

Emotional Interaction Design In Augmented Reality Technology Learning Environment

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Abstract

The process of learning is the process of knowledge acquisition and emotional experience, and the unity of cognition and emotion. The interactive technology based on augmented reality provides educators with a new way of expressing to learners, and build a space for independent exploration for learners in the most natural way. At present, the educational application of augmented reality ignores the important role of affective factors in the cognitive development of learners, and the problem of lack of emotions is gradually highlighted.

In order to enable learners to achieve a comprehensive and unified development of cognition and emotion in the augmented reality learning environment, the concept of "emotional interaction" was introduced into the augmented reality learning environment, and the relationship between cognitive interaction system and emotional interaction as well as the law of interaction in the augmented reality learning environment were explored from the perspective of "learner-centered". Based on the research results, the elements of emotional interaction design were summarized, which could be used for in-depth understanding of the essence of augmented reality learning environment and for enriching and developing the theory of teaching interaction.

Key words: Augmented Reality Technology, Learning Environment, Emotional Interaction Design

Augmented Reality (AR) Technology is an extension of virtual technology, a virtual digital technology based on the real environment, which enables learners to see virtual images in a realistic environment through a new way of presentation. This kind of novel and close-to-natural interaction of AR has a great inspiration for learners to understand the learning content.

Advantages of augmented reality technology in the education process

AR integrates virtual phenomena into the real world to achieve real-time interaction between virtual and real objects. AR technology is a newborn thing in the field of education, and the virtual learning environment created by AR is consistent with certain views of educational theory. For example, the AR virtual learning environment enables learners to interact with the environment and get quick feedback to establish a connection between knowledge and response, in line with the view behaviorism holds, learning is accomplished by

responding to stimuli [1].The AR virtual environment emphasizes the learner's own control behavior. The learner uses the rich construction toolkit and performance venue to envision and practice in the virtual learning environment constructed by AR [2], which is consistent with the learning theory of constructivist that learning is a real-situation experience[3].

Combining the characteristics of AR with different types of technologies, it can exert enormous potential in the field of education and can have a great effect on educators and learners. The role of AR in education is divided into three aspects according to its characteristics and functions.

A. Visualization of abstract learning content

The 3D model constructed by AR enables learners to enhance their visual perception of real-world situations, and observe 3D models from different perspectives to enhance their understanding of real-life things. For example, Cai, Chiang, Sun, Lin and Lee [3] used AR and Kinect devices to visualize the magnetic field, which is objective but invisible, and enable learners to interact with the magnetic field through gestures in the teaching of physical magnetic fields in junior high school. Fjeld and Voegtli[4] used AR technology to construct a 3D molecular structure model which could be rotated arbitrarily and viewed from different angles in the teaching of chemical elements, as shown in Fig. 1.

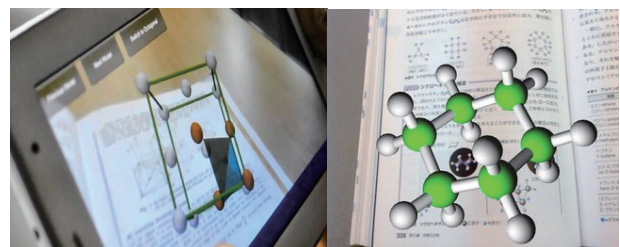


Fig. 1 Simulating molecular structure with AR

B. Immersive experience of the learning process

Bronack[5]mentioned that virtual teaching games, augmented reality devices, and immersive teaching media can provide learners with a sense of presence and enhanced intuition, leading them to focus on the learning process. As shown in Fig. 2, intuition is crucial to the learner's emotional and cognitive value. Therefore, AR has great potential in cultivating learner intuition and may affect learners' interest in learning content.



Fig. 2 Scene of AR teaching

C. Rich experimental interaction

Traditional multimedia technology cannot simulate a real experience, but AR technology can make learners feel a sense of presence. For example, the AR Practice Research Lab comprehensively applies AI and AR technologies, virtually reproduces real experimental scenes through 3D modeling, and uses real-world somatosensory interaction devices to perform virtual-real interactions, combining real teachers and virtual simulation experimental equipment into one screen. It realizes interactive experiment teaching with only gestures, without wearing any somatosensory equipment, as shown in Fig. 3. The AR Practice Research Lab covers physics, chemistry, biology, etc., and is suitable for physics, chemistry and biology laboratories of middle school. Present research shows that the use of AR technology to create visual effects in teaching can enhance students' perception and understanding of abstract and invisible phenomena.



Fig. 3 AR Practice Research Lab (Kinect equipment)

The role of AR described above in education is not unique to AR and may have similar technologies in other areas of the mobile learning environment. Emotional interaction is crucial in the design of AR and has a great influence on learners' perceptions. Therefore, in order to improve learners' cognitive level in the AR learning environment, the most important thing is to explore the main structural functions and elements of emotional interaction design in the AR learning environment.

Concept of emotional interaction design

Emotional interaction refers to the experience of executive emotions in the interaction between learners and the learning environment. Emotional interaction is reflected in the interaction between learners and teaching media, learning resources, teachers, learning communities and other subject and object. Cognitive interaction focuses on deep understanding of deep principles and concepts, while emotional interaction focuses on the positive emotions,

emotions, attitudes, evaluations and other psychological tendencies that learners generate during the interaction process.

In order to explore the law of emotional interaction in the AR learning environment, the "emotional interaction" is integrated into the "teaching interaction hierarchy tower", and the "Emotional Interaction Hierarchical Tower" model is constructed, as shown in Fig. 4.

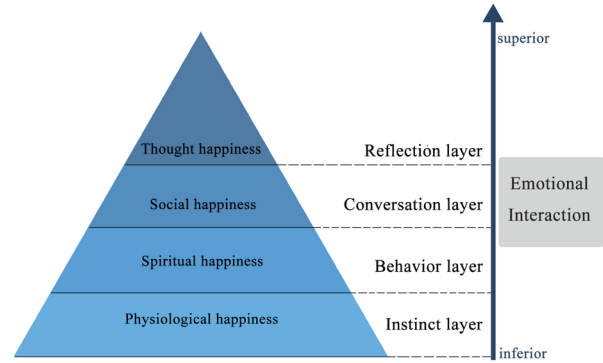


Fig.4 "Emotional Interaction Hierarchy Tower" model

The design of the learning environment based on AR should be "people-oriented". It is necessary to conduct an in-depth study of the emotional interaction of the AR learning environment and adjust the teaching behavior and strategy according to the learner's state and emotional changes to achieve the best results. Emotional design should start with the design of the sensory and stimulating elements such as the visual and sound effects of the "instinct layer", and then scientifically set the operational skills and challenge levels of the "behavior layer", supplemented by the design of multi-participation and collaborative learning activities of the "session layer". Finally, through the close combination with other cognitive interaction level design, emotional design provides learners with visualized and diversified presentation, gradually achieving the ultimate goal of "reflective layer" interaction design.

In summary, the interaction design of AR learning has to meet the rational needs as well as the emotional needs of the learners. In the AR learning environment designed above, learners can explore independently, enriching their psychological and emotional experiences, and give full play to their imagination and creativity.

Emotional interaction structure model of learning process in AR environment

Emotional interaction design and structure improvement can link various environmental elements more effectively, and exert the characteristics of virtual reality, interactivity, openness and richness of information resources more fully. Based on this, the AR emotional interaction design structure and function model are constructed, as shown in Fig. 5.

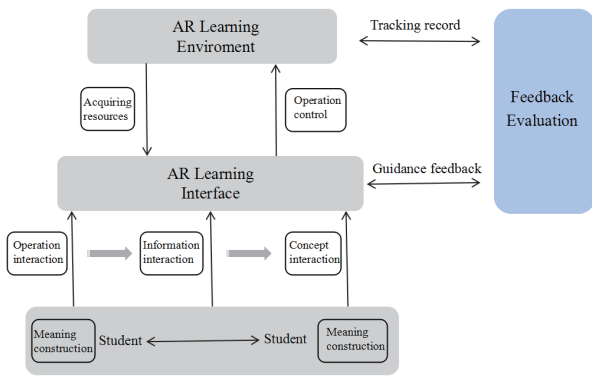


Fig.5 AR learning environment emotional interaction design model

A. Effective interaction in the AR environment

The essence of AR learning environment design is interaction and control. The interaction in the AR-based learning environment should include the following levels: 1. The interaction between the learner and its environment. 2. Information interaction between learners and learning resources and learning tasks. 3. Interaction between learners and educators. When designing the AR learning environment, no matter which level of communication, it is necessary to follow the "learner-oriented", that is, analyze the learner and teaching objectives, select the appropriate technology, and build the learner's operation interface, which meets the needs of learners' perceptions, emotions, and behaviors. The things built by the AR learning environment flexibly and effectively reflect the characteristics of the communication and coordination system in the components of the network environment. As shown in Fig.5, students provide and acquire resources through the virtual presentation of the construction, and construct meaning through the interaction between learners, the multiple interactions of information interaction and concept interaction.

B. Real-time feedback and guidance

In the web-based AR learning environment, real-time feedback and guidance can detect and inform learners of the current learning state and effects of the learner. In a real environment, learners usually use multi-sensory to directly obtain feedback on learning. In augmented reality scenarios, learners can only obtain feedback information through the operation and control of the mobile terminal. In order to enhance the sense of realism and immersion, facilitate the migration of motor skills and enrich the learner's experience, there must be obvious real-time feedback and prompt guidance in control and interaction.

The AR learning environment should be designed to adapt to changes in learner behavior and tasks. The feedback information required between learners and educators, augmented reality scenarios and tasks presented by AR, is shown in Fig. 5. The prompt feedback system is divided into three aspects: pre-operation prompt, operation need and post-operation feedback. Their functions are the prompts of the precautions, the prompts of the operation process and giving opinions according to the learning performance, respectively. The design of the real-time feedback system can greatly enhance the intelligence and interactivity of feedback and

guidance in the AR learning environment, thereby improving the efficiency of learner meaning construction.

C. Tracking and evaluation of learning effects

In the AR learning environment, the tracking and results of the learning process enable the learner to fully understand herself/himself and gain confidence and correct the direction of the problem from the emotional evaluation results. In the virtual environment created by AR, the design of the tracking and evaluation of the learning process should be comprehensively considered in terms of ideas and application techniques. The emotional characteristics of real-time feedback should be reflected in: 1. Responsiveness, capable of responding to changes in movements between learners and tasks in a timely manner; 2. Learning, capable of adjust the behavioral strategies of the system according to learners' behaviors; 3. Anthropomorphism, enabling learners of different roles to interact and cooperate with each other through role-playing.

Elements of emotional interaction design in the learning process in the AR environment

The design and implementation of emotional interaction in the AR learning environment must meet the basic functional structure while meeting the essential requirements of education. Therefore, the emotional interaction design in setting the AR learning environment must agree with the educational requirements and product functions so that the products meet the learner's needs. as shown in Fig. 6.

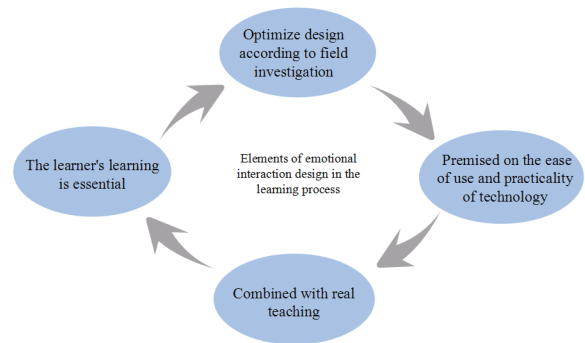


Fig.6 Elements of emotional interaction design in the learning process in the AR environment

A. The learner's learning is essential

The design of emotional interaction in the AR learning environment should fully examine the learner's knowledge structure and level, learning personality and desire, to meet the learner's cognitive and emotional needs, and rationally formulate the AR learning environment design plan to encourage learners to become the leading role in the learning process and thus promotes their comprehensive abilities.

B. Optimize design according to field investigation

In order to avoid blindly following the trend of technology and ignoring the learner-centered teaching objectives, the design must continuously optimize the design according to the needs of the teaching objectives, reduce the labor input for

development and application, and improve the practical value of the AR learning environment.

C. Premised on the ease of use and practicality of technology

Improve the simulation and accuracy of the AR learning environment, but avoid the one-sided pursuit of sensory effects, which would make the operation of AR teaching products exceeds the hardware and software compliance and affects the normal transmission of the network, thus affecting the teaching effect. Based on the normal operation of the system and the network, technical solutions that are easy to develop and update should be designed. Technical solutions that are easy to develop and update should be designed while ensuring that the system and network are functioning properly.

D. Combined with real teaching

The AR learning environment is an auxiliary education essentially. Therefore, it is necessary to combine the augmented reality and classroom teaching to complement each other. That is to say, in the classroom teaching, when there are phenomena that are difficult to display visually or more abstract principles, using the AR learning environment can improve the overall efficiency and effect of learning emotional interaction.

Conclusion

By integrating the concept of "Emotional Interaction" into the actual design and development process of the AR learning environment, the structure and function of the emotional design of the AR learning environment were proposed, and the elements that need attention in emotional interaction design were discussed

By paying attention to the psychological characteristics and changes of learners, the emotional interactions missing in the learning process in the AR environment were compensated, and the AR environment with high level of "emotional interaction" was designed and developed, which realized the meaning construction in different levels of interaction activities in the learning environment and was conducive to the construction and popularization of high-performance AR learning environment.

The "Emotional Interaction"-focused design was more adaptable to the needs of learners since it could promote the emotional experience and personalized knowledge growth of learners in the learning process, and thus, it could be used to solve the problem of lack of psychological emotions such as the sense of participation, belonging and self-confidence of learners in the current AR learning environment.

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