Analysis of the Construction of a Dance Teaching System based on Human-Computer Interaction Technology

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Abstract

With the rapid development and continuous integration of computer technology, network technology and digital communication technology, the degree of information and digitization of various disciplines has been deepened, especially in the field of art. In this paper, the author analyses the construction of dance teaching system based on human-computer interaction technology. The theoretical research and stage practice of new media dance have springing up, that has promoted the technological transformation of dance education. By analysing the digital dance application based on human-computer interaction motion capture technology, the most convenient technology used in digital dance performance is the inertial real-time motion capture system based on the micro inertial sensor (MTX) and the wireless Xbus system. Digital dance pays more attention to the visual impact and the rich connotation of dance content. The rich human-computer interaction technology has brought challenges to dance choreography and dance art design. It also provides new space for development. Digital dance, the new form of dance, will continue to innovate.

*Keywords:*Intelligent system, Human-computer interaction , Data search, System design

1. INTRODUCTION

Human-computer interaction (HCI) is a science that studies the design, evaluation and implementation of interactive computing systems for people and the research of these phenomena. The technology of human-computer interaction is to realize the dialogue between human and computer in an effective way through computer input and output equipment.Since twentieth Century, human-computer interaction technology in the era of rapid development of the environment, highlighting the incomparable sense of immersion and technological development. With the rapid development of digital information technology and computer technology, it has a profound impact on people's lives, so the use of computers has also changed. With the development of science and technology, the input device of computer has developed from tape input to keyboard input, and then to mouse input. With the popularity of smart phones, touch input has become the mainstream input mode. In the whole development process of input device, it is a process from machine recognition itself to the actual perception mode as close as possible. In the field of human-computer interaction, the management limitation of traditional human-computer interaction is more and more obvious.The natural and harmonious human-computer interaction model is what people need and hope, at this time, a very close to the interaction between people, the mode of interaction has come into being, we call it natural human-computer interaction.Compared with the

traditional human-computer interaction technology, natural human-computer interaction technology is not a single technology, but a general term for the technology of realizing human-computer interaction in natural form, mainly involving six main branches, such as voice recognition, touch screen, gesture recognition, eye movement tracking, touch interaction and brain computer interface. Compared with the traditional interaction in which characters, images and graphics are used as the presentation of information, Natural interaction extends information mode to speech, expression, posture and emotion. The new interaction mode makes the interaction get rid of the limitation of desktop computing environment, can better support the application requirements of handheld devices, wearable devices, virtual reality and many other situations, and realize the leap from graphical user interface to natural user interface.

The problems in dance teaching lie not only in the difficulty, but also in the experimental environment and the teacher's on-the-spot instruction. In the limited teaching process, the course can not guide the students to develop the teaching methods of logical thinking, innovative thinking and problem solving. In the long term information technology education, researchers have realized that information technology is not only an effective tool for teachers, but also an effective tool for students to learn. Therefore, this study uses Kinect somatosensory technology development visualization teaching software, design a suitable university learning dance interactive teaching in the course of teaching, planning the use of systematic instructional design, and analysis, design and development of interactive teaching and learning courses through teaching methods, improve the learning interest, to enable students to solve the problem a deeper understanding and experience. The implementation results of students learning motivation, enhance creativity, not only better in learning dance, in the field of information technology subject learning content mastery has greatly promoted. Dance training has certain complexity and comprehensiveness, which refers to the ability of basic training in basic dance

training (basic). Is the training of extension training the muscles of various parts of the body and joints of the body, so that the trainee can freely control your body and do some dance moves with a variety of skills to maintain the stability of both scientific and normative dance training. Under the premise of maintaining the inherent style of dance, how to achieve accurate and graceful dance is also a difficult problem in the current dance training, but also regarded as an important criterion to measure the quality and level of dance.

In the existing dance training process, the learners can achieve the purpose of training by watching videos repeatedly or by looking for coaches to correct the guidance in person. This not only consumes a lot of time and energy, but also brings some difficulties and challenges to learners. The significance of this study lies in the dance training combined with Kinect recognition on position, application of Kinect technology to capture the entire skeletal tracking training movement and dance movement data acquisition, and then matching and comparison with standard action, analysis of user action and standard action of skeletal direction the size of the gap, users can be more intuitive that gap lies. In this way, the majority of dance teaching workers, dancers and dance learners who have strong demand in teaching and self-study can make accurate adjustments to their irregular dance postures, so as to ensure the accuracy of dance movements in training.

2. HUMAN DETECTION AND TRACKING TECHNOLOGY

2.1 Human detection technology

Human detection technology is to extract people from pictures or video streams. Generally, human detection technology includes traditional detection technology and statistical principle detection technology. Human detection technology based on statistics can be summarized into two stages: training stage and detection stage. In the training phase, a large number of samples to be detected and

noise samples are collected to form the positive and negative eigenvectors, and the features are formed through training and classification. The detection phase is to scan the video frames to be detected one by one and form the features in the corresponding positions, and finally determine whether the human body is a target or not. Dalal uses gradient histogram to describe human characteristics, and combines support vector machine to judge the characteristics of human body. This method can detect the human body accurately in the static picture, but the calculation is large and the detection speed is very slow, and it can not guarantee the real-time performance of the detection.

Human detection technology in the past first to achieve the detection of moving objects, commonly used methods include optical flow method and frame difference method and so on, then to analyze and judge according to the prospect that, according to the various parts of the body and the proportion of the shape or color of the skin is to analyze the characteristics of the underlying image matching, so as to human body target and non target classification. This kind of traditional detection method is not ideal in the complex external environment and the outside object occlusion interference, and it is also vulnerable to the influence of the bottom image characteristic noise. The target tracking is called the target tracking by monitoring the detected target, analyzing and predicting its trajectory, and then tracking the target of interest. Human body tracking is usually based on feature, contour and other methods.

Figure 1. Human detection motion capture

(1)   feature based tracking: combining the texture, shape, edge and color features of the region to track the human body. Point feature and corner feature of motion contour are commonly used features. The former can be considered as the speed of motion at the center of the moving human body, and the latter refers to the distance measure between consecutive frames based on position and point curvature values.

(2)   tracking based on active contour: firstly, a closed contour of human body is given, and then the movement of the contour is tracked. The key point of this method is to give the contour of human body accurately.

(3)   region based tracking: the method divides the human body into several regions, including the head, arm, trunk and so on, then tracks each region according to the proportion, and then tracks the whole proportion with the tracking proportion.

2.2 Kinect Technology

The name of Kinect is synthesized by the two words, Kinetics (dynamics) and Connect (connection). It is a set of advanced vision technology in a natural interactive equipment, once came out, it has been very high attention. Can realize the real-time systemic and skeletal tracking, motion capture and microphone input function, and be able to identify a series of actions, people can stand in front of the Kinect through a variety of gestures to interact with computer, this way to bid farewell to the past the embarrassment of worn sensor on the body, and greatly reduce the cost of operation. Therefore, the development of natural human-computer interaction based on Kinect has become the current research hotspot. After detecting and tracking the human body, it is necessary to do the next step of the gesture recognition. Human posture recognition can be divided into direct method and indirect method. The direct method is to establish the human posture model, and compare the collected human body data with the model one by one to find the most similar appearance of human posture. The indirect method is

based on the prediction generative model, which predicts the feature contour according to the collected human body data, and identifies the human posture according to the feature contour. Through human posture recognition, people can communicate with the computer gesture. In recent years, gesture recognition has been widely used in many industries. In the field of surgery, doctors can use hand gestures to access patient information and surgical information during the operation; in the food industry, operators can control the assembly line production by hand gestures. In order to recognize the range from gesture to the whole body, unmarked human posture recognition has become a research hotspot. However, due to the complexity of human motion and the influence of occlusion illumination, it is very difficult to identify unmarked human postures.
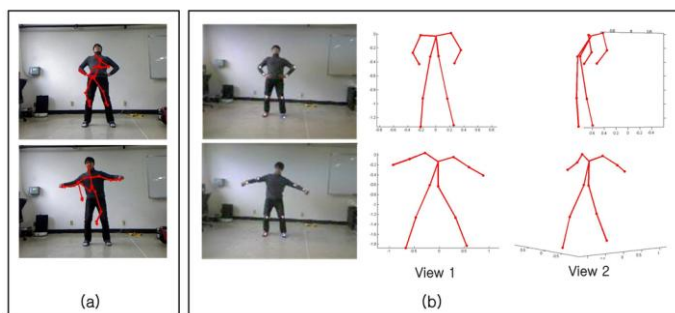

Figure 2. Kinect Technology

3. HUMAN DETECTION AND TRACKING TECHNOLOGY

Data acquisition, data processing and data analysis of these three parts are the main components of the system. Among them, the data collected include the dance trainer's movement data and the trainer's movement data. By collecting the movement information of dance coaches, a standard dance posture database is established. Data processing is mainly to restore the occluded joints and restore the skeleton information of the human body. The data analysis part is to compare the trainer's movement information and the standard movement information, gives the training instruction according to the

comparison result, thus raises the trainer level rapidly.

3.1Establishment Of Standard Dance Action Database

In order to correct the dancer's movements, standard dance movements must be used as a comparison template. In this section, by acquiring the dance movements of dance coaches, the normalized motion data are formed by occlusion information recovery. In this paper, a professional dance instructor is invited to demonstrate standard dance movements, and Kinect is used to collect dance action data, and the occlusion restoration algorithm is used to recover occluded joints. Each group of data marked corresponding action name, unified preservation as motion information, as a contrast template trainer. Contains a database of 20 group in basic dance training action, each training action is divided into 5 which contains 100 decomposition action, action, can meet the training needs of beginners and later, this system can also be different according to the standard action of the new entry training needs.

The dancers perform the dance movements before Kinect, and the dancer's movements are captured by Kinect in real time. After the occlusion points are repaired, the trainers' motion data are obtained. Finally, the obtained trainer motion data is compared with standard motion data. In the process of teaching production and development, it is necessary to continuously collect relevant data to evaluate the teaching content and structure continuously, which is in line with the teaching needs. This research is evaluated according to three aspects: teaching content, teaching design and user interface design. The survey is carried out in two stages, the first stage is to implement expert evaluation, to revise inappropriate teaching content and teaching plan, and the second stage is to evaluate the students and teachers, in order to understand the advantages and disadvantages of teaching design and development as the basis of teaching improvement.

Figure 3.Acquisition of motion data

3.2Dance auxiliary training

The system construction needs to solve the development environment of Kinect first, and the development tools of this system must be built in the visual and Java development environment. The network method of man-machine interactive system and user interface of the system is based on Socket network transmission, and network through the wireless network address; human-computer interaction system mainly in the notebook computer platform, and through the skeleton detection results of Kinect transmission of information to the user interface system for the transmission of information system operation, through the coordinate location map orientation the real-time tracking of user interface system in this system the position real-time display coordinates information back to the user interface and the user interface to the main system; user interface platform for information transmission and reception, and transmission through the wireless network control chip. The network transmission process of this system can be transmitted to the user interface system through the requirements of man-machine interaction system, and the information received by the system is controlled by the server in the wireless transmission.

Figure 4.Comparison of dance movements

The main function of the system is to combine the Kinect somatosensory device with the mobile device for human-computer interaction of the main control system, and the human-computer interaction system will receive the user interface to return the coordinate information, real-time control the location of the mobile device. Analysis of human-computer interaction system mainly Kinect to the operation of the body and the network transmission packet to transmit information to the user interface, system to control mobile devices, in order to avoid the user's posture caused similar conflict situation, the basic operation in swing posture classification.

Figure 5. Comparison of dance movements

The system mainly uses the way of dancing search theme to interact with the user to achieve the systematic teaching. This system uses the database to record the time spent by the user in the dance learning process and to store the user information in the database. In order to facilitate the user to record information, before the beginning of the dance will be in the human-computer interaction system device lens to confirm the identity, through the face identity confirmation method allows users do not have to fill in the tedious data.

4. EMPIRICAL ANALYSIS

4.1Dance learning evaluation

Through the dance information teaching mode based on Kinect somatosensory technology, we analyze the dance teaching effect of students. First, we should evaluate students' learning is a learning process and evaluation, including physical fitness and motor skills, cognition, learning requires attitude and behavior, communication and the spirit of cooperation, such as the performance of the situation, in favor of the principle of operation , determined by the expert opinion to assess student learning sports more appropriate five aspects: (1) physical and (2) motor skills (3) basic theoretical knowledge Dances (4) learning attitude (5) the spirit of cooperation. Then apply the key features of the survey prepared by the dance learning the five evaluation, please Colleges 40 dance teachers to express their views, and then select the content according to the five "very important" Number Percentage (see Table 1), weight content calculated for each weight, calculated for each content selection is to look "very important" in the five percentage content selection percentages very important number in proportion. Followed by another four to calculate the weight of the contents were 0.24,0.21,0.21,0.13 and give scores result: physical and motor skills 20 points; physical fitness and motor skills' progress 30 points; 20 points physical basic theoretical knowledge; learning attitude 20 points; show affection and spirit of cooperation 10 points.

Table 1:Evaluation in dance learning content

Evaluation	Physical fitness	Motor skill	Theoretical knowledge	Learning attitude	Spirit of cooperation
Number	35	39	35	34	21
Percentage	87.5	97.5	87.5	85	52.5

Students' modern and new dance learning evaluation content and value questionnaire results show (see Table 2), the students of the new dance learning evaluation content and value satisfaction rate was 82.4, and current only 35.3, suggesting that the vast majority of students to reflect the development as the goal, pay attention to dance learning effect and process, dilute the evaluation results of the new dance education learning evaluation of the content of the affirmation and approval, so as to implement the new dance learning evaluation system has laid the main foundation.

Table 2:Students' satisfaction with the current evaluation

content	factor	very satisfied	satisfied	General	Dissatisfied	Very dissatisfied
Current Evaluation	Number	2	13	35	48	44
	percentage	1.4%	9.2%	24.6%	33.8%	30.9%
New Evaluation	Number	11	74	32	18	7
	percentage	7.8%	52.1%	22.5%	12%	4.9%

Students' modern and new dance learning incentive effect investigation of evaluation method. The results show in table 3: that the new dance learning evaluation methods form of conscious exercise habits and lifelong dance consciousness, grasp the method and the skill, to improve physical fitness, to

experience the fun of dance and work sense; have an incentive to form good teamwork spirit, identity of student evaluation approach to new incentive effect

was significantly better in the current evaluation method.

Table 3:Students' recognition of the motivation

Factor	Current Evaluation			New Evaluation		
	effective	commonly	invalid	effective	commonly	invalid
Physical fitness	18	43	47	61	14	10
	12.7%	30.3%	33.1%	42.9%	9.9%	7%
Motor skill	35	17	20	48	20	7
	24.6%	12.7%	14.1	33.8%	14.1%	4.9%
Theoretical knowledge	16	23	19	18	38	17
	11.5%	15.2%	13.4%	12.1%	26.7%	11.9%
Learning attitude	13	26	41	27	45	9
	9.1%	18.3%	28.9%	19%	31%	6.3%
Spirit of cooperation	16	24	18	34	18	4
	11.3%	16.9%	12.7%	24.6%	12.5%	3.9

4.2Improvement of teaching performance

Physical fitness and motor skills evaluation should first follow the progress of the case of biological evolution "use and disuse" principle, fully reflected in the same period of physical and motor skills of students with different sport levels the rate of progress was generally slow down the growth of the law, that the more low levels of student movement, the greater the level of increase, the opposite is the small, according to the principle of progressive score, combined with the actual preparation of dance

teaching physical and motor skills rate of progress evaluation form. Reflect students' progress and better incentives for student rates are above 95%, while the rate applicable to the various colleges and universities, compared with 35.5% agreed. The results show in Table 4, the vast majority of teachers in this table design methods and ideas have a positive attitude, but believed to be actually develop appropriate evaluation methods and evaluation forms according to the teaching of the school.

Table 4:Evaluation of physical fitness and motor skills

content	very good	good	commonly	Not so good	Not so good
Design ideas	18	16	2	2	0
	45	41	5	5	0
Studentsprogress	15	18	6	1	0
	37	45	15	2.5	0
Incentive effect	8	13	17	2	0

	20	32.5	42.5	5	0
Applicability	0	3	11	25	1
	0	7.5	27.5	62.5	2.5

5. CONCLUSIONS

The problems in dance teaching lie not only in the difficulty, but also in the experimental environment and the teacher's on-the-spot instruction. In the limited teaching process, the course can not guide the students to develop the teaching methods of logical thinking, innovative thinking and problem solving. With the support of human-computer interaction technology, researchers have realized that information technology is not only an effective tool for teachers, but also an effective tool for students to learn. The dance auxiliary training system is designed. The system can analyze and evaluate the trainer's movements from two aspects of the joint point coordinates and the angle of the joint, and provide intuitive error correction tips for the trainers. Experiments show that the system can accurately give the difference between the training action and the standard action, and the trainer can adjust the action gesture according to the cue, improve the dance level, and achieve the purpose of auxiliary training.

Nowadays, the penetration of intelligent technology into dance education system breaks the inherent ecology of traditional education system. Human-computer interaction technology, with natural interaction as the core, enables the intelligent development of dance education, promotes the deep integration and innovation coordination of art and Science in the intelligent era, and constructs a new thinking of human-computer cooperation in art creation. It is believed that in the near future, human-computer interaction technology will be applied in the field of new media dance practice, dance animation design, etc., creating a new paradigm of intelligent art education in the context of the intelligent era.

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