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Research on VR Geography Teaching Mode Based on SOLO Classification Theory

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Abstract: With the deepening of educational reform and the rapid development of educational technology, VR (virtual reality) technology is increasingly widely used in the field of education. In the face of various VR technology means and application paths, how to design scientifically in middle school, geography VR teaching mode has become an urgent problem to be solved. This paper aims to explore the VR geography teaching model based on SOLO classification theory, and improve the effectiveness of geography teaching and the level of students' geography thinking by integrating the immersion of VR technology and the hierarchy of SOLO classification theory. This paper first introduces the theoretical basis of SOLO classification theory and VR technology, then analyzes the problems existing in current geography teaching, and finally proposes and designs the VR geography teaching mode based on SOLO classification theory, in order to guide the orderly development of VR teaching in middle school geography and improve the scientific and technological content of middle school geography teaching.

Keywords: SOLO classification theory; Virtual reality; VR technology; Geography teaching

Introduction

With the development of productivity in China, the teaching software and hardware technology in the field of education are progressing rapidly. In 2019, China's Education Modernization 2035, issued by the CPC Central Committee and The State Council, proposed the establishment of a digital education resource sharing mechanism to realize the organic combination of large-scale education and personalized training^[1]. Then in December 2022, the Ministry of Education issued about the teachers digital literacy education industry standards, pointed out that improve teachers use digital technology optimization, innovation and change education activity consciousness, ability and responsibility, which emphasizes the artificial intelligence, VR, big data direction of digital technology in teaching application, application scope including digital teaching design, digital teaching facilities, digital academic evaluation, and digital collaborative education^[2]. The application of VR technology in teaching has been widely expanded in the basic education system.

In 2022, the Ministry of Education newly revised the Compulsory Education Geography Curriculum Standard (2022 Edition) (hereinafter referred to as the curriculum standard) to put forward guidance for the application of VR technology in geography teaching. The curriculum standard points out that simple experimental schemes should be designed, and geographical experiments should be carried out in simulated and virtual ways^[3]. As a comprehensive discipline integrating natural science and humanities, geography is also constantly innovating in its teaching methods and content, which has high requirements on students' thinking ability and spatial imagination. However, in the traditional teaching mode, geography teaching often focuses on the indoctrination of knowledge points, and ignores the cultivation of students' geographical thinking ability. SOLO classification theory, as a qualitative evaluation tool, provides a new perspective for instructional design by describing students' thinking level in levels. At the same time, VR technology provides students with a more intuitive and vivid geographic learning environment through its highly immersive and interactive nature. Therefore, it is of great research significance and application value to combine SOLO classification theory with VR technology to construct a VR geography teaching model based on SOLO classification theory.

1. Theoretical principle

1.1 SOLO category theory

SOLO classification theory is a student academic evaluation method founded by Australian educational psychologist Biggs in 1982. It is a qualitative evaluation method characterized by grade description^[4]. According to the thinking ability shown by students in answering questions, SOLO classification theory divides the thinking level into five levels: the level of anterior structure, single structure, the level of multiple structure, the level of correlation structure and the level of extended abstract structure.

1.2 The VR technology

NASA, Milgram, Bryson gave a representative concept definition, here the key reference Zhao academician definition, generalized VR contains virtual reality, augmented reality, mixed reality technology, its connotation is the computer generated digital object or simulated digital environment and the user perceive the real world object or environment overlap rendering, realize different time and space scene embedded, the virtual world and the real world in the sensory cohesion^[5], So that users get a kind of virtual and real symbiotic environment experience. VR technology of narrow refers to virtual reality technology is computer technology as the core, and other related science and technology construction in visual, hearing, touch, highly similar to the real environment, the user use with VR technology matching hardware facilities and the digital environment object interaction and influence each other, in the process can produce immersive experience^[6].

2. Existing problems in the geography teaching mode

2.1 The teaching means are single, and they pay too much attention to the indoctrination of knowledge points

For a long time, the middle school geography teaching often adopts the traditional mode of "teachers speak, students listen", focusing on the memory and reproduction of geographic knowledge, while ignoring the application and transfer of knowledge. In class, teachers often instill a large number of geographical concepts, principles, place names and other knowledge points to students through PPT presentation, blackboard writing and other ways, while students are busy recording class notes and are in a passive state of learning acceptance. Due to the lack of intuitive feeling and in-depth understanding, students are often confused when they face the complex and changeable geographical phenomena, and it is difficult to flexibly apply the knowledge learned to solve practical problems.

2.2 Low student participation, lack of initiative and enthusiasm

In the traditional teaching model, students are often regarded as the recipients of knowledge, rather than the subject of learning. In class, students' participation is not high, mainly manifested in the phenomenon of not active speech, not in-depth discussion, and low degree of homework completion. This passive learning mode not only limits the development of students' thinking, but also affects the cultivation of their innovation ability and practical ability.

2.3 Ignoring the cultivation of geographical thinking ability, students' thinking development is limited

In the current middle school geography teaching, teachers often pay too much attention to the teaching of knowledge points, and simply introduce the concepts, characteristics, problems and solutions of the textbook, rather than guiding students to analyze the specific formation process, explore the natural, humanistic and other factors behind it. Most of the students' geographical knowledge and space ability relatively lack, cognitive development level most in the specific symbol of the single structure level, mainly through the way of rote learning to improve the mastery of geographical knowledge, did not really realize their own cognitive level, it is difficult to form a comprehensive understanding of geographical problems and deep thinking, and ignored the cultivation of students' geographical thinking ability.

3. Design strategy of VR geography teaching model based on SOLO classification theory

3.1 Define the teaching objectives

At the beginning of the teaching design, teachers should clarify the teaching objectives according to the SOLO classification theory. Specifically, teachers should determine the level of thinking that students need to achieve according to the curriculum standards and students' actual situation. For instance, When teaching in the geography classroom, Teachers can set the following different teaching objectives: first, the single-point structure level: students can understand the basic concepts and influencing factors of geography textbooks; Second, the multi-point structure level: students can list many influencing factors of geographical phenomena, And briefly explain the relationship between them; The third is the level of correlation structure: students can comprehensively analyze multiple factors, To explain their common impact on geographical phenomena; Fourth, the level of abstract expansion: students can use what they have learned, Predict and explain the changes in geographical phenomena, And propose the corresponding solution.

3.2 Design of VR teaching content

In the design of VR teaching content, teachers should choose appropriate geographical phenomena and things to present according to the teaching objectives and students' thinking level. In the geography class, teachers can build a virtual geographical environment through VR technology, so that students can feel the changes of geographical phenomena personally. In addition, teachers can also design a series of interactive experiments, so that students can observe the influence of different factors on geographical phenomena by operating virtual devices, and present the occurrence process and causes through VR technology, and guide students to analyze and discuss.

3.3 Implementation of hierarchical teaching

In the teaching process, teachers should carry out hierarchical teaching according to the students' thinking level. To be specific, teachers

can use VR platform technology to set different teaching objectives for students at different levels, design a series of hierarchical problems according to the teaching objectives, and guide students to gradually explore the geographical problems. Through the problem-oriented way, students' thirst for knowledge and exploration are stimulated to promote the development of students' thinking level, and ensure that every student can be improved on the basis of their own. Finally, teachers can evaluate students' thinking level from multiple dimensions through the SOLO evaluation mode. At the same time, attention should be paid to the feedback and application of the evaluation results, and the teaching strategies should be adjusted according to the evaluation results to help students find their own shortcomings and improve them, so as to improve the teaching effect and quality.

4. Conclusion and outlook

This study will SOLO classification theory combined with VR technology constructed VR geography teaching mode based on SOLO classification theory, through the hierarchical teaching design, rich teaching content and comprehensive teaching evaluation, can significantly improve the students' interest in learning and participation, effectively improve the students' geographical thinking level and learning enthusiasm, meet the needs of students' diversified learning, promote the all-round development of students. Future research can further explore the deep integration mechanism of VR technology and geography teaching, and develop more VR geography teaching resources in line with the law of students' cognitive development. At the same time, the empirical research of VR geography teaching model should be strengthened to verify its effectiveness and universality. In addition, we can also pay attention to the application of VR technology in the professional development of geography teachers to improve the information technology literacy and teaching innovation ability of geography teachers.

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