



Analysis of video teaching mode of remote network music education based on human-computer interaction

Qingling Xu^{1,*}

¹ University of Science and Technology Beijing, Beijing 100083, Beijing, China

SUMMARY: *The mode of music teaching is undergoing great change because of the present economic situation and the rapid progress of digital technique. The requirement of music education is increasing in current culture, and music education is gradually becoming more professionalized. The aim of this research work is to probe into the application of human-computer interaction (HCI)-based video teaching patterns in remote network music education and inspect how these modes bring influence to students' musical attainment, particularly when put into comparison with the traditional music teaching model. This research inspects the experiment outcomes of three groups of students in one high school before and after the HCI-based long-distance network music education video teaching method was brought into use. The experimental result indicates that, when the remote network music education video teaching mode which is based on HCI was used, the three student groups' music scores in five topics have obvious promotion, therefore these scores are higher than the scores got under the traditional teaching mode. The distant network music study video teaching way, which is built on man-machine interaction, has obvious advantage for promoting students' music ability.*

KEYWORDS: *Music Education, Human-computer Interaction, Remote Network, Teaching by Video*

1 Introduction

Education, especially the education of music, is undergoing great change on account of the rapid development that information technology has made. In the condition that the demands for specialization and customization are continuously growing, the traditional method of music teaching already cannot fully satisfy the requirements of the current time's education. Human-computer interaction technique and distant network teaching open up new chances for music teaching, particularly in the shape of video guidance, which can get over time and position limits and provide a more adjustable and useful teaching method. Hence, the research of human-computer interaction-rooted long-distance network music education video teaching has practical meanings for promoting the level and quality of music education besides its important academic value.

Many people attach importance to music teaching, and have many views on music education and teaching. After all, music has developed for many years from ancient times to the present, and has already become an indispensable part of people's life. Modern music education can be said to be a hot topic for people. Scholar Daubney A discussed the impact of the COVID-19 pandemic on music education in British schools, how schools and teachers

*xuqingling@ustb.edu.cn

<https://doi.org/10.65102/is2026336>

suddenly changed into a very large online teaching model, and its impact on music teaching [1]. Pitts S E believed that music education has a long history of defending its position in the school curriculum. At the same time, those who doubt the benefits of music learning may rarely consider this [2]. Niknafs N believed that music education would become a way of life, and music education would cultivate their ethical sensitivity to human contact, which is helpful to alleviate human suffering in the world [3]. Culp M E believed that music educators must meet the diverse needs of students, including cultural background, music ability and interest, as well as physical, behavioral, social and cognitive functions [4]. The development of music education and people's strong pursuit of progress have greatly changed people's quality of life. It is the constant exploration and progress of music teaching that makes the modernization of music teaching more and more mature, and people can see the shocking music teaching mode today.

The integration of modern technology and music teaching is the focus of research, because the integration of modern technology and music teaching can bring great convenience to music teaching. Among them, HCI technology is one of the most commonly used modern technologies in modern music teaching mode, and the popularization of HCI technology would be of great significance. According to Crawford R., the global education policy is full of expectations for information and ICT and respect for its high-level standards, and it is well-known for the use of HCI in education, which makes sense given the popularity of technology and equipment. The existence of technology and the idea that it ought to be incorporated into education are uncontested [5]. According to Eyles A. M., classroom music teachers restrict their instruction to entire class activities that rely on scarce ICT resources because they lack ICT resources and support. professors' confidence would be strongly impacted by their lack of professional development chances since music professors are not sufficiently available or dependable. This can be changed by combining ICT and HCI [6]. Bautista A believed that classroom videos are mainly used to cultivate teachers' thinking of reflection on their own teaching. The ultimate goal is to improve teaching practice. Compared with mathematics, science and literacy education, music teacher education is still at the primary stage in the use of classroom videos [7]. The relationship between the period and HCI technology, according to De Visser E J, is progressively changing from the straightforward use of computers by humans as tools to the development of relationships between humans and autonomous entities that are working on our behalf [8]. People are living in a time of social and cultural transformation, according to Rolle C. The cornerstone of music education is being challenged more and more, just like other subjects. Therefore, merely basing the objectives and content of music education on music tradition and static teaching methods will not allow for the reliable determination that these aims and contents may be achieved in schools [9]. One of the priorities of education, according to Dudar V. L., is the widespread use of distance music instruction, which differs from traditional education. In light of current events, practically every educational institution is using distance learning. However, the success of the entire distance music instruction process is significantly impacted by the quality and educational background of the teachers [10]. The rapid development of HCI technology has changed people's education level and improved people's quality, so that the construction of the country can be improved. However, when people are surprised at the progress of education and modern science and technology, they can not forget to move forward. Only modest progress, one step at a time, science and technology development and education development can take a longer road, and the country's future would be more and more bright.

The combination of music teaching and HCI technology has greatly changed the music teaching mode, and the change of teacher education methods is also very surprising.

Traditional teachers call names in class to ask people to answer questions. Now they can interact with students on the network platform, which is unprecedented. This paper used experiments to prove that the video teaching mode of HCI in remote online music education has more advantages than traditional teaching, and the experimental results did prove that the video teaching of HCI in remote online music education is very helpful to improve students' performance. In addition, students have achieved comprehensive development in various music disciplines, and their achievements in various disciplines have been improved.

The main contributions of this paper are as follows

1) Explore and verify the advantages of the remote network music education video teaching model based on human-computer interaction: This paper analyzes the impact of the remote network music education video teaching model based on HCI on students' music level through experimental research. It proves the effectiveness and advantages of the remote video teaching model in improving students' music level.

2) Propose and solve problems in the traditional music teaching model: The traditional music teaching model has problems such as insufficient teaching interaction and low student participation, especially when face-to-face teaching cannot meet students' personalized needs.

3) Provide practical support for the modernization of music education model: With the rapid development of information technology, the modernization of music education has become an important issue. This paper demonstrates the application potential of information technology in music teaching by comparing and analyzing traditional teaching and HCI-based distance education models, and provides strong theoretical support and practical basis for the application of technology in educational practice.

2 Exploration on HCI Clustering Algorithm

2.1 Exploration on Clustering Algorithm of Video Teaching Mode of Human-computer Interactive Distance Network Music Education

In HCI technology, clustering algorithms are frequently utilized. Clustering is an efficient technique for classifying data based on its internal, as-yet-undiscovered intrinsic scheme. An increasing number of moving items are being tracked and recorded as location-based positioning technologies have been developed. As a result, moving object data mining research surely focuses on trajectory clustering of moving objects [11]. The multi-hop clustering technique serves as the foundation for the PMC (Policy Modeling Consistency) algorithm, which guarantees clustering stability and coverage. To choose the optimal neighbor node to join the same cluster, a priority-based neighbor following technique is suggested during the cluster head selection step. This tactic results in highly stable and dependable nodes between clusters.[12]. The commonly used clustering algorithm is FCM (Fuzzy C-means) clustering algorithm, also called Fuzzy C-means algorithm, which is a clustering algorithm for processing objective functions. It is a widely used and mature algorithm. It is also a partition based algorithm. The idea of FCM clustering algorithm is to partition objects to find the maximum similarity. FCM algorithm belongs to a flexible fuzzy algorithm. Clustering algorithm can be used in market analysis to help the database distinguish different consumer groups and summarize consumer habits. As a specific module, clustering algorithm can mine the deep information in the database, and summarize the characteristics of various databases and make further analysis, so as to make preprocessing. The elbow method, gap statistic, contour coefficient and canopy are four kinds of k-value selection methods which have been investigated. The standard data collection is employed for experimental checking, and the algorithm's false code is given. Then, the verification results are undergone

assessment. The clustering scope of this dataset is emphatically put forward, together with the advantages and disadvantages of the four above-mentioned algorithms in the selection of k value [13]. The clustering algorithm is introduced as follows:

The initial data set is set to y , and then the data set is divided into b categories according to the requirements, so that the requirements are in the b categories, and each group of data z has a membership degree m_{xz} corresponding to the cluster center x . The formulas for setting such a FCM clustering function and its constraint function are:

$$Z = \sum_{x=1}^b \sum_{z=1}^n m_{xz}^a \|y_x - b_x\|^2 \quad (1)$$

$$\sum_{x=1}^b m_{xz} = 1, z = 1, 2, \dots, n \quad (2)$$

By connecting the above conditions with the relationship between Formula (1) and Formula (2), the iterative formula of m_{xz} can be calculated, and the formula is:

$$m_{xz} = \frac{1}{\sum_{x=1}^b \left(\frac{\|y_x - b_x\|}{\|y_z - b_z\|} \right)^{\frac{1}{a}}} \quad (3)$$

There is b_x in Formula (3), so the Formula (4) can be obtained after its second level sum and derivation:

$$b_x = \frac{\sum_{z=1}^n (y_z m_{xz}^a)}{\sum_{z=1}^n m_{xz}^a} \quad (4)$$

m_{xz} is related to b_x , but there is no m_{xz} and b_x at the beginning of the FCM algorithm, so they are randomly assigned an arbitrary value that meets the conditions at the beginning of the program, and then start the calculation.

3 HCI Teaching Mode

3.1 Introduction to HCI Teaching Mode

The definition of visual design, learning variables, and user interface design principles in the field of instructional design and technology (IDT) are frequently used as the basis for discussions about how to create HCI in educational technology (ET)[14]. HCI is widely used in music education. The use of HCI is mainly embodied in voice interaction, and voice interaction is becoming more and more popular. Through the review of research papers, people have explored the trends, topics, findings and methods of empirical research on voice interfaces in the field of HCI [15]. Voice interaction uses separate hardware as the carrier to achieve voice interaction control, but this mode of voice interaction function is relatively limited, and its application cannot be further expanded. Therefore, the use of voice control can improve the efficiency of voice interaction function by using the control motherboard with the third generation motherboard as the core in Figure 1. Figure 1 shows the hardware motherboard and voice recognition interaction function module using HCI technology.

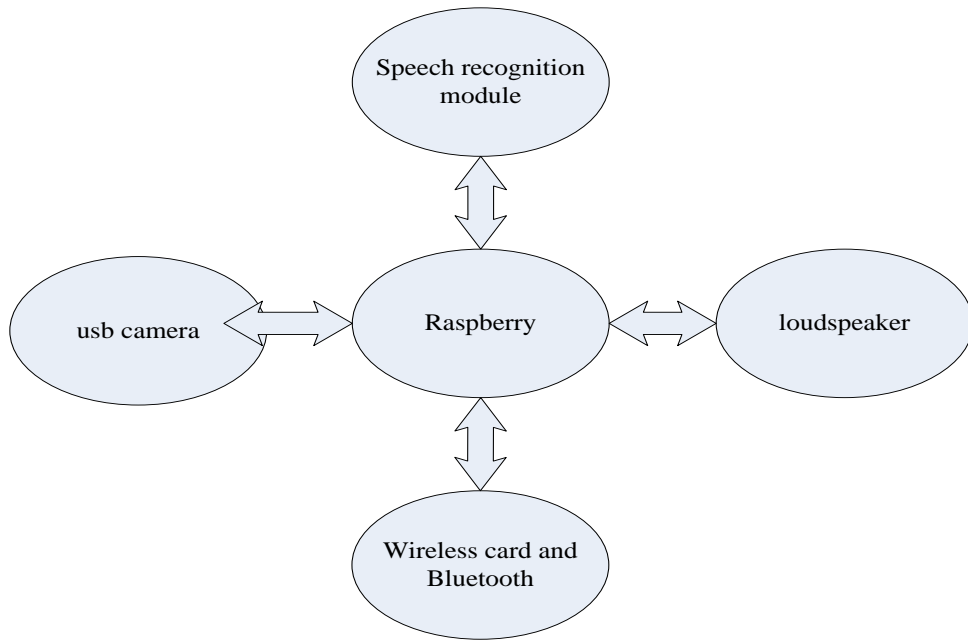


Figure 1: The main board and voice recognition interaction module

As a relatively new technology, the voice recognition of the third generation motherboard can have video and audio processing functions at the same time. It has video analog signal and TV output interface. It also has a complete operating system and its own interface, which can quickly recognize the code of a variety of programming software. The control and operation flow chart of the voice recognition of the third generation motherboard is shown in Figure 2.

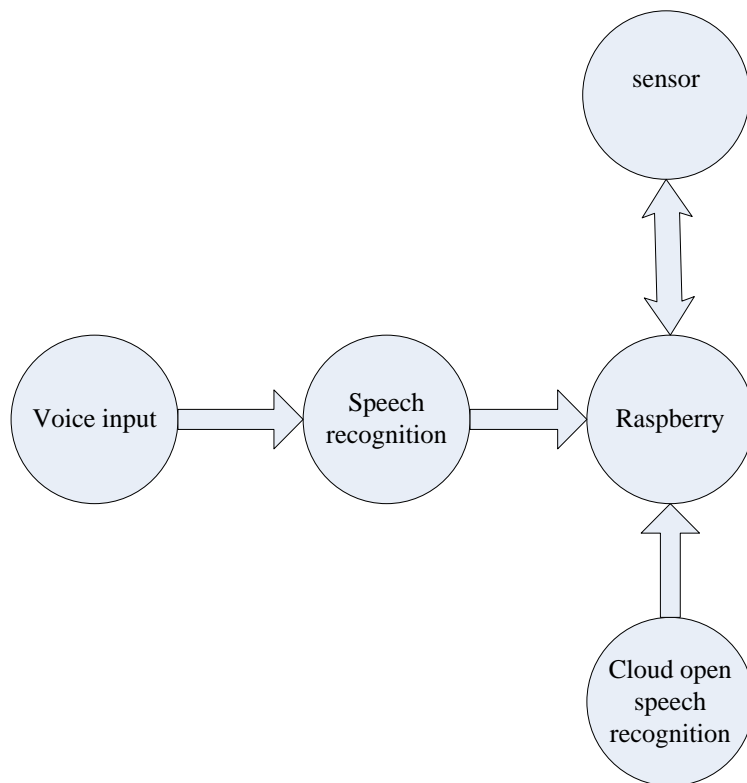


Figure 2: Control system operation flow chart

3.2 Preparation for Remote Video Teaching Experiment

This experiment selected a school that has never used HCI remote network music education video teaching. Through the optimization of school equipment and the addition of HCI technology, students can learn music through online video. Firstly, the examination subjects of music examination for students in the school were investigated, and then the final examination scores of music examinations for students in various subjects before the installation of equipment were collected. After the installation of human-computer interactive remote network music education video teaching equipment, this teaching mode was adopted to carry out teaching for one semester, and then the school's music examination results were collected again. This paper compared the scores of two music examinations before and after the video teaching of distance online music education with HCI. By observing the changes of the two scores, the effect of the video teaching mode of HCI remote network music education can be seen at a glance.

3.3 Remote Video Teaching Experiment and Evaluation

In this experiment, the average scores of the final music examination of three classes in the same grade were extracted to calculate the average. The video teaching of remote online music education using HCI also investigated these three classes. The comparison chart of the average score of vocal music test between the three classes before using the HCI remote network music education video teaching mode (traditional music teaching) and after using the HCI remote network music education video teaching mode is shown in Figure 3.

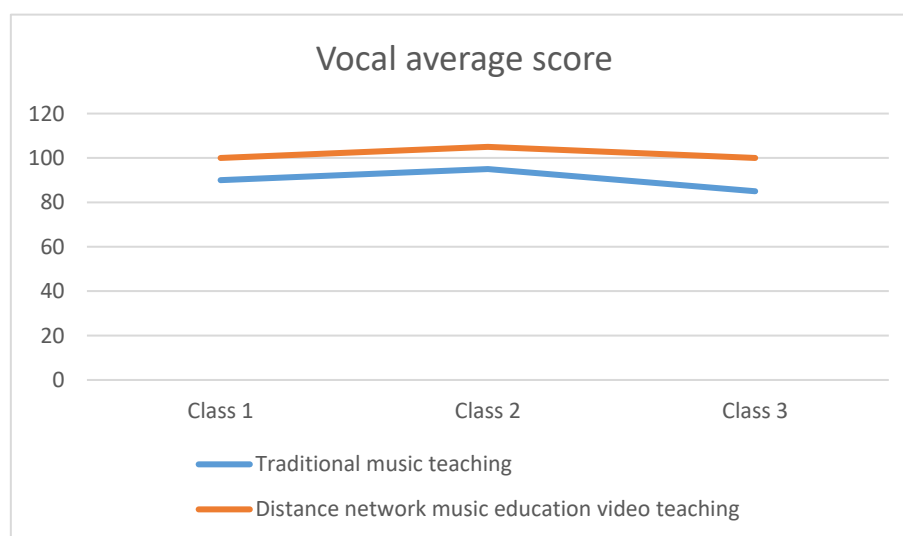


Figure 3: Vocal music average score comparison

It can be seen from the comparison chart in Figure 3 that under the traditional music teaching, the first class's vocal music test score was 90 points. After using the HCI remote network music education video teaching mode, the first class's vocal music test score was 100 points on average. Under the traditional music teaching, the second class's vocal music test score was 95 points. After using the HCI remote network music education video teaching mode, the second class's vocal music examination score was 105 on average. Under the traditional music teaching, the third class scored 85 points in the vocal music examination. After using the HCI remote network music education video teaching mode, the third class's vocal music examination score was 100 points on average.

The comparison of average scores of piano tests between traditional music teaching and

HCI distance music education video teaching is shown in Figure 4.

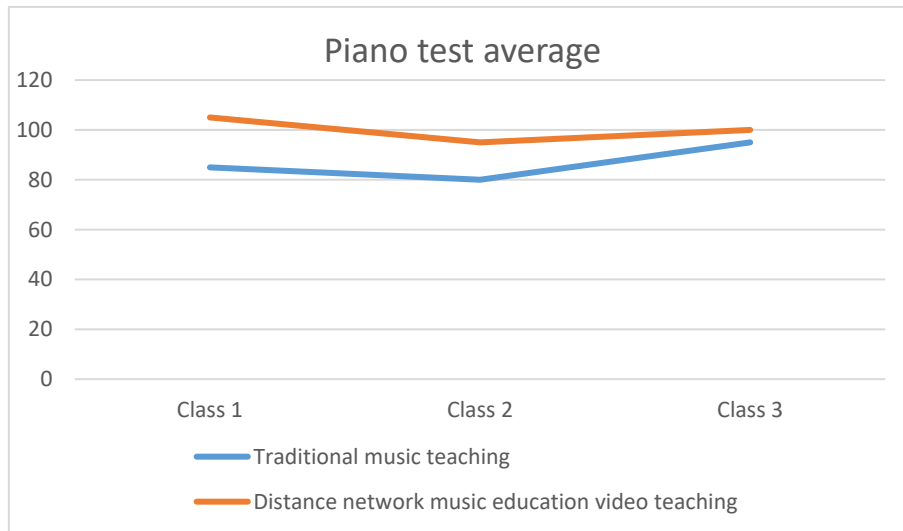


Figure 4: Piano test average score comparison

It can be seen from the comparison chart in Figure 4 that under the traditional music teaching, the first class scored 85 points in the piano exam. After using the HCI remote network music education video teaching mode, the first class scored 105 points on average in the piano exam. Under the traditional music teaching, the second class scored 80 points in the piano exam. After using the HCI remote network music education video teaching mode, the average score of the piano exam of the second class was 95 points. Under the traditional music teaching, the piano exam of the third class was 95 points. After using the HCI remote network music education video teaching mode, the average score of the piano exam of the third class was 100 points.

The comparison between the average scores of traditional music teaching and HCI distance music education video teaching ear training test is shown in Figure 5.

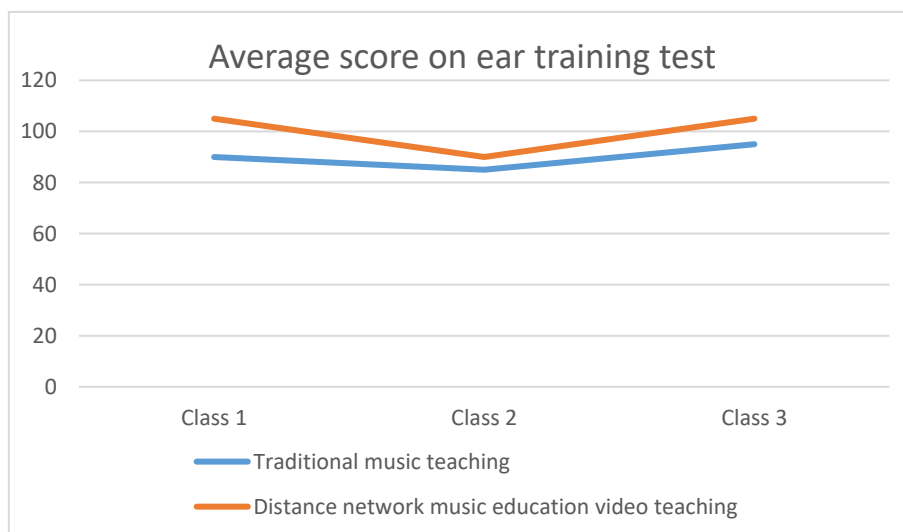


Figure 5: Average score on ear training test comparison

The first class's ear training test score under traditional music instruction was 90 points, as shown in the comparison table in Figure 5. The first class's average score on the ear training

test was 105 points following the use of the HCI remote network music education video teaching mode. The second class's ear training test score under traditional music instruction was 85 points. The average result on the second class ear training exam was 90 points following the use of the HCI remote network music education video teaching mode. Under the traditional music teaching, the third class got 95 points in the ear training test. After using the HCI remote network music education video teaching mode, the average score of the third class ear training test was 105 points.

The comparison between the average scores of the video teaching of traditional music teaching and HCI distance music education is shown in Figure 6.

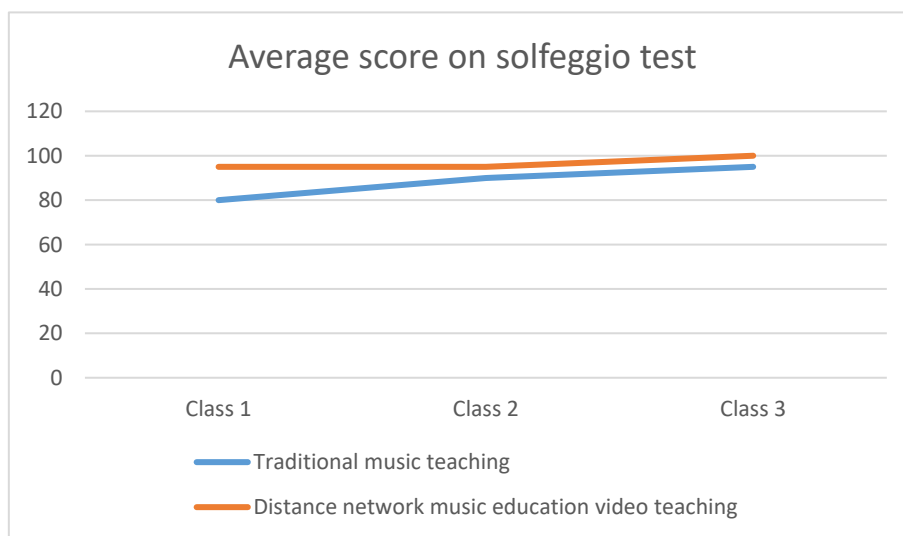


Figure 6: Average score on solfeggio test comparison

It can be seen from the comparison chart in Figure 6 that under the traditional music teaching, the first class's solfeggio test score was 80 points. After using the HCI remote network music education video teaching mode, the first class's solfeggio test score was 95 points on average. Under the traditional music teaching, the second class's solfeggio exam score was 90 points. After using the HCI remote network music education video teaching mode, the second class's solfeggio exam score was 95 points on average. Under the traditional music teaching, the third class's solfeggio exam score was 95 points. After using the HCI remote network music education video teaching mode, the third class's solfeggio exam score was 100 points on average.

The comparison of average scores of music theory test between traditional music teaching and HCI distance music education video teaching is shown in Figure 7.

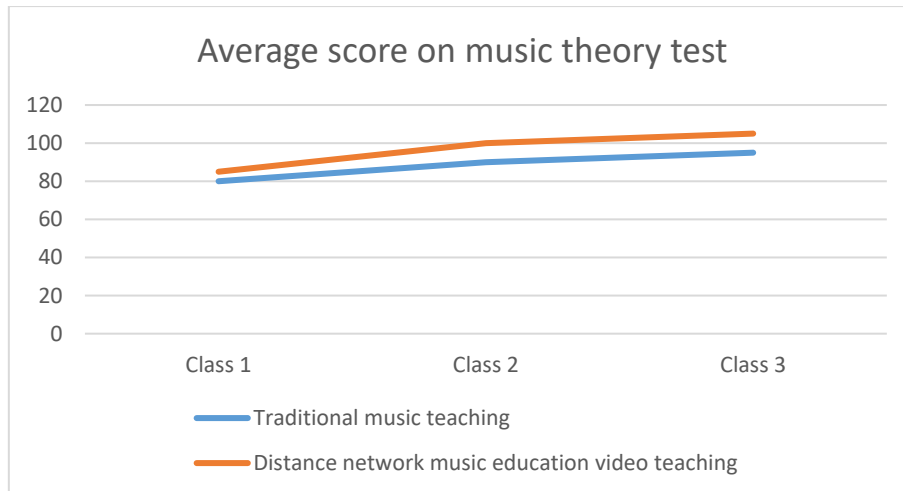


Figure 7: Average score on music theory test comparison

The comparison chart in Figure 7 shows that the first class music theory exam result under traditional music instruction was 80 points. The average result on the first class music theory exam was 85 points following the use of the HCI remote network music education video teaching mode. The second-class music theory exam score under traditional music instruction was 90 points. The average result on the second class music theory exam was 100 points following the use of the HCI remote network music education video teaching mode. The third class received a score of 95 on the music theory test under the traditional music teaching method. After using the HCI remote network music education video teaching mode, the average score of the third class music theory examination was 105 points.

The average scores of five subjects in three classes under the traditional music teaching mode and the HCI remote network music education video teaching mode were calculated and plotted, so that the comparison effect could be seen more intuitively. The average scores of five subjects in three classes under the two teaching modes were compared as shown in Figure 8.

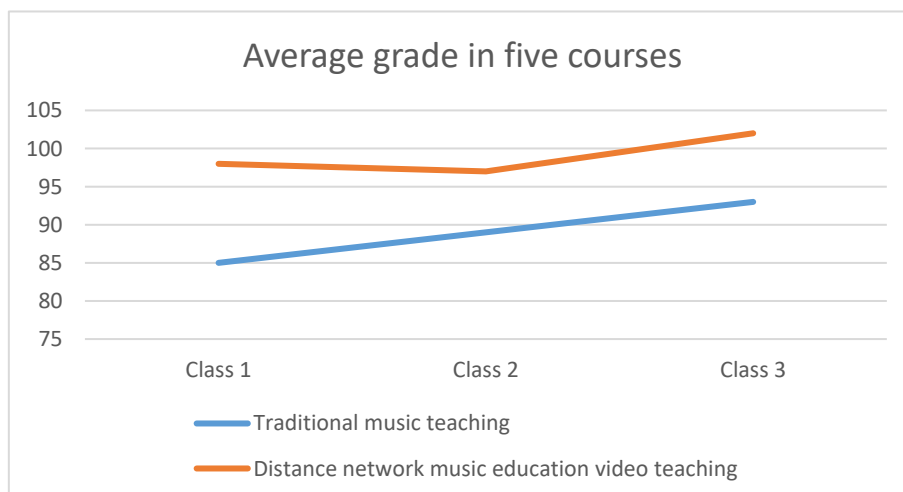


Figure 8: Average grade in five comparison

The comparison chart in Figure 8 shows that the scores of music exams in five topics under traditional music teaching and the HCI remote network music education video teaching differed significantly. The comparison of the trial data demonstrated that students' music

scores can be significantly raised by using HCI remote network music education video instruction.

4 Conclusions

By means of experiment research, this article deeply carries out exploration on the HCI-based long-distance network music education video teaching pattern, and makes comparison between it and the conventional teaching pattern. The outcome indicates that the utilization of HCI technology within long-distance music education obviously promotes students' music marks in each subject, promotes teaching interaction and student participation, and fully shows the latent capacity of long-distance video teaching model in promotion of education quality. Nevertheless, this study has existed certain deficiencies. Firstly, the experiment's sample quantity is not large, therefore this may influence the universal property of the research outcomes; second, this research mainly puts focus on the analysis of short-period effects, and has not completely probed into the sustained influence of long-time utilization of HCI technology on students' musical standard. In the coming days, the scope of samples can be enlarged to further confirm the effect of students coming from different backgrounds and levels after they use this model for a long time. In addition, along with the unceasing progress of HCI technology, more advanced mutual action ways can be researched, for example virtual reality and augmented reality technology, therefore further promote the teaching experience and effect.

About the Author



Qingling Xu, born in 1992, is currently a postdoctoral researcher at the University of Science and Technology Beijing, holding a doctoral degree in Art Studies. He obtained his master's degree from the Belarusian State Academy of Music and his doctoral degree from the Russian State Pedagogical University (Herzen University).

E-mail: xuqingling@ustb.edu.cn

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