Design and Application Research of VR/AR Teaching Experience System

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Abstract. This paper is based on the current situation of teaching, such as the lack of contextual interaction in the learning experience, the single situation, and the poor teaching experience and utilizes virtual reality (VR) and augmented reality (AR) technology to solve these problems. With the immersive, interactive and imaginative features of virtual reality technology, the virtual somatosensory virtual learning space with human-computer interaction is designed. The superposition of augmented reality technology is used to create an AR superposition learning space that combines real world and virtual space. According to the extension of VR/AR teaching thinking dimension, the teaching experience system design framework is constructed, and the physical model of experience system is proposed. Through data mining and teaching feedback, the learning experience is adjusted. Then design a personalized teaching experience system which can enhance learning experience and improve learning interest.

1. Introduction
With the continuous development of computer software and hardware technology, the combination of new technology and teaching is getting closer and closer, but the application of new technology has not solved the problems caused by traditional teaching. The current problems in school teaching mainly focus on the lack of interaction in the teaching process. Most of the teaching environment lacks a real contextual learning environment in the classroom. The teaching methods are single and it is difficult to inspire students' association and creativity. Application of the teaching process and teaching results are poor. So it is difficult to meet the task requirements of real jobs. The root cause of these problems is the poor teaching experience, which cannot provide learners with a real learning environment, intuitive and three-dimensional spatial experience.

The maturity of VR technology and AR technology, as well as the learner-centered, emphasis on teaching experience and the urgent need for adaptive learning, have driven the appearance of the VR/AR teaching experience system. VR achieved a brand-new state of human-computer interaction. It can obtain intuitive and real perceptions such as sight, hearing and touch by operating objects in the virtual world [1]. By combining virtual objects and the real world, AR can simultaneously display the information of the real world and the virtual world, enabling learners to use 3D models to enhance the visual perception ability of real-world situations [2]. VR enhances sensory interactivity by constructing a simulated virtual world. The main features are: immersion, interactivity and imagination. Immersion allows learners to eliminate external disturbances and immerse themselves in virtual reality to gain an immersive feeling. Interactivity is based on the learner's head, hands, eyes, language and body movements to adjust the image and sound presented by the system. Imagination is to acquire visual,
auditory, tactile, kinesthesia and other perceptions simultaneously in the virtual environment, enhance the learner's perception of the learning content, the high sensitivity and rational understanding of the cognitive content, so that to make the user to deepen the concept and sprouts new association, and motivate the learner's creative thinking. AR is a bridge connecting virtual world and real world. It is characterized by superposition and openness. It superimposes virtual information in the real world, enhances visual, auditory and tactile sense, and enables learners to experience the combination of real world and virtual world in the senses. The VR/AR teaching experience system compensates for the problems that appeared in traditional teaching. Figure 1 shows the VR/AR features.

2. VR/AR Teaching Experience System Model Design

VR/AR teaching experience system model design mainly focuses on how to implement the experience system, how to design the system physical structure. The experience system is divided into five levels, from the bottom to the top, VR/AR base layer, VR/AR space layer, VR/AR logic layer, teaching data mining layer, teaching adjustment layer. The implementation process is to use the underlying physical device to enter the VR/AR learning space, and learners enter the database to intelligently retrieve the experience environment and experience context according to the needs in the learning space. The learner learns the state and data in the learning space and analyzes it through the teaching data mining layer, and then feeds back to the teaching adjustment layer to achieve the dynamic update of the learner's learning experience. Figure 2 shows the VR/AR teaching experience system model design.

2.1. VR/AR base layer

The VR/AR base layer is the bottom part of the entire teaching experience system, and is also the physical device carrier and platform that enters the learning space, such as HMD, VR glasses, mobile phones, simulation devices, iPad, and so on. The learner enters the virtual platform through the physical device, and the virtual platform is a fusion of one or more learning spaces to ensure the reliability of the learner entering the VR/AR space layer.

2.2. VR/AR space layer

The VR/AR space layer contains various learning spaces of the system, including VR direct interaction space, AR superposition space, shape space, and virtual and real interlaced space [3]. In these spaces, learners can choose their own learning context according to their own learning situations, or they can choose intelligently through fixed and creative modes to understand the learners' knowledge storage and learning abilities, so that learners can be clear about themselves. In order to choose the best, most suitable learning situation and enhance the sense of learning experience.

2.3. VR/AR logic layer

The VR/AR logic layer achieves the learning of methods, processes and skills in the virtual space according to the characteristics and needs of the learners [4]. This layer implements the physical
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The physical device enters the learning context created by the VR/AR space layer, and sets the contactor. When the learner touches the contactor during the learning process, the logic introduction will start. The learning situation increases the difficulty node and the mission, and the learner completes the task by learning the knowledge and skills provided in the space to be able to enter the next contactor.

2.4. Teaching data mining layer

The teaching data mining layer mainly analyzes the learner's feedback data learning process and learning state in the VR/AR space layer, including the proficiency of the learners' knowledge when in the contactor or upgrade and the number of times that learner asks for help when encountering difficulties. Through the analysis and mining of these contents, the best learning path between learners and learning trajectories can be calculated and then be fed back to the teaching data adjustment layer to dynamically optimize the learner experience situation.

2.5. Teaching adjustment layer

The teaching adjustment layer is mainly divided into teaching strategy adjustment and teaching experience adjustment, mainly through the feedback of teaching data mining layer to adjust the learning strategy and adjust the learning situation. The teaching strategy adjustment is to personalize the teaching methods, set suspense or story plots, and attract learners to explore in the learning space. The teaching experience adjustment is to automatically complete the learners' experience scene in learning space according to the plots of teaching strategy adjustment.

3. VR / AR Learning Space

The VR/AR learning space is the core content of the teaching experience system. The learner goes to the virtual space for experience learning through the first viewpoint of VR, and enters the external perspective from the internal perspective [7]. The AR uses the third viewpoint to experience learning. The AR is a bridge between the virtual world and the real world. The learner enters the virtual world of the internal perspective from the external perspective in the real world to improve the interactive experience. The establishment of the two-way viewpoint of the VR/AR learning space enables the learner to switch back and forth between the internal perspective and the external perspective to achieve a fusion of virtual and real learning spaces and enhance the learning experience. The VR/AR learning space is mainly designed from database resources and JDK and SDK platforms. Figure 3 shows VR/AR learning space design.

![Figure 3. VR/AR Learning Space Design](image)

3.1. Database Resources
The database resources are mainly used to develop and store the models and scenarios required in the learning space. The Unity 3D is mainly used to develop the VR model system and the AR model system for the development tools. Using 3dsmax production model and UV finishing, using Photoshop for post-laying drawing, then outputting textures and models into Unity3D to implement interactive programs through C#, and then making AR and VR separately [6]. Database resources are then passed to the JDK and SDK platforms for interaction through the management server.

3.2. JDK, SDK development platform
The JDK and SDK development platforms mainly implement resource mutual transfer between the VR model system and the AR model system. The JDK and SDK development platforms use the management resource server to acquire database resources, and implement resource packaging and interaction functions through Unity, and finally form a VR model system. The AR model system uses HIAR as an augmented reality development tool. HIAR provides cloud image recognition services in the form of REST and API, and uses HIAR's background management tools to implement AR content editing and management [5]. Through the JDK and SDK development platform, the VR model system and the AR model system are mutually called to form a VR/AR learning space with interactive functions.

4. Design of VR/AR Teaching Experience System
The VR/AR teaching experience system is an adaptive dynamic adjustment experience system. It can enable learners to experience the learning situation and collect the activity data generated by the learner in the learning space through the switching between the VR learning space and the AR learning space. The data is transmitted to the storage server, and analyzed by the data mining technology, and the analysis result is fed back to the computing server, thereby achieve the teaching experience and teaching strategy adjustment of the learning space. Figure 4 shows VR/AR teaching experience system design.

4.1. VR/AR learning space entry
The VR/AR learning space needs to be accessed from the VR/AR base layer, and corresponding hardware devices such as VR glasses, HMD, smart phones, and emulation devices are required. These devices can provide direct or indirect access to the learning space. The selected learning space can be a single space or two mixed spaces.

4.2. VR/AR learning space conversion
VR/AR learning space conversion is mainly based on virtual reality interactive platform. Through the database resources and JDK, SDK development platform, the fusion of VR model system and AR model system is implemented. According to the needs of the learners, different resources are used to transform and interact among the learning spaces. The combination of virtual and reality and superposition of each other greatly enhances the sense of reality of the teaching experience.
4.3. VR/AR learning spatial data analysis
According to the learning goal, the learner enters the corresponding VR/AR space by means of VR or AR, and can select different learning modes depended on the proficiency of knowledge mastery in the space. The system records the learner's entire learning trajectory and learning action data and then submits it to the storage server for analysis and production of the results through data mining techniques.

4.4. VR/AR learning space teaching adjustment
Through the feedback of the teaching data mining layer, the computer server selects the most suitable learning situation and learning task for the learner according to the result, so that besides the reality, the learner can also experience the comfort in the learning situation, and increase the enthusiasm of the learner to learn, encouraging learners to continue to learn.

4.5. VR/AR Experience Output
Experience output refers to the experience and feelings that learners have gained in completing the learning process. Learners enter the learning space, choose the learning situation, complete the learning tasks based on the learning objectives, and the difficulties encountered in the learning space can be analyzed, fed back, adjusted by the system, and finally reach the optimal experience path.

5. Conclusion
The introduction of VR/AR has changed the traditional teaching thinking, increased the control of teaching problems and teaching quality, and made the VR/AR teaching experience system an achievable reality. The system is designed based on the problems existing in traditional teaching. The experience of learners switching between the VR learning space and the AR learning space is the key point. It tracks the learning path and learning activity data in the learning space in real time, changes the teaching strategy and teaching experience, and provides an optimal learning experience environment for the learners.

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