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# Research on Situational Cognition of Calligraphy Education Based on Virtual Reality Technology

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**Abstract—Calligraphy is one of the traditional cultures with a long history in China, which is full of the wisdom and cultural essence of the Chinese nation. With the continuous development of science and technology, traditional art is gradually integrated with modern science and technology to produce a form of art development based on the characteristics of the times. As a new teaching tool, virtual reality technology appears in the classroom and promotes the development of education and teaching to a certain extent. It can effectively generate experience and make the learning form of traditional art clearer. This paper aims at refining the integration of calligraphy education and virtual reality technology, breaking through traditional teaching forms, providing students with more real and wonderful visual, auditory and tactile learning experience, helping students' situational cognitive system, and thus improving students' perception ability and learning interest in calligraphy learning.**

**Index Terms—Traditional art, VR technology, Calligraphy education, Situational cognition, Fusion inquiry**

## I. INTRODUCTION

The Chinese character is a unique creation of the Chinese nation. It is the main carrier of the inheritance of Chinese culture. It is because of it that the Chinese civilization has been inherited and developed for thousands of years. Calligraphy is a unique art category in China and a bright pearl in the world's cultural and artistic treasure house. With the continuous development of science and technology, traditional art is gradually integrated with modern science and technology to produce a form of art development based on the characteristics of the times [( Hu Xiaoqiang, 2005)].

Virtual reality technology is an important development direction of modern simulation technology. It is an interactive system simulation of 3D dynamic scene and entity behavior with multi-source information fusion. At present, it has been successfully applied to military, engineering, medicine, culture and education, and has achieved ideal results of good practical value [(Han Xiaoling, 2007)]. As a new teaching tool, virtual reality appears in the classroom and promotes the development of education and teaching to a certain extent. It can effectively generate experience and make the learning form of traditional art clearer. Compared with traditional art courses, virtual reality technology can provide students with more real and wonderful visual, auditory and tactile learning experiences.

Then, how to combine calligraphy education with virtual reality technology, and produce certain applicable value through effective construction and objective practice. This will be the main problem to be solved and integrated in this paper.Traditional calligraphy emphasizes internal beauty and internal skill cultivation, while innovative calligraphy pursues external beauty and focuses on novelty of form. The inner beauty requires people to be quiet, so that they can gradually improve their realm. The beauty outside shows that people should move. As the leader of China's innovative calligraphy - Professor Wang Dongling of the China Academy of Fine Arts, he wrote Chuang Tzu's Leisure Journey again in 2021 with VR technology, and also performed VR calligraphy in relevant exhibitions [(Zheng Zi, Wang Wenjun, Ma Zhiqiang., 2007)]. VR calligraphy refers to the direct use of virtual reality technology to write calligraphy. The characters are three-dimensional. The calligrapher can turn and move the characters at will, as if you made them into acrylic materials in reality, which can be displayed 360 degrees[(FIG. 1 to FIG. 2)].

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FIG.1Wang Dongling's Traditional Writing Scene

FIG.2 Wang Dongling VR wrote "Leisure Journey" (2021)

Through the practice and exploration of Professor Wang Dongling, the leading figure in the Chinese calligraphy art, it may provide some thinking directions for the introduction of virtual reality technology into calligraphy art and calligraphy classes. Although, at present, the research theory and empirical exploration of Chinese calligraphy art and calligraphy education in this area are relatively scarce [(Xu Yan,2008)]. However, by sorting out the relevant calligraphy art teaching situation and the questionnaire analysis of students' learning psychological orientation, we can get the corresponding conclusions. This provides a certain reference material and theoretical value for the future research on the application of virtual reality technology to calligraphy art. Next, it will elaborate the relevant contents from three aspects: the value of virtual reality technology applied to calligraphy art, the diversity of the introduction of calligraphy art teaching forms, and the questionnaire analysis of students' learning psychological orientation [(Bian Feng, Jiang Manqing, Sang Yongyin,2007)].

## Ⅱ.THEVALUEOFVIRTUALREALITYTECHNOLOGYINCALLIGRAPHYEDUCATION

At present, combined with the development trend of contemporary science and technology, diversified educational models have emerged one after another. Calligraphy, rooted in the long spiritual core of the Chinese nation, has its important cultural value and inheritance significance, and should also present a modern development model suitable for this. Traditional art should not be abandoned, but also be insisted and inherited. In addition, higher level thinking and innovation are also required.

VR technology was first proposed by VPL Exploration Company and its founder Jaron Lanier in the middle of the 20th century. Later, Ames Space Center of NASA began to develop low-cost virtual reality systems using popular LCD TVs and other equipment, promoting the progress of its hardware [(Jarmon L , Traphagan T , Mayrath M , et al, 2009)]. At present, this technology has made great progress. The Computer Department of Beijing University of Aeronautics and Astronautics is one of the earliest and most authoritative units in China to conduct VR research, and has made progress in the following aspects. The State Key Laboratory of CAD&CG of Zhejiang University has developed a real-time roaming system for desktop virtual building environment, and has also developed a new fast roaming algorithm and a fast generation algorithm of progressive grid in virtual environment; Harbin University of Technology has successfully simulated the synthesis of specific facial images, facial expressions and lip movements in human advanced behaviors; The Department of Computer Science and Technology of Tsinghua University has studied virtual reality and telepresence; The Institute of Information Engineering of Xi'an Jiaotong University has studied the stereoscopic display technology, which is the key technology in virtual reality, and proposed a new compression coding scheme based on JPEG standard, which has achieved high compression ratio, signal to noise ratio and decompression speed [(Roth W M , Jornet A, 2013) ].

Burdea&Coiffet (1992) summarized the important characteristics of virtual reality as "3I", namely immersion, interaction and imagination.

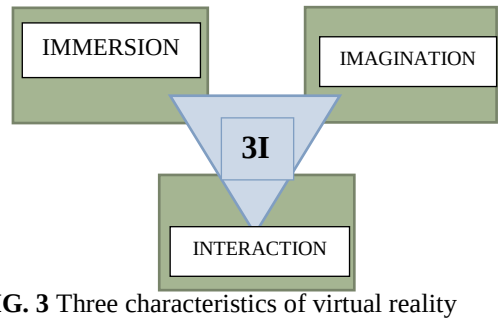


**FIG. 3** Three characteristics of virtual reality technology

International Journal of Engineering, Management and Humanities (IJEMH)
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Situational cognitive theory holds that "learner" and "environment" are two elements of the same learning system, and they interact with each other. Constructivism emphasizes the internal construction process of human brain, and situational cognition pays more attention to specific external situations. Experients' situational cognition of virtual reality involves three dimensions: immersion, interaction, and cognition [(Lan , Y . J . , Wei , H . H . , & Chiu , Y . L . , 2014)]. Each dimension contains three levels of progressive progress, gradually approaching the cognition in the real situation.

Immersion, interaction and imagination greatly overcome the limitations of traditional calligraphy art and teaching environment, which is conducive to stimulating learners' learning motivation, enhancing learning experience, and realizing situational learning and knowledge transfer [(Huang Ronghuai, Chen Geng, Zhang Jinbao, et al., 2010)].

Learners, especially young learners of calligraphy art, are often used to this way of self representation, and will express their thoughts and feelings through roles. More importantly, this learning experience will stimulate learners' creativity and imagination. The main reason why the traditional calligraphy teaching has been criticized is that the traditional teaching method is divorced from the specific and real situation, resulting in the insufficient transfer ability of students to the calligraphy art knowledge. Situational learning is committed to solving this challenge and promoting students' motivation and fun of learning by setting situations similar to life situations. Virtual reality technology supports the occurrence of situational learning, and can provide rich perceptual clues and multi-channel (auditory, visual, tactile, etc.) feedback to help learners transfer what they have learned in virtual situations to real life, and meet the needs of calligraphy art situational learning.

## Ⅲ. DIVERSITY OF CALLIGRAPHY EDUCATION FORMS

The perceptual situation generated by virtual reality technology will become one of the new models of calligraphy education in the future by combining the three perceptual experiences of vision, hearing and touch to study and explore the traditional calligraphy culture, which is of great significance to broaden the diversity of teaching forms of calligraphy education.

Because of the depth of the essence of traditional culture and the long history of calligraphy, its unique traditional meaning is strong, which is relatively divorced from modern life and rhythm, making it difficult for students to understand or absorb the connotation and characteristics of calligraphy in a short time. In this case, it is particularly valuable to explore more appropriate teaching methods in calligraphy education [(Huang Ronghuai, Zheng Lanqin, Cheng Wei, 2012)]. The multiple perception of virtual reality technology can guide students to effectively grasp the content of calligraphy, solve the visualization of learning content and knowledge, enhance the sense of immersion in learning, give students the sense of experience of relevant carriers in real life, and help to enhance students' perception and learning interest in calligraphy art.

## Ⅳ. AN ANALYSIS OF THE QUESTIONNAIRES ON STUDENGTS' PSYCHOLOGICAL ORIENTATION IN LEARNING

Based on the two different teaching methods of traditional calligraphy teaching and virtual reality technology application and calligraphy teaching, the author conducted a questionnaire survey on the learning psychological orientation of 260 students in some senior high schools in Tianfu New District, Chengdu, Sichuan Province, China, on different calligraphy teaching models. This part of students have completed two different types of calligraphy courses in the same year. The main content of the questionnaire includes calligraphy learning mode, students' learning interest and students' learning psychological orientation. A total of 260 questionnaires were distributed and 257 were actually received. The following is the data presentation of part of the questionnaire.

1. Which of the two different calligraphy learning styles do you prefer?

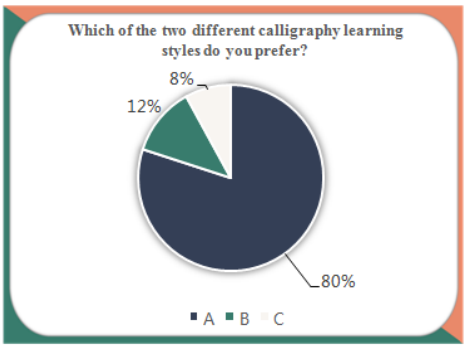


FIG.4 Questionnaire results of students' liking for calligraphy learning mode

International Journal of Engineering, Management and Humanities (IJEMH)
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According to the data, the proportion of students who choose option A virtual reality technology to calligraphy teaching is 80%, the proportion of students who choose option B to traditional calligraphy teaching is only 12%, and the proportion of students who choose option C without knowing is 8%. This shows that students are more active in learning virtual reality technology.

2. Which calligraphy learning form makes you more interested in learning?

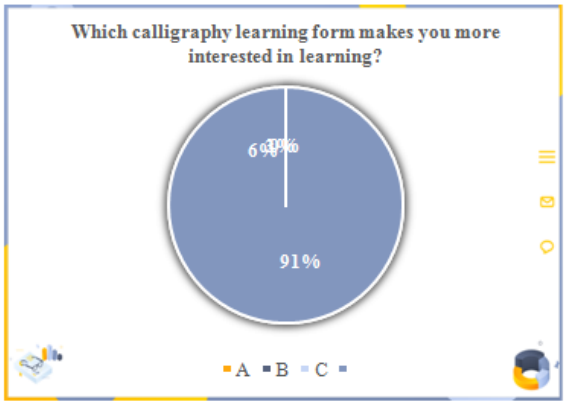


FIG.5 Questionnaire Results of Students' Interest in Calligraphy Learning

According to the data, 91% of students choose option A virtual reality technology to teach calligraphy, 6% choose option B to teach traditional calligraphy, and 3% choose option C. This shows that students are full of interest in the learning mode of virtual reality technology.

3. Which learning mode do you prefer when learning calligraphy later?

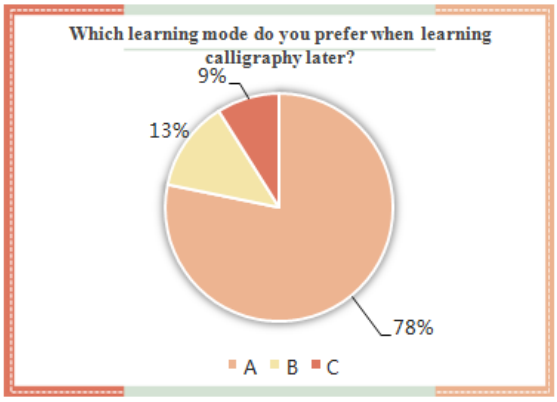


FIG.6 Questionnaire Results of Students' Tendency to Calligraphy Learning Mode

According to the data, 79% of students choose option A virtual reality technology to teach calligraphy, 13% choose option B to teach traditional calligraphy, and 9% choose option C. This shows that students are more inclined to apply virtual reality technology to the learning mode of calligraphy education, and are full of expectations.

## Ⅴ. LIMITATIONS OF IMITATIONS OF VIRTUAL REALITY TECHNOLOGY IN CALLAIGRAPHY EDUCATIONEVALUATION OF THE EFFECTIVENESS OF VR TECHNOLOGY

First, cognitive load control.

In the virtual environment, students sometimes find it difficult to focus on learning activities. Too many functions and rich simulation scenes in the virtual world will interfere with learners' attention to important content. Such as sound, image, text and even force sense. Multi channel information transmission and rich stimulation easily increase the cognitive load of working memory in unit time, resulting in cognitive overload.

Second, the development and use of effective learning monitoring and evaluation tools.

In the virtual environment, it is difficult for teachers to monitor the development of the education process, and it is difficult to distinguish whether students are playing or learning in the virtual world. This objectively requires the development of effective monitoring and evaluation tools for students' learning behaviors and processes in the virtual environment, so as to help teachers understand students' learning performance and provide guidance and intervention in a timely manner.

## Ⅵ. THE CONCLUDING

As a new technology, virtual reality technology is still in the primary stage in the field of calligraphy education. However, the virtual reality technology is full of vitality. It is marching towards the practical direction, showing broad application prospects to people. It is known as "the new technology of the 21st century", and is also one of the important technologies developed in this century. As a combination of science and art, it will continue to mature. The essence of applying virtual reality education to calligraphy education lies in the introduction of new teaching methods. This is the key and difficult point of virtual reality technology education application. We believe that with the continuous development and improvement of technology and the deep integration of educational theory, virtual reality will play an increasingly

important role and value in the field of calligraphy education.

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She was born in Chengdu city, Sichuan, China on 7th June,1990. She graduated from Renmin University of China with a master's degree in educational administration. She is the director of the basic calligraphy education branch of the (National) education calligraphy and Painting Association, the deputy secretary general and executive director of the Calligraphy Education Professional Committee of Sichuan Education Society, the executive director of the Art Education Professional Committee of Sichuan Education Society, and the executive director of the film and television education professional Committee of Sichuan Education Society.

She is the editorial board member of the book “theory and practice of humanistic education in the new era”, a key planning project of China's national publishing house. She participated in China's national projects “Research on the activity mode of art education workshop in primary and secondary schools” and “Research on the inheritance of Chinese traditional culture in art disciplines in senior high schools” and served as the main researcher. She was awarded the honorary title of “advanced individual” in Sichuan Province by the people's Government of Sichuan Province on the “Sixth National College Student Art Exhibition”. At the same time, she is a calligraphy judge of the art talent competition for primary and secondary schools in Sichuan Province, China. Her article “application and teaching exploration of virtual reality technology in art approval” was published in the International Journal IJIET, and her article “on the teaching practice of strengthening the protection and inheritance of China's intangible cultural heritage - a case study of Tianfu new area, Chengdu, Sichuan” was published in the International Journal IJSHI. The article “Inquiry Teaching of Chinese traditional painting based on virtual reality technology - take Han Xizai's banquet as an example” was published in the International Journal ELTLS. She published 10 articles in China to China's national art core publications “Chinese primary and secondary school art” and “Calligraphy Education”.