

Application Strategies of Virtual Reality Technology in the Teaching Design of Vocational Courses from the Perspective of Learning Transfer Theory

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Abstract: With the rapid development of virtual reality technology, it has been widely used in the field of education. It can promote the development of learning transfer, which is an effective method for learners to learn effectively. Therefore, this paper describes how to use virtual reality technology to achieve learning transfer in order to achieve teaching goals and improve learning efficiency.

Keywords: Learning transfer; Virtual reality technology; Application strategy

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1. Introduction

Virtual reality technology, as one of the means of information technology, has been widely used in the field of education. In teaching, it is not enough to merely impart knowledge and skills to students; it is equally important to cultivate learners' problem-solving skills, innovation ability, summarization skills, etc., which need to be achieved through the cultivation of learning transfer ability. Therefore, when teaching with virtual reality technology, we should make full use of the viewpoint of learning transfer theory to study the teaching design to promote the positive transfer of learning, cultivate students' ability to generalize and summarize, and improve independent learning ability and learning effect.

2. The main ideas and influencing factors of learning transfer theory

Transfer is an important law in educational psychology, which refers to the influence of one kind of learning on another kind of learning. In educational psychology, learning transfer refers to the influence of skills, knowledge, or attitudes acquired in one context on the acquisition of skills, knowledge, or the formation of attitudes in another context ^[1]. Any kind of learning is subject to the influence of the learner's existing

knowledge and experience, skills, attitudes, etc., wherever there is learning, there will be transfer; transfer is ubiquitous and is not only the continuation and consolidation of learning but also to improve and deepen the conditions of learning ^[2]. Transfer can be categorized into positive transfer and negative transfer. Positive transfer occurs when learning in one context strengthens learning in another context. Negative transfer, on the other hand, occurs when learning in one context interferes with or weakens learning in another context. Generally, transfer is produced by the similarity of the stimulus and response of the two learning. When the response is the same, the more similar the two learning stimuli, the more positive transfer occurs; when the response is different, the more similar the stimuli, the more negative transfer occurs.

The traditional theories of transfer include Formal Training, Thorndike's Common Factors Theory, Judd's Generalization Theory, and Kohler's Relational Theory. Formal training theory sees learning as a process of mental training and believes that the transfer of learning is the automatic functioning of mental faculties strengthened through training in other fields, which is the earliest theory of learning transfer. In the early 20th century, Thorndike put forward the theory of identical elements that transfer can only occur when there are identical elements in two situations ^[3], i.e., the reason why one kind of learning can have an effect on another kind of learning is that the two have the same elements. In 1915, Judd put forward the theory of generalization, which holds that the existence of common elements is only a necessary prerequisite for transfer and that it is only when a person makes a generalization of his experience that transfer can take place from one situation to another. The main reason for transfer to occur is not the superficial similarity between tasks, but the acquisition of a generalized understanding of the knowledge in question, and the higher the learner's ability to generalize, the greater the likelihood of transfer. Later, Kohler proposed the relational theory, which concluded through experiments that the relationship in the context plays a role in transfer and that transfer depends on two conditions, namely, the existence of a certain connection between the two types of learning and the learner's understanding and appreciation of this connection.

Modern cognitive transfer theories mainly include the cognitive structure transfer theory proposed by American psycho-educator Ausubel, the generative transfer theory proposed by information processing psychologist JR Anderson, the cognitive strategy transfer theory proposed by Bruner, and the contextual transfer theory proposed by Greenough *et al.* Among them, Bruner and Ausubel, etc., are the representatives, who define transfer as a process in which learners make use of the original concepts of cognitive structure, analyze and generalize the content of new topics through thinking, and transfer learning based on revealing the common nature of the old and new topics ^[4].

From the above point of view, it can be seen that transfer is common in the learning process, and various factors affecting the learner's learning will have an impact on transfer, including subjective and objective factors. Subjective factors include the learner's cognitive level, ability to analyze and generalize, and transfer orientation. Objective factors include the similarity of learning materials, the similarity of learning situations, and the teacher's conscious efforts to guide students to discover the commonalities between different knowledge or situations during the teaching process.

3. The basic requirements of learning transfer theory for the application of virtual reality technology teaching

Based on the exploration of the intrinsic mechanism of transfer, Stenberg, a famous cognitive psychologist, proposed that there are four mechanisms of transfer: encoding, organization, discrimination, and orientation ^[5]. It tells us that whether learners can carry out the effective transfer is related to whether they encode the information effectively during the learning process; whether learners organize the information rationally directly affects the transfer

effect; when learning in two different contexts, if learners cannot clearly differentiate the knowledge previously learned, it may interfere with acquiring new knowledge; at the same time, the psychological preparation for the transfer and the awareness of the initiative, i.e., the orientation, have an impact on learning transfer. Therefore, the theory of learning transfer puts forward the following requirements for the teaching application of virtual reality technology.

3.1. Realistic nature of the learning environment

Virtual reality (VR) technology, also known as virtual simulation, is the use of a virtual system to imitate another real system of technology, which can provide users with a simulation of the visual, auditory, tactile, and other senses. However, when creating a virtual context, it is important to consider its similarity to the real environment, because the similarity determines the extent of transfer between virtual and real environments; the closer the similarity, the easier and more extensive the transfer tends to be ^[6]. Therefore, in the creation of the virtual context to focus on its sense of reality, the virtual environment is closer to the “real” environment, the easier it is for students to produce knowledge transfer of the active consciousness, directly affecting the occurrence of transfer.

3.2. Interactivity of learning content

In the process of teaching design, we should make full use of the virtual reality technology of motion capture, haptic feedback, eye tracking, voice interaction, and other forms of interaction, which can effectively stimulate students’ interest in learning, so that the learners have a strong desire to learn, thus stimulating the learners to produce the active awareness of learning transfer. Meanwhile, in the continuous human-computer interaction, the knowledge information is effectively added, edited, and organized.

3.3. Diversity of learning activities

The more diversified the methods of linking old and new knowledge in learning activities, the more stimulation the learners feel, and the more they can identify the previously learned knowledge, which is conducive to knowledge consolidation and expansion. In the platform constructed by using virtual reality technology, we should give full consideration to the setting of various activity modules, such as personalized guidance, virtual practice, virtual assessment, and so on.

3.4. Richness of presentation form

Psychologist Paivio’s dual coding theory suggests that encoding for long-term memory can be divided into visual and semantic coding. Therefore, in the teaching process, to remember a piece of knowledge, dual coding is necessary. With the help of virtual reality technology, we should pay attention to the multiple representations of knowledge, presenting a set of three-dimensional images, sound, text, virtual video, etc. as a whole in a variety of forms, so as to increase the encoding of the same knowledge. At the same time, once there is a cognitive point related to a certain kind of representation, it will activate the corresponding knowledge, and promote the extraction and transfer of information.

4. Analysis of teaching design strategies

Modern educationalists point out that the broad sense of transfer refers to learning activities based on existing knowledge and experience, the use of existing knowledge and experience to continuously acquire new knowledge and skills process; a narrow sense of transfer, specifically refers to the impact of the former learning

on the latter learning or the latter learning on the former learning impact. This paper argues that with the help of virtual reality technology, the knowledge and skills acquired in the virtual context can be transferred to the acquisition of knowledge and skills in the real context. Therefore, how to improve students' problem-solving skills, the ability to generalize new and old knowledge, independent learning ability, and so on, and then promote the transfer of knowledge and skills, is the focus of the teaching design strategy.

4.1. Contextual strategy combining virtual and real environments

In order to improve the effectiveness of learning transfer, contextual transfer theory puts forward that “the problem-solving process in different contexts is different, without considering the specific context to discuss the transfer is meaningless^[7], that the participation in a context of learning can affect the ability to participate in other different contexts of learning.” With the help of virtual reality technology in teaching and learning, we can create a situation similar to the actual learning work and real things, and learners learn in two situations. Therefore, the construction of a virtual reality technology training platform for the creation of context lays the foundation, such as building a VR course system, assessment system, and VR practical training management system.

4.2. Strengthening the original cognitive structure strategy

According to Ausubel, learning is meaningful learning, all learning is generated on the basis of the original learning, and learning that is not affected by the original cognitive structure of the learner does not exist^[8]. Therefore, teachers should carefully understand the students' existing foundation and the ability to analyze the gap between the original foundation and the new content, to find the students' “nearest development zone”^[9]. When learners engage in virtual segmented training activities, they primarily explore on their own. They compare new and old knowledge, ponder, and reflect repeatedly. Teachers then provide appropriate guidance. In addition, teachers also need to design guiding materials closely related to the new knowledge content, so that the original knowledge can be flexibly applied, such as case studies.

4.3. Fine processing strategies combining the real and the virtual

Cognitive strategy transfer theory suggests that cognitive strategies, when properly trained, can be applied in many scenarios, contributing to the acquisition of knowledge and the formation of skills^[7]. Fine processing strategy is one that belongs to the higher level of cognitive strategies, which is the deep processing strategy that connects the newly learned knowledge with the knowledge that has been used in the mind, so as to increase the meaning of the new information. There are various strategies for general fine processing, and so many of them are known as mnemonics, which is a useful fine processing technique for learning in general, making connections between new material and visual imagery or semantic knowledge^[10]. Using virtual reality technology, in the process of teaching design, the design of learning activities combining virtual and real should be able to help learners' memory and understanding of knowledge, repeatedly linking old and new knowledge with the participation of various forms of activities, consolidating old knowledge, promoting the processing of new knowledge, and then obtaining learning transfer. The form of learning activities is shown in **Figure 1**.

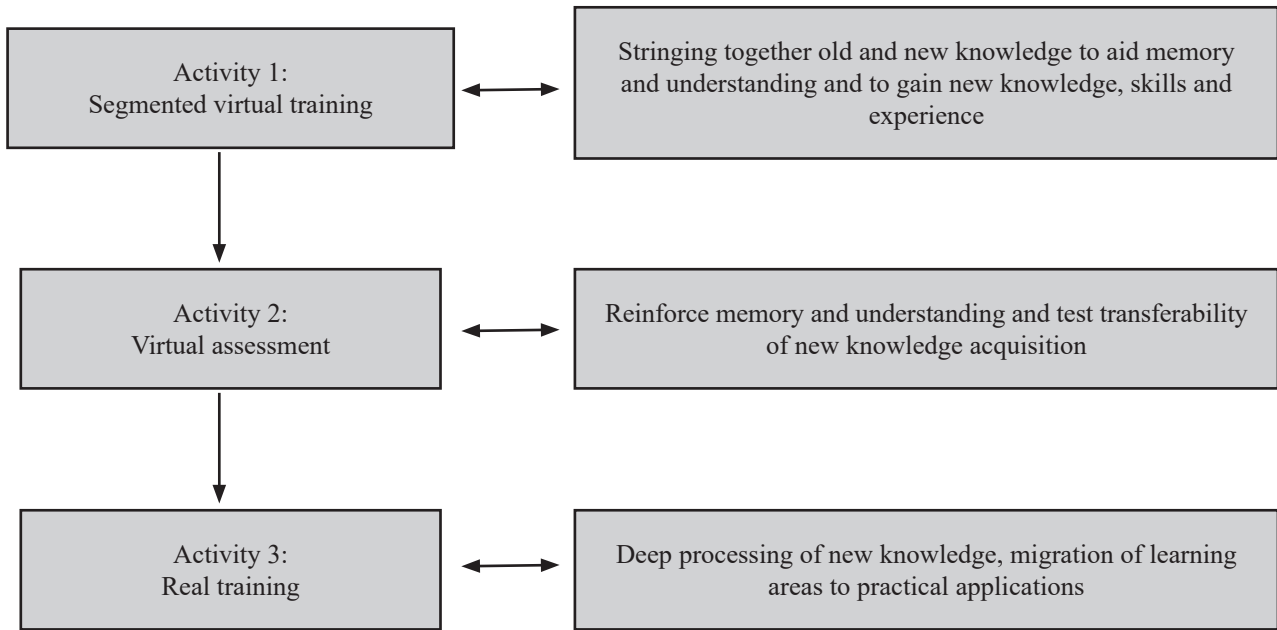


Figure 1. Activities and significance of the fine processing strategy

4.4. The strategy of cultivating the ability to generalize by combining the real and the virtual

American psychologist Bruner emphasized the transfer of the basic principles and attitudes of the discipline and believed that the more basic and general the content mastered, i.e., the higher the level of generalization of the experience in the discipline, the wider the adaptability to new situations and problems, and the more extensive the transfer can be produced [7]. Therefore, in the teaching design, it is important to incorporate elements such as summarization, comparison, and classification to guide students in developing the habit of summarizing after completing a learning activity. In segmented virtual training activities in **Figure 1**, according to the training situation, teachers demonstrate virtual operations for tasks with high error rates, guiding students to summarize and reflect on their own operations. Through voice systems and interactions with peers, students engage in repeated summarization, practice, self-correction, problem-solving, and subsequent summarization, enhancing memory and understanding until completing each task segment with zero errors. Subsequently, entering real training, learners, relying on the experience gained from virtual training, can improve the accuracy of practical operations.

4.5. Self-evaluation strategy combining the real and the virtual

The theory of cognitive strategy transfer holds that if students do not reflect on the success or failure of their strategy use, strategy training cannot be successful in transfer, and students' self-evaluation plays an important role in transfer [7]. Therefore, it is necessary to strengthen the learners' awareness of self-evaluation. Taking Project 4 *Staphylococcus aureus* detection as an example, the evaluation session is designed to guide students to reflect after the completion of each activity in **Figure 1**. The evaluation is divided into virtual and real evaluation.

Disclosure statement

The author declares no conflict of interest.

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