning environment that transcends real and interactive. There are three basic principles for the construction of a VR learning environment: one is immersive, there must be a feeling that the experiencer can be immersive; the second is interactivity, friendly prompts and interactions in the virtual environment are very important; Imagination, in the virtual learning environment, enables the body to achieve the transfer of knowledge, so that learning from the "Out of the body" to the "Embodied " new realm [8].

In October 2018, developer Schell Games teamed up with students, educators and RAND to bring HoloLAB Champions on the Steam platform. HoloLAB Champions is a chemistry-themed game-based virtual reality chemistry lab. Available for $9.99 on Steam, it is available for Oculus Rift and HTC Vive. It is free for teachers, students, and educational institutions. The 30-40 minute duration teaches players basic chemistry skills, procedures, and operational skills. There is a moderator (called Earl) in the lab, which is equivalent to a friend to guide the learner to carry out the step-by-step operation [9]. There are currently only two scenes. The first scene, Chemiluminescence, teaches students to mix the right amount of liquid and solid ingredients to create a chemical solution that can react. These experimental data are of very high accuracy and accuracy, especially in liquid tests, which can be accurate to every milliliter, just like in a real laboratory. The second scene, "Identify Unknowns," shows students a range of substances, and with limited reference information, the player

must correctly identify each substance. Depending on whether the player can complete the task safely and accurately, they can get rewards and complete an event to reward an elemental trophy. In addition, a training mode is provided that allows players to practice previously learned skills to cope with the next round of challenges. Jell Schell, CEO of Schell Games, said: "HoloLAB Champions is important because it teaches students science and laboratory safety knowledge in an educational and engaging environment, and virtual reality is still a new one. Relatively untapped space, so we are happy to see it being used in the classroom environment. [10] "It can be seen that HoloLAB champion provides a new way for students to learn basic laboratory experiments and also for educators. Provide resources to bring games into the classroom and create a virtual experimental environment that is fully committed.

In addition, Khanal and Vankipuram et al. [11] designed a VR-based ALCS emergency system to help participants learn and train knowledge in a virtual collaborative environment. Recently, the developer VRLab Academy released a VR application of VRLab Anatomy interactive human anatomy map on Steam. It can explore 8 kinds of human anatomy systems in the laboratory, show the real model of human anatomy, and add a medical A new way of learning and teaching.

The main feature of the VR learning environment is the interactive multi-perceived virtual learning environment. Therefore, the construction of the VR learning environment should pay attention to the following points: First, combined with the immersion of VR technology, individuals can use VR technology to perceive, And it is transformed into the individual's perception and body feeling; the second is to create a virtual environment with rich interaction and multi-perception, fully mobilize the learners' perception, sensation and sensation, to expand their perception, strengthen the learning experience and promote knowledge. The third is to design a flexible and open personalized learning environment, so that students can freely move, explore and communicate, so that students can actively participate in the environment; Fourth, imagination, in the VR learning environment, Promote the transfer of learners' knowledge.

5. Conclusion

The cognitive theory of embodiedness emphasizes that learning knowledge requires not only the participation of "heart", but also "body" is the same. "Body and mind unity" can achieve the best state of knowledge construction. The construction of VR learning environment should fully consider the immersion of learning environment. Interactivity, imagination, and multi-perception, focusing on the posture and movement of the body to participate in the situation. The framework of the learning environment is for better knowledge transfer, embedding knowledge into the learning environment without the learner's perception, binding to the space and time of the related objects, and the learner can manipulate the object effortlessly. Interaction, free from time and space constraints, to participate in the learning process, to stimulate the learner's imagination.

References

[1] Shapiro: Embodied Cognition (Huaxia Press, Beijing 2014)Li Hengwei, et al.

[2] Zhao Yuping:Overview of Virtual Reality,Chinese Science(F Series:Information Science), Vol.39 (2009) No.1 p.2-46.

[3] Burdea G,Coiffet P.Virtual Reality Technology.NJ:John Wiley and Sons,1994

[4] Don Ihde.Technology and Life World: From the Garden of Eden to the World(Peking University Press,Beijing 2012)Han Lianqing, translation.

[5] Wang Jing,Chen Weidong:The Cognitive Theory of Body and Its Enlightenment to Teaching Design and Technology,Journal of Distance Education,Vol 30 (2012) No.3,p.88-93.

[6] Information on https://baike.baidu.com/item/learning environment/3449654.

[7] Liu Geping,Xie Tao:Overview of 3D Virtual Learning Environment,China's Electrification Education ,(2015) No.9.p.22-27.

[8] Huang Hongtao, Meng Hongjuan: How to promote physical concept understanding in the mixed reality environment,Research on Modern Distance Education,(2018) No.6,p.28-36.

[9] Information on https://www.vrfocus.com/2018/10/educational-chemistry-experience-hololab-champions- arrives-on-oculus-rift/

[10] Information on http://www.arinchina.com/article-9232-1.html

[11] Khanal Prabal,Vankipuram Akshay, Ashby Aaron,et al.Collaborative virtual reality based advanced cardiac life support training simulator using virtual reality principles[J]. Journal of Biomedical Informatics, 2014,51(C):49-59.266/5000