Research on the Application of Virtual Reality Technology in Dance Teaching
——Taking the Teaching of "Dunhuang Dance" as the Example

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ABSTRACT

Under the background of the in-depth development of Internet + education, the deep integration of virtual reality technology and dance teaching is a new way to innovate the training mode of dance talents and satisfy students' all-round development and lifelong learning. This article introduces the pain points of the current dance teaching, and the breakthrough point of integrating virtual reality technology into dance professional teaching: using virtual reality technology to build immersive dance teaching environment, building dance online resource library, conducting virtual choreography and rehearsal, and simulation training. Finally, the paper shows the case of the application of virtual reality technology in dance teaching through the lesson of "Dunhuang Dance", designs the six links of the whole process of teaching implementation, introduces the process of making Dunhuang Dance courseware with VR content making tool Nibiru Creator, and constructs the dance course mixed teaching mode based on virtual reality technology, On this basis, experimental and interview methods were adopted to study the influence of immersive VR micro-lessons on students' learning, with the presentation of micro-lessons as independent variables and the positive emotions and knowledge acquisition scores of choreography major students as dependent variables. Through experimental research, it is found that immersive VR micro-class has extremely high application value in students' emotional guidance and knowledge understanding. It can bring students immersive emotional experience and interactive experience exploration of VR courses in dance teaching, and guide students to think positively and deepen their understanding of learning content. After that, this paper analyzes and discusses the experimental results, analyzes the limitations of the experiment, and makes some assumptions and prospects for dance VR teaching, hoping to provide some enlightenment for practice.

Keywords: dance teaching; vr technology; application strategy; instructional design

1. INTRODUCTION

Dance major has the characteristics of practicality, intuition and strong emotion, and has always adopted the way of information communication between teachers and apprentices. For a long time, the integration of information technology and dance teaching has been slow to start, and the most commonly used information means in dance teaching is still in the primary stage of simple audio and video playback. From the perspective of future talent demand of social development and student development, the limitations of traditional dance teaching are obvious. It is urgent for dance teaching to innovate talent training methods and actively explore realistic paths suitable for students' all-round development and lifelong learning. In recent years, the academic circle has carried out the preliminary exploration of "online + offline" mixed teaching of dancet [2], and has successively developed dance micro courses and MOOCs courses. However, two-dimensional dance teaching videos still cannot avoid their own limitations, especially during the epidemic, the advantages and limitations of dance "online teaching" compared with traditional "offline" courses are obvious [13]. Virtual reality technology, with its significant advantages of "immersion" and "interactivity", has brought new opportunities for promoting Internet + education. Many scholars believe that virtual reality technology has a wide application

prospect in the teaching of various disciplines [9][10], which can improve the learning effect and has many advantages in the teaching of dance [11], especially in the online teaching of dance, virtual reality technology will play an incomparable advantage [1][5].Based on the research results of the application of virtual simulation technology in dance teaching, this paper takes "Dunhuang dance" as an example to carry out exploration and research, in order to provide reference for teaching practice.

2. RESEARCH TRACEBACK

2.1. Dance teaching and characteristics

Dance is a spatial, practical and comprehensive dynamic plastic art, and its main means of expression are human gestures and expressions and the continuous flow of human movements [6]. Dance teaching mainly follows the traditional teaching method of "oral teaching", oral teaching, namely oral transmission, teaching dance knowledge and culture and relevant movement essentials; "Body teaching", that is, teachers perform in person for students to follow, so that the complex and delicate aesthetic emotional content in dance teaching can be understood by students, so that the silent knowledge of "only can be understood but not explained" becomes vivid and easy to understand, and at the same time permeates the cultivation of students' aesthetic feelings, attitudes and values. In academic circles, there are many about the oral teaching method "and the significance of exploration in the dance teaching [3][7]," oral body to teach dance teaching method "is considered to be in conformity with the dance teaching law, even in the context of contemporary and future informationization teaching, is still the main or important teaching method [8], with an alternative [12].

2.1.1. Advantages and disadvantages of "oral teaching of dance teaching method"

In Internet + deep development under the background of education, life-long learning has become a way of life, is the only way for students their own development and adapt to the needs of society, exposed the shortcomings of traditional dance teaching should not be ignored: one is difficult to break through time and space limit, do not build a lifelong education system to meet the demand of the target, can not meet the requirements of personalized, diversified and lifelong learning; Second, the teaching mode is closed and single, ignoring the cultivation of students' innovative spirit and ability, which can not meet the diversified needs of students and the social requirements for the cultivation of compound talents. Therefore, the reform of dance teaching is the general trend.

2.1.2. Dance informatization teaching faces severe challenges

Lack of resource construction: Informatization teaching is in full swing, but the informatization application of dance teaching in colleges and universities has not been widely and deeply carried out, let alone deep integration, and information technology has even become dispensable. Recently, the national higher education wisdom education platform (hereinafter referred to as "wisdom" of higher education) the first online course 20000, covers 92 professional class 13 subjects, on April 26, 2022, and the search term "dance", 64 primary retrieval course door, further comb and remove irrelevant and repeated courses, music dance classes only 44 door, Obviously, the resource construction of dance MOOC is lacking. Further statistics show that 44 courses are from 34 universities, among which Shandong Youth University of Political Science (Shandong Union) has the largest number of 4 courses online, followed by Beijing Dance Academy with 3 courses online, as shown in Figure 1. In terms of provinces (municipalities directly under the Central Government) where courses are located, Shandong province and Hubei Province are tied for the first place, with 9 courses selected respectively. Beijing ranks the third place, with 7 courses selected, as shown in Figure 2.
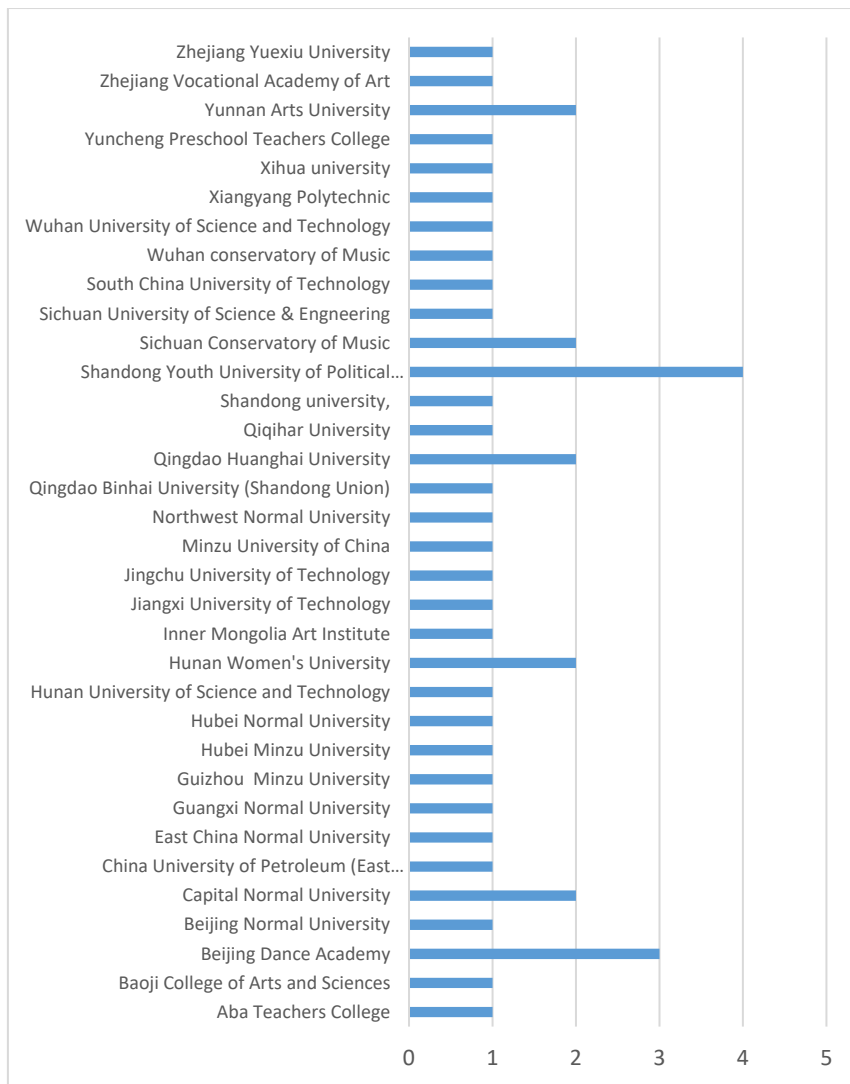
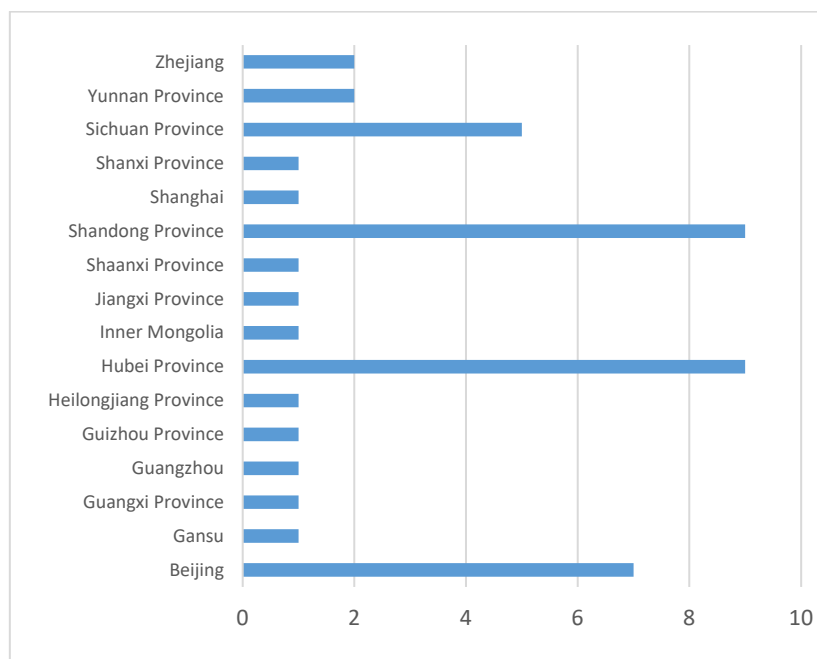**Figure 1:**Statistical table of Course unit

Figure 2: Statistics on the number of courses in each province

The teaching information conveyed by two-dimensional dance learning videos has shrunk seriously. Students want to through the online course improve their dance professional knowledge and skills, mainly want to contact with more types of dance, constantly explore your body's largest space, the two-dimensional dance video learning can convey the teaching information badly shrunk, affect students' understanding, outbreak further test the effectiveness of the network teaching dancing.

How innovation can be incorporated into the dance teaching, the advantage of the means of modern and traditional dance teaching innovation, not only meet the real-time interaction of teaching and accurate vitality and breakthrough the limitation of time and space, and can make dance teaching becomes the current dance education reform education to adapt to the future development direction of key, virtual reality technology provides a new opportunity for everything.

2.2. The entry point of applying virtual reality technology to dance teaching

Virtual Reality Technology, referred to as VR or psychic Technology, is a computer simulation system that can create and experience the Virtual world. The use of computer technology to simulate a 100% virtual world, so that users have a sense of immersive. Augmented Reality (AR) technology is an extension of VR, which can overlap simulated information to the real world, making the real environment and virtual objects superimpose to the same screen or space in real time, and then produce Mixed Reality. Cinematic Studio Reality (XR) and MR = VR * AR will enable users to explore and interact with the real and virtual worlds. Sutherland, the father of American computer graphics, proposed the basic idea and classic description of the concept of virtual reality in 1965. It was not until the early 1990s, with the continuous development of multimedia and communication technology, that virtual reality technology was promoted from the laboratory to different fields. However, limited by technical barriers, VR equipment has not entered the mass consumer market, naturally there is little attention. 2016 is known as the first year of virtual reality technology, mass consumer VR devices from mainstream manufacturers enter the market, and virtual reality technology enters the stage of comprehensive development. In the field of education, virtual reality technology has not been introduced into the classroom on a large scale. With the development of 5G technology, lightweight terminal devices of virtual reality will eventually break the problems of bulky, imaging delay and vertigo caused by traditional devices, and bring users better interactive experience. Virtual reality technology can provide effective resources for autonomous learning, and create favorable conditions for the development of situational

learning, experiential learning and cooperative inquiry learning. It coincides with the ideas of behaviorism and constructivism, and provides theoretical basis for the effective application of virtual reality technology in teaching and learning.

The unique characteristics of immersion, interactivity, conception and intelligence of virtual reality technology make it possible to carry out high-cost and irreversible inquiry learning in high-risk or extreme environments, help to break through teaching difficulties, solve the pain points and doubts of teachers' teaching and students' learning, and foster new teaching methods and models. In general, the application of virtual reality technology in dance teaching mainly includes the following aspects.

2.2.1. Application in teaching experience exploration

VR space is used to build theater (dance) environment scenes and application scenes with high imitation degree and good immersion effect. On the one hand, students can comprehensively and vividly master the layout and functions of theater space, and carry out scenario-based teaching, personalized learning and comprehensive practical training and exploration activities. On the other hand, rendering the emotional atmosphere of the stage and stimulating the "role substitute" of students' performance will help students deduce the spiritual connotation of the work and improve the performance level.

2.2.2. Application in the construction of dance teaching resource database

At present, the coverage of high quality virtual simulation teaching resources is limited, especially in dance specialty. In the construction of dance teaching resource library, first, the virtual reality system of dance teaching can make the teaching resources in class become a kind of digital resources for students to observe and practice repeatedly after class to meet the requirements of students' self-study; Second, through VR panoramic video and motion capture technology, some precious achievements that are difficult to reproduce are systematically collected for immersive 3D restoration and resource pool is established.

2.2.3. Application in choreography and rehearsal

First, in dance creation, virtual dance images are used to set up music, scenes, costumes, numbers, etc., to explore new means of artistic creation and expression, which can provide new ways for teachers and students to create and choreograph independently or in teams, and bring new choreography experience to creators. The

second is to introduce the virtual image into the dance works to inject new elements into the creation, so as to expand the boundary of dance art.

2.2.4. Application in dance simulation training

First, virtual teachers (learning partners) provide students with very standard dance demonstrations, so that students can master dance performance skills by imitating movements in full autonomy.

Second, students' dance movements are captured and recorded, and compared with the movements in the dance movement database to find deficiencies and shortcomings, mark differences, analyze and calculate, and then make real-time analysis of students' movements through a variety of ways, feedback reports, and put forward guidance schemes. At the same time, the precipitation of teaching data can provide effective basis for carrying out diversified student evaluation, monitoring and evaluation of learning effect.

3. PROCESSES AND METHODS

At present, the theoretical research on the application of virtual simulation technology in dance teaching is in the majority, while the practical exploration is still poor. The construction of virtual simulation teaching resources for dance is insufficient, and there are no achievements of systematic teaching resource construction and teaching application research for specific dance teaching content. Therefore, starting from specific dance teaching problems, under the guidance of constructivism and behaviorism and taking dunhuang Dance as an example, this study designed six links of the whole teaching implementation process, introduced the development mode of curriculum resources, and constructed a mixed teaching mode of dance courses based on virtual reality technology.

3.1. Course introduction

This study chooses the Teaching unit of Dunhuang Dance as the case for the following reasons: Dunhuang Mogao Grottoes has incomparable historical and artistic value, and the study of Dunhuang dance is of great significance for inspiring students' pride in national culture and carrying forward and inheriting traditional culture. On the one hand, due to the limited class hours, the teaching has been focusing on the practice of Dunhuang dance techniques rather than the cultivation of art and humanistic qualities, and the teaching content of art and humanities cannot be developed, making learning into boring repeated mechanical exercises; On the other hand, due to the limitation of teaching funds, it is not realistic to visit the Mogao Grottoes on the spot, and the lack of real scenes makes students lack a perceptual understanding of the brilliant culture of Dunhuang, and a deep understanding of dunhuang dance

from static fresco dance elements to dynamic dance language generation. Create a full scene of Mogao Grottoes with VR, enable learners to experience the music and dance culture and plastic arts of Dunhuang murals, understand the style of Dunhuang dance, stimulate students' learning enthusiasm, independently explore the dance elements in the murals with questions and tasks, bring students immersive interactive experience and enhance learning initiative. It will pave the way for students to further explore the elements of mural music and dance to the formation of dance language, study the aesthetic characteristics, artistic characteristics and inner emotions of Dunhuang dance, and then create dunhuang dance.

3.2. Teaching process design based on VR and teaching mode

The following takes the learning unit Dunhuang Dance as an example to share the specific measures of using virtual reality technology to carry out the mixed dance teaching of the trinity of pre-class, in-class and after-class, online + offline, and the combination of virtual and real. The teaching process designed for Dunhuang Dance mainly includes six links:

Background knowledge: It is used for online self-study of students before class, providing VR scenes of Mogao Grottoes to start a journey of exploring Dunhuang culture, helping students deeply experience the shock of Dunhuang frescoes and excavating the living soul of Dunhuang music and dance. Setting up games to test students' knowledge mastery;

Case introduction: Guide students to appreciate the excellent Dunhuang Dance works and further stimulate students' interest in learning;

Question exploration: Based on VR program, students are asked to explore the prototype of dunhuang dance, capture the artistic images in the fresco, and understand the reference and development of contemporary creation on the elements of fresco dance; Share their own exploration feelings, understanding of Dunhuang dance style, and perform dance skills they have learned;

Summary: The teacher guides the students to summarize the various figures in the fresco, the five typical external features of Dunhuang dance and the style of Dunhuang dance;

Expansion and extension: According to the dance posture of the mural, students are invited to create the "resurrection" dance in groups, and perform the creation, group display, and group evaluation;

After-class practice evaluation: After class, the dunhuang dance virtual music and dance teacher driven by motion capture acts as a training partner for students, allowing students to freely observe and learn in a VR

immersive environment; Using dunhuang dance virtual dance score, through real-time movement measurement to analyze the accuracy of students' dance movements, strengthen and improve the learning effect; At the same time, the process measurement data can be used as the basis of teaching effect evaluation and feedback. On this basis, NibiruCreator software is used to design and develop the courseware of this lesson.

The courseware is highly extensible. You can export it to a local PC or VR appliance. According to the development practice of this lesson, this paper further proposes the mixed teaching mode of dance course based on virtual reality technology, as shown in Figure 3.
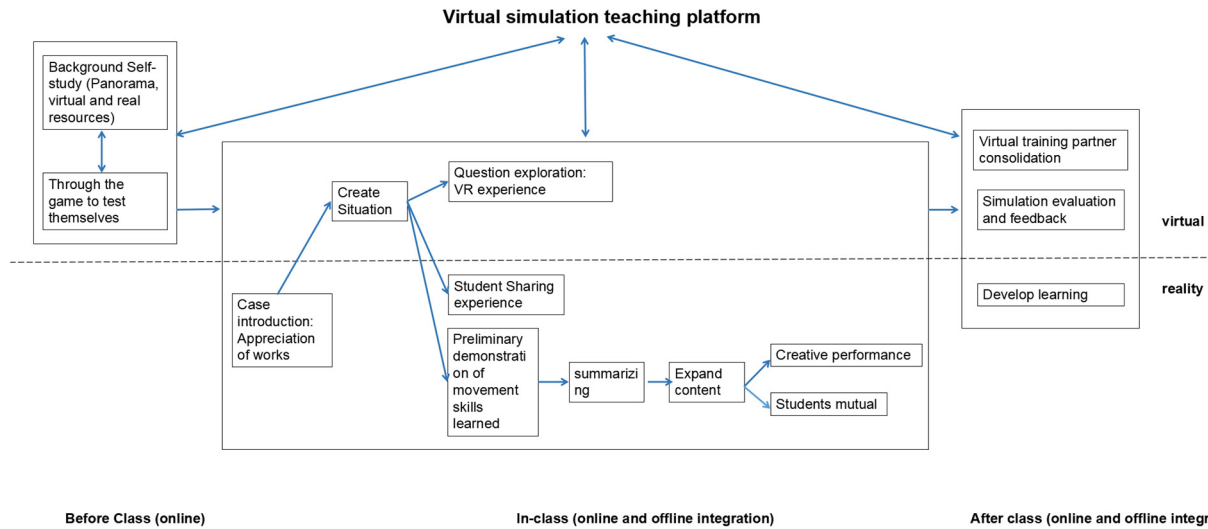
Figure 3: Structural relationship model of influencing factors of online learning experience (revised).

3.3. Make VR courseware with Nibiru Creator

Nibiru Creator (" Creator "for short) is a VR content making tool for non-technical personnel. It supports interactive editing of panoramic pictures and panoramic videos. It can help users jump through scenes in series and add corresponding response events, so as to quickly complete the production of a VR presentation content.

The overall process framework of Creator is relatively clear.The editing process of an interactive panoramic content is mainly through: project creation, resource addition, flow chart establishment, scene editing、preview/export, as shown in Figure4 below:

1)Create a project: Double-click the program desktop icon, open the startup page, enter the program, click New project or open the recently saved project file to officially enter the Creator, draw your virtual world.

2)Add scenes: Add customized panoramic images and videos to be made, and add images and videos in batches. Images can be .JPG or .PNG and videos can be MP4.
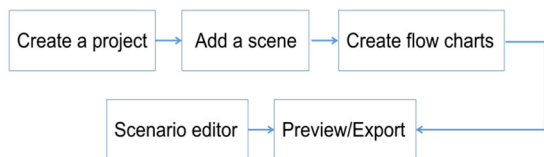

Figure4: Flow operation diagram

3)Flow chart editing: Mainly set the scene switching effect, which can be divided into two Settings: "Switch hotspot connection" and "Event connection". The design of the process reflects what kind of story the designer wants to present to the user. The smoothness of the process will directly affect the user's interactive experience.

"Switching hotspot" is connected by thin white solid line, and the triggering mode can be divided into click and hover. "Event connection" can realize the "automatic" triggering mode which can be automatically triggered at a certain point in the video.

When multi-scene and multi-process events need to be set, multi-path can be set through the event selector, and the selection layer can be displayed in the center or pop-up for learners to choose as required, which is of great help to carry out task exploration and game links.

Hot spot trigger effect: support setting zoom value, replacing icon resources and adding sound when moving into a hot spot; support setting zoom value and adding sound when clicking a hot spot. Using the function of hot trigger, different types of learning interaction can be designed in the process of learners' self-learning, so as to improve students' learning interest and enhance the sense of immersion experience.

4)Scene editing: it is the key to enhance the visual immersive experience. The main view can be set for panoramic pictures and videos to enhance the sense of scene insertion.

5)Export:You can export it to PC or VR appliance.

3.4. Courseware Achievements

On March 27, 2021, the "First National Simulation Teaching Competition" was held in Beijing, which was the largest national simulation teaching competition with the most comprehensive categories and the largest number of participants. Among the 192 works that entered the final, only dunhuang Dance, a dance virtual simulation teaching courseware of the author's team, won the second prize in the competition. It is a preliminary attempt and exploration of applying virtual simulation technology in dance teaching field.

3.5. The impact of Dunhuang Dance VR courseware on learning

3.5.1. Experimental subjects

30 sophomores majoring in dance choreography in Y University were randomly divided into experimental group and control group. The experimental group was group A with 15 students, with A male to female ratio of 6:9 and an average age of 19.6 years. The control group was group B, with 15 participants, the male to female ratio was 7:8, and the average age was 19.54. All subjects had normal visual acuity or corrected visual acuity. There were no significant differences in gender ($X2 = 0.21$, $P > 0.05$) and age ($t = 1.23$, $P > 0.05$) between the two groups.

3.5.2. Experimental materials

The two groups of experimental materials are micro-lessons of Dunhuang Dance, and the knowledge organization structure, dubbing and other factors are the same. Independent variables of the experiment are controlled as the way of knowledge presentation. Group A: The experimental materials were VR micro-lessons, which were presented in the way of combining VR scene roaming and task exploration. The learning material lasts about 215 seconds, and the learning device is "mobile phone with gyroscope +VR glasses". Group B: The experimental materials were traditional video micro-lessons, which were organized by combining case presentation and knowledge explanation. The learning material lasts 215 seconds and the learning device is a mobile phone.

3.5.3. Measuring tools

Knowledge pretest: make a knowledge pretest questionnaire to investigate the learner's understanding of the learning material. Watson D and Clark LA were used to measure positive and negative emotions. Positive emotion negative Emotion Scale (PANAS) jointly developed. [4]) Emotion score = positive emotion score - negative emotion score. Learning effect test: according to the learning objective, set up knowledge content related questionnaire, a total of 10 questions, each question value of 5 points, the full score of 50 points.

3.5.4. Experimental procedures

Before the experiment, the author helped the subjects in group A to wear glasses and adjust the comfort of wearing, placed the mobile phone with micro-lesson in the VR glasses, confirmed that the subjects could watch the VR micro-lesson, and informed the methods of learning micro-lesson for the subjects in group B. After learning the relevant courses, the subjects were asked to complete the "Emotion Questionnaire" and "Knowledge Post-test Questionnaire" successively.

3.5.5. Experimental results and discussion

Influence on students' positive emotions. There was no significant difference between the two groups in pretest positive emotions, but significant difference in posttest positive emotions: the positive emotions in the two groups were significantly higher than the pretest positive emotions, and the positive emotions in the experimental group were significantly higher than the control group. Before and after comparison results are shown in Table 1:

Table1: Comparisons of positive fmotion data before and after test in two groups

	Control group	experimental group	t	P
Pretest positive emotion	1.575	1.51	0.31	1.831
Positive emotions were measured after the test	3.989	4.093	2.656	0.008
t	2.9	4.927	\	\
p	0.021	0.001	\	\

Research results show that compared with traditional micro-lessons, THE VR micro-lessons of Dunhuang Dance have a more effective effect on the positive emotions of dance art students, and VR micro-lessons have a significant effect on creating a learning atmosphere for inquiry and arousing emotional resonance, which is consistent with the conclusions of previous studies. Combined with the interviews, it is found that VR courses bring students immersive emotional experience and stimulate the "role substitution" of students' performance.

The impact on learning tests.After taking the after-school test, it was found that the control group (average score 30.33) and the experimental group (average score 38.52) had significant differences in

knowledge acquisition scores (P=0.002). The research results show that compared with traditional micro lesson, lesson "dance" VR micro can promote dance art students understanding and mastering of knowledge, combined with interviews found that VR course interactive experience to explore, to guide students to active thinking, deepen the students understand the dance of the inner emotions, then the dance of the plait.

Due to limited time and energy, the difference in knowledge retention and knowledge retention rate has not been involved in this experiment. In the later stage, experimental materials, sample size, learning time and other variables can be increased to further improve the experiment, so as to obtain more abundant research data.

4. DISCUSSION AND SUGGESTIONS

Through the above exploration of the application of virtual reality technology in dance course teaching, this paper enriched the innovative practice research of dance specialty teaching, and summarized the enlightenment of the research as follows:

Excellent teaching design is the basis for the effective integration of virtual reality technology and dance teaching. It will greatly promote the effect of dance teaching by taking full advantage of VR resources and multimedia technology to enrich teaching activities, enhance teaching interaction and meet the diversified learning needs of students based on the principle of being able to be real and not virtual. The application of VR technology is a new way to solve the problem that the current practical dance teaching can not meet the needs of modern teaching.

At present, the research on dance VR micro-lesson still needs further exploration. The promotion of VR teaching application largely depends on the reduction of the development cost of micro-lesson products, and finding a convenient and effective VR micro-lesson development tool is an effective way to reduce the development cost of VR micro-lesson.

Make full use of internal and external forces, strengthen the combination of production, education and research, and form a curriculum resource construction team. The author and the team in the development of "dance" in the process of the virtual simulation courseware, deeply felt the panoramic VR material is very scarce, and resources development is the current teachers stand in the way of VR practice, strengthen the school scientific research strength and with the help of a third party agencies to promote technology is a feasible path for the construction of high quality dance courses, let professional people do professional thing, optimize the allocation of resources, Only in this way can virtual reality technology be applied to dance teaching.

Technology can empower education rather than replace teachers, tradition and information, offline and online go hand in hand, complementary advantages rather than substitute, give full play to the advantages of both, for the already used, in order to better adapt to the development direction of future education. History of development and promote decides the dance teaching in colleges and universities in our country in the future will be to mix the coexistence of "online and offline" teaching time, dancing, there is a huge space for development, the informationization teaching needs attention and participation of all parties concerned, the virtual reality technology is applied to the practice of dance teaching remains to be further exploration.

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