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Construction of learning environment based on virtual reality technology

Sheng Zeng

School of Information Technology Engineering, Tianjin University of Technology and Education, Tianjin 300222, China

Abstract

Virtual reality technology can provide a richer and more vivid learning environment, which is conducive to enhancing students' interest in learning, mobilizing learning enthusiasm, and helping students to establish connections between new and old knowledge and construct diagrams. Based on constructivism, situational cognition and embodied cognition theory, this paper discusses the principles of virtual reality learning environment construction, and designs a virtual reality learning environment construction model from the learning environment elements.

Keywords

Virtual Reality; Learning environment; Constructivism; Embodied cognition.

1. Theoretical basis

1.1. Constructivist learning theory

As the basis of virtual reality technology, constructivist learning theory advocates "scenes" which are just models and scenes under virtual reality technology. Students can obtain real experience in similar virtual scenes, fully mobilize the original knowledge and experience, so as to obtain new knowledge and complete meaningful construction.

According to the idea of constructivist learning theory, when using virtual reality technology to develop the learning environment model, it is necessary to build an interconnected whole, connecting concepts, theories, methods and technologies, rather than simply focusing on the realization of technology.

1.2. Situational cognitive learning theory

In the learning process of learners, some periods are crucial. At this time, educators should build "scaffolding" for learners, which can be meaningful guidance or some tips. It is necessary to create a matching learning environment and atmosphere according to the cognitive characteristics of learners, and at the same time make learners interact in the learning process to promote their knowledge construction.[1]

According to the connotation of the situational cognitive learning theory, the four fundamental elements of the situational cognitive learning theory should be integrated into the design of the learning environment, and the application of abstract knowledge should be added to the virtual learning scene. In order to let students experience the actual operation and strengthen the authenticity, let students explore in the virtual situation, and independently discover and obtain knowledge. In a word, while expanding the space scope of traditional experiments, we should strengthen the authenticity and situational nature of knowledge learning.

1.3. Embodied cognitive learning theory

Embodied cognition organically unifies the body, mind and environment in the cognitive process. in addition to the influence of body participation on cognition, it also emphasizes the

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influence of environment on cognition. The theory of embodied cognition holds that through physical senses, learners can mobilize their existing knowledge and experience when interacting with the external environment to form external cognition.

With the thought of embodied cognition theory, learning environment design can realize the unity of sense, experience and environment, and achieve the goal of optimizing teaching effect and learning behavior.

2. Construction principles

2.1. Principle of authenticity

Make full use of 3D modeling and visualization technology to provide a real or near real environment and situation, generate a strong sense of immersion, stimulate learners' motivation, and authenticity is conducive to improving environmental fidelity, manipulation credibility and user experience.

2.2. Principles of key decision points

Prompt learners at key decision points, provide guidance when necessary, and present the consequences of decisions in a timely manner.

2.3. Principle of moderate content

The difficulty of learning content should be moderate. Too high difficulty is likely to cause learners' anxiety and worry, and too low difficulty is likely to cause learners' uninteresting reaction, which will affect people's immersion. The learning content should not be too much and too complex. The content with difficulty slightly higher than the current level of students should be selected by reference to the nearest development area.

2.4. Principles of expert feedback

During and after the learning process, students need to be given feedback so as to guide learners to conduct self-assessment and independently seek better solutions.

2.5. The principle of easy navigation.

The navigation operation mode shall be diversified, and the characters and icons shall be as clear and eye-catching as possible and easy to identify. If the navigation is too complex, learners are likely to lose enthusiasm and interest in learning, which will also increase cognitive load.

3. Design elements

3.1. Characteristics of learners

Make a preliminary analysis of the learners, and determine the grade, major, cognitive style, virtual reality using ability of the users. For example, younger learners need more observation and experience to obtain direct experience; Older learners already have abstract thinking and need to be promoted to generate knowledge and concepts.

3.2. Environment

Including application scenarios and technical support, such as in class or out of class, online or offline, theoretical courses or practical training courses, desktop or experiential, etc. Selecting appropriate technical elements requires analysis of application scenarios.

3.3. Learning content and learning objectives

The design of learning environment can not be separated from the learning content. For example, the experiential learning environment is more suitable for the learning areas that need operation, experience and observation. After choosing the learning content, the type and

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level of learning objectives should be clarified. Learning content and objectives are the key basis for reflecting education, so they are the core design elements.

3.4. Technical elements

Specify hardware support, viewing angle, interaction mode and type, scene switching mode, whether to use avatar, development tools, development cost, technical feasibility, and development cycle.

4. Construction of learning environment model based on virtual reality technology

Using virtual reality technology to support the construction of learning environment, the key is how to realize the sense of presence and schema. The design of learning environment must be divided into four levels: "learner", "environment", "content and objectives", and "media". That is to say, with learners as the main body, with virtual reality learning environment as the means, with a high sense of presence and the construction of new schemata as the goal, enhance learners' emotional experience, inspire their thinking, and then affect their behavior. *References*, see Fig. 1.

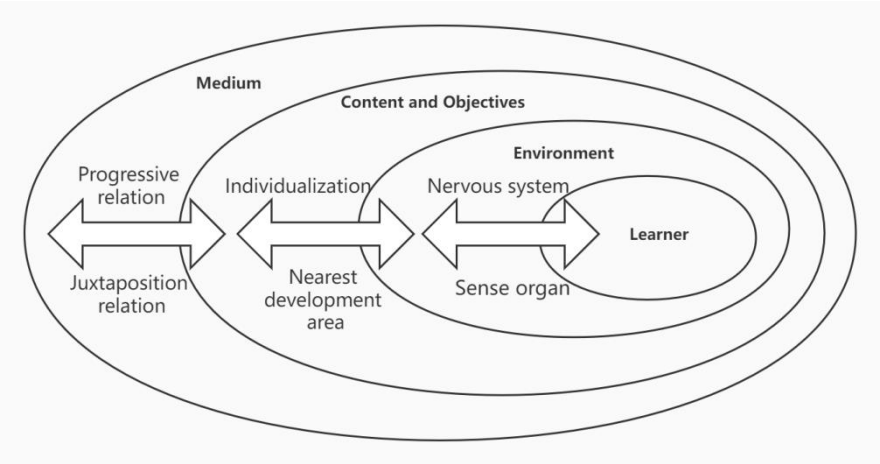

Fig.1 Learning environment construction model based on virtual reality technology

4.1. Design of learner level

Learners are the core, and all designs are designed to promote human development. The teaching concepts such as learner centered, giving full play to learners' subjectivity and individuality, and paying attention to teachers' guiding role should be fully reflected to promote the improvement of everyone in the space. People here are all embodied, that is, their bodies and minds are in a positive and active state, their bodies perceive active movement, and their brains are mentally excited. All people are embedded in the environment and devote themselves to teaching and learning activities.

To enhance learners' "sense of presence" and provide learners with real experience, we can build a diagram and enhance emotional experience. When designing the learning environment, the interaction and immersion should be enhanced as much as possible. Through the mobilization of the learners' sense system, the learners can have a real emotional experience in the process of interaction with the environment to mobilize their enthusiasm for learning. At the same time, because the learner's body participates in the cognitive process, it is also necessary to consider the body and the projection formed by the body's actions when designing the learning environment. To enable learners to combine previous experience and cognition, it is necessary to make learners' actions in the virtual reality learning environment consistent with their actions in the real world, and awaken knowledge stored in long-term memory through similar situations. Virtual reality learning environment can design virtual avatars of

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learners, including first person and third person avatars. According to the needs of different types of learning, learners can also switch between the two perspectives. Generally speaking, learners using the first person virtual deity will get a stronger sense of presence than the third person. After receiving the stimulus, the sensory organs will feed back the information to the brain, which will assimilate, adapt and balance the new information, and finally build a new schema, forming new knowledge, concepts and logic.

4.2. Environmental level design

Environment is the medium that connects other levels. If learners enter the learning situation in a positive mood, their positive mood can improve the efficiency and level of learning, and can give good feedback to teachers. All individuals in the environment can immerse themselves more wholeheartedly in the teaching and learning scene, which is conducive to learners' acquisition of new knowledge.

When designing the learning environment, the abstract content should be visualized and perceptual as much as possible[2], and the core value behind the learning content should be conveyed through the concrete external symbols, such as cultural details, humanistic spirit, historical background and other abstract and difficult to understand content. To integrate core values into learners' existing diagrams, it is necessary to rely on concrete carriers, such as words, objects, colors, sounds and other intuitive representations. On the one hand, the external symbol is the carrier of meaning and the presentation of spiritual externalization; On the other hand, it has an objective form[3].

4.3. Design of content and target levels

Learning objectives have the functions of guidance, motivation, evaluation and aggregation. They are at the core of the whole teaching and learning activities and are the primary prerequisite for achieving meaningful learning. According to the teaching objectives, appropriate learning contents can be selected based on the students' existing knowledge and experience and their development needs.

In the activities of teaching and learning, learners should be clear about the learning objectives. In the design of learning environment, learning objectives can be explained in the form of virtual characters or video text, and teachers and students can work together to achieve the objectives. Learning objectives are personalized, challenging and moderately difficult. The design should ensure that the content and objectives are consistent in the whole virtual reality learning space, in all activities involved, with consistent logic, clear connection and interlocking, so that learning activities can not deviate from the objectives, and learners can have meaningful learning.

4.4. Media level design

Learners are the main body of learning, and overly complex technologies will increase the cognitive load of learners. The embodied cognition theory emphasizes the embodiment of technology, striving to achieve the real existence of technology, while the body cannot perceive the existence of technology [4], so that learners can focus on the acquisition of new knowledge.

In order to achieve technical invisibility as much as possible, interactive methods, scene switching and other technologies are often used in the design of learning environment. Common interaction methods include explicit interaction and implicit interaction. In explicit interaction, interactive elements in the learning environment can be felt from beginning to end, such as highlighting interactive elements, highlighting colors, flashing, indicating arrows, etc., so that learners can use at any time[5]. The interaction elements in implicit interaction are not always displayed. When learners' learning behaviors meet certain conditions, they appear to provide temporary hints so that learners can achieve barrier free learning in the specific learning environment. The virtual reality learning environment is generally composed of

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multiple scenes. When the learning content changes, it will often be accompanied by scene switching. The sequence of scenes should conform to the learners' cognitive rules. The scene switching should not be too abrupt. There are generally two ways of scene switching in the learning environment, one is to switch the scene naturally, and the other is to select the target location to switch the scene instantaneously [6]. The former is more suitable for presenting the learning content of juxtaposition relationship, while the latter is more suitable for presenting the progressive relationship.

5. Summary and outlook

Although virtual reality learning environment has many advantages, the current development is still in the initial stage, and the indoctrination education method still exists in actual use. In addition, the learning space may be fragmented, which makes it difficult for learners to integrate decentralized learning modules. Finally, building an effective virtual reality learning environment requires strong technical support.

However, the immersive learning environment provided by virtual reality learning environment can fully mobilize learners' sensory organs and nervous system to cooperate with learning, encourage learners to create and imagine, and improve learners' ability to solve practical problems. With the continuous development of modern information in the future, the construction of learning environment for virtual reality technology will have broad application prospects.

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