



# Exploration and Design of Dance Virtual Simulation Teaching System

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**Abstract.** This paper introduces the background and the significance of the construction of dance virtual simulation teaching system, details the system functions of the teaching platform, and gives the system framework and development process of the system.

**Keywords:** Dance · Virtual simulation · Exploration · Design

## 1 Introduction

At present, the teaching of dance in most universities in China is usually conducted face to face by professional dance teachers. Most of their dance knowledge and skills require students to learn and understand by imitating the teacher's dance movements. Dance teaching is highly practical, but it also has limitations. The emergence and development of information technology has greatly promoted the reform of dance teaching methods. The application of virtual reality technology in dance teaching has greatly promoted the informational development of dance education. Virtual reality technology presents dance teaching content in three-dimensional virtual space through computer interaction technology, which breaks the space-time limit of traditional teaching mode, and greatly improves the efficiency of dance teaching. As virtual simulation technology can build a three-dimensional virtual world and gives feedback to learners' behavior and actions, and also bring learners a sense of immersive, so virtual reality technology is used in the dance teaching creatively.

## 2 Research Objective

The “Dance virtual simulation teaching system” takes “high-level, innovative, challenging” as the guiding principle, takes the “National Virtual Simulation Experimental Teaching Project Technical Requirements” as the standard, and relies on virtual reality, multimedia, human-computer interaction, database, network communication and other technologies to build a management and sharing platform which is extensible, compatible and forward-looking.

Through the combination of motion capture technology and 3D simulation technology, the system allows students to carry out experimental dance demonstration, dance

action design, dance rhythm exploration, dance theory learning and examination, examination data processing, experimental report generation and other experimental activities in a virtual environment, and has the functions of information release, data collection and analysis, interactive exchange, performance evaluation and management, achievements display and other functions. This system can realize the sharing of high-quality experimental teaching resources, and meet the needs of virtual simulation experiment teaching in college dance teaching, and so as to establish a powerful virtual simulation experiment teaching service support system. This system needs to use the current advanced motion capture technology, which is a technology to record human motion information for analysis and playback. The captured data can be as simple as recording the three-dimensional spatial position of a part of the body, or as complex as recording the detailed movement of facial expressions [1].

### **3 System Function**

#### **3.1 Interactive Learning and Assessment Function of Dance Movement Track**

In the traditional teaching process, students can only understand the movement track of dance movements through the teacher's live demonstration or watching videos. Through our action capture of the teacher's standard dance movements, in the virtual simulation teaching of dance movement tracks, students can not only see the standard dance movement tracks, but also can interactively operate and control the virtual human on the key points of the movement tracks, so as to realize the virtual simulation teaching that is truly visible, touchable. There are prompts for students' mistakes. Only such virtual simulation teaching can be truly responsive and interactive. The motion matching functionality where the learners match their motion with the motion modeled by the Virtual Reality helps the students to follow, mimic and learn the movement [2].

At the same time, after understanding and getting familiar with the dance movement track, students will enter the assessment stage. We will conduct assessment and interaction at different movement track points, and the system records the operation process of students, which form assessment data.

#### **3.2 Interactive Learning and Assessment Function of Dance Movement Image**

The beauty of dynamic image of human body is the main point of creation and appreciation of dance performance. In dance performance, we construct a certain aesthetic image through human body dynamics. On the one hand, we make the dance get rid of the restriction of human body appearance and form, and obtain a broader field of expression; On the other hand, it can make dance get rid of the single lyrical expression, reveal the philosophy of life through the creation of certain aesthetic images, and make dance become a profound art. Therefore, another key point of dance teaching is to let students understand the aesthetic basis of dance movements. Let students understand dance movements through the idea of human body beauty and dynamic beauty, and also use dance movements to reflect the dynamic beauty of human body better. In the traditional teaching process, dance images can hardly be conveyed to students in a realistic way, and students can experience their own feelings only through the teacher's explain.

Combined with the data of the teacher's standard dance movements captured by the motion capture device, using 3D computer simulation technology, we can realize the image representation of the dance image potential, meaning and image, and can realize the different forms of different movement points, so that students can see the images that different dance movements should be based on, and students will have a better understanding and experience of dance movements.

### **3.3 Interactive Learning and Examination Function of Dancing Skeletal Muscles**

Dance is an art of body action language. It's not a purely technical sport, and what is more needed is the culture and artistic accomplishment of actors. Whether an actor performs on the stage or practices basic skills in the training room, the control of consciousness is particularly critical. The actors need to control the contraction and relaxation of muscles and the degree of contraction force through consciousness, which makes the dance performance good both in form and spirit. Therefore, it is particularly important to explain the movement rules and mechanisms of the bones and muscles to the students in the dance teaching, which can not be reflected externally in the traditional on-site teaching process.

By modeling the data captured by teachers' standard dance movements, combining the physiological characteristics of human skeletal muscles, we can enable students to further understand and learn the relationship between skeletal muscles and dance movements on the premise of understanding the dance movements and movement tracks.

### **3.4 Interactive Learning and Assessment of Breath in Dance**

The breath in dance refers to the artistry of people's breathing in body movements. The dance takes the breath as the driving force for the external posture, and also pays attention to the experience and imitation of the flow form of the breath. Through training, people's natural body can become expressive artistic body. Breath is closely related to body training. In the dance, the use of breath can not be ignored. The rational and correct use of breath can express the pleasure, anger, sadness and joy of the characters through the integration of breath and movement, which can make the dance more vitality [3].

Students can only understand the teaching of dance breath in traditional teaching scenes by themselves. Combining dance movements and 3D light and shadow effects, we can present interactive, diverse and vivid inner atmosphere through virtual simulation teaching system. Students can interact with these internal breath at different operating points and experience the internal breath changes of different actions.

### **3.5 Learning and Examination Function of Dance Course Theory**

The "dance virtual simulation teaching system" will be designed in accordance with the principle of gradual progress and highlighting cognitive rules, and Will add a lot of text, pictures, audios and videos, Turn the boring teaching of dance theory into a learning form that is easy for students to accept and understand, Realize the combination of online browsing, immersive experience and evaluation, so that students can better understand dance theory.

The learning process of dance theory is synchronized with the interactive action assessment, After learning the corresponding interaction points, students will intersperse the study of theoretical knowledge points to avoid boring theoretical study, realize the combination of theory with practice, and better understand theory after practice.

### **3.6 Data Analysis Function**

This function is mainly used to analyze and process the learning and training data of students on the “dance virtual simulation teaching system”, generates the training report, gives the score evaluation, and generates the analysis chart, and thus to evaluate the teaching effect. The assessment consists of two parts: online question test (50%) and submission of students’ experimental report (50%).

## **4 System Architecture**

The operation of the “dance virtual simulation teaching system” depends on the support of the open virtual simulation experiment teaching management platform. The two are seamlessly connected through the data interface to ensure that users can access the system through the browser anytime, anywhere. At the same time, through the user-oriented intelligent guidance and automatic correction service functions provided by the system, we can help users to achieve independent experiments as much as possible, strengthen the open service ability of experimental projects, and improve the open service effect. The system architecture is divided into three layers, and each layer provides services for its upper layer until the construction of the specific virtual experimental teaching environment is completed.

## **5 System Development Process**

Dance action capture: We adopt mainstream motion capture equipment to accurately capture the dance movements of demonstration teachers, including fingers, generate data sets, refine and adjust, and strive to accurately restore the track of dance movements. At present, there are many ways to capture the dance movement in our country, and optical dynamic capture is the most widely used capture technology [4].

Dance character modeling: According to the requirements of the system, at least four models should be modeled. In addition to making male and female virtual human, in order to adapt to the display of skeletal muscles, it is also necessary to create a dancer’s skeletal model and muscular body model. Then, we will bind and adapt the above generated data with the model to achieve the best binding effect. The data of motion capture is driven by bone binding. When binding bones, you must pay attention to the influence of weight, that is, the influence of bone motion on each point of the model, so that the motion of the model can be as naturally coordinated as possible [5].

Action interaction programming: After the model is created, and successfully bound to the action data set, the animation programming is carried out for the four key aspects of the system: “motion track, internal breath, skeletal muscle, and motion image”, this is

the most complex stage of technology in the system. At the same time, the development of theoretical learning module will be carried out simultaneously at this stage.

Website program integration test: After the completion of the above three stages, the system will be integrated; Interactive programming and web programming will conduct data interaction. It is also necessary to complete the data docking with the National Virtual Simulation Experiment Teaching Course Sharing Platform; conduct joint debugging and stress testing; correct the bugs found. Also, we need to make the introduction video of the dance virtual simulation teaching system according to the relevant requirements of the national platform.

## 6 Conclusion

The dance virtual simulation teaching system introduced in this paper uses motion capture technology and other information technologies, and guides learners into the three-dimensional information space by synchronously displaying dance movements, soundtracks, text explanations, movement key points. Students can not only observe the dance movements, but also carry out interactive operations, and really feel the essence and inner breath of the dance movements, so as to deepen the understanding of dance movements and skills. It is of great significance to promote the dance teaching and the daily basic training of students in colleges and universities.

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