Considering Computer Aided System of Music Skills and Digital Teaching

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Abstract. Music skill computer-aided system analyzes the learner's audio, video, and physiological information in detail, saves the exercises in a database, monitors changes in skill levels, and provides intuitive visual information. Digital teaching mode provides comprehensive scientific parameters for teaching and training, transforms abstract skill theories and methods, and transforms them into intuitive and easy-to-understand images or data, thereby improving the scientific nature of music skill training and improving the efficiency of music skill learning. This paper discusses the connotation of the public music teaching model in ordinary colleges and universities from the perspective of teaching theory, with the help of aesthetics, psychology, sociology, musicology and other disciplines, and proposes a new public music teaching model. Music skill assistance system for public music teaching in ordinary colleges and universities and the specific measures and conditions for implementing this model in digital teaching provide a basic framework for the process of public music education and teaching activities in ordinary colleges and universities, and promote the development of university public music education.

Keywords: Music teaching; Computer-aided system; Digital teaching; Music skills; Higher education
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1 INTRODUCTION

In music education, music skill training is a very important part. The use of computer-aided systems for the training of music skills will greatly improve the quality of teaching. Music skill training teaching is an important content of music education. For a long time, computer-aided teaching has been widely used in many disciplines. However, there are few digital research achievements on music skills teaching and training at home and abroad. The author attempts to

establish a comprehensive computer-aided teaching digital system that can be used in the training of music skills during the research process, expand the traditional methods and methods of music training, and use digital methods to improve the efficiency of music skills training.

Teaching method refers to the teacher-student interaction activities composed of a set of methods guided by teaching principles for teachers to achieve teaching purposes, achieve teaching content, and use teaching methods [1]. It includes both the teaching methods of teachers and the learning methods of students under the guidance of teachers. It is an effective combination of teaching methods and learning methods [2]. Vocal music teaching and other teaching subjects in the music discipline are very different. The teaching is relatively abstract and generally only external singing. The development of computer technology has brought great convenience to vocal teaching [3], which makes vocal teaching more intuitive. In traditional vocal music teaching, teachers mainly rely on teaching experience and feeling. In traditional teaching methods, students can only listen to the teacher's singing or music tape, and the students cannot hear their own voices. In modern teaching methods, Xie and Schimpf's research on installing digital sound cards and digital audio software on multimedia computers can make vocal music teaching more intuitive [4]. Qu's research shows that teachers can use digital technology to analyze sound waveforms in teaching and then guide students. In traditional vocal music teaching, teachers use piano accompaniment as the main teaching method, which can adapt to students' personal feelings to a certain extent [5]. However, this training cannot provide students with accurate rhythm. Using digital teaching methods, you can prepare the accompaniment of the song in advance. In addition, the digital teaching method researched by Ronghua, Lanzhen and Li can introduce multi-tone music teaching [6, 7], students can learn multi-tone music. Vocal music teaching is not very demanding on the environment. If the school conditions are better, you can configure more advanced teaching equipment. Wu and Georgio's research recognizes that if the school's teaching conditions are limited, it can only configure some basic equipment and use digital teaching methods [8, 9], the basic equipment required is as follows: first, 586 grade computers; second, digital audio cards; third, microphones, monitor speakers; fourth, digital audio software, like Cake W a1k6.0 or higher software. For teachers, teachers need to be able to operate these audio devices proficiently. Taking the analysis of waveform files as an example, in digital teaching, you need to make full use of the advantages of digital teaching methods. The general approach is to select a certain segment of the student's singing and then record it to compare the sound of several singings. Ige believes that teachers need to help students find the best state of [10], taking "My home on the Songhua River in the Northeast" as an example, this sentence is divided into two singing parts, the second part needs to be more emotional than the first part, Akhtar and Kolmanic believe that teachers can record sounds for these two sentences of students to guide students to adjust the singing state [11,12], abbreviated as CA SM, connects external equipment and computer together, analyzes the trainer's audio and video information by collecting the trainer 's physiological state and music expression the analysis of the system software provides scientific parameters and generates images and data. Teachers can use these to provide more targeted guidance to students.

Taking vocal skills as an example, its teaching and training is a complex system including many factors. The content of sounds includes: height, strength, length, timbre, spitting, etc., and the physiological content includes: performance form, breathing, expression, Posture, movement, orientation, etc. Therefore, a new digital teaching model of music skill training has been formed. The diversity of the public music teaching process in ordinary colleges and universities should be reflected. This is clearly stated in the teaching objectives of public music in ordinary colleges and universities. That is to understand, absorb excellent artistic achievements from home and abroad, and understand and respect multiculturalism. The traditional teaching model of public music in ordinary colleges and universities ignores the diversity of public music in ordinary colleges and universities, which restricts the development of students' individuality.

2 TRAINING AND TEACHING MODEL INNOVATION BASED ON MUSIC SKILL COMPUTER-AIDED SYSTEM

2.1 Work Flow and Innovative Teaching Model of Music Skill Computer Aided System

The application of music skill computer-aided system in music skill training is an innovation and extension of traditional music teaching methods. In the teaching of computer-assisted music skills, it is necessary to organically combine computer-assisted technology and music skills training in order to realize the innovation of the teaching model. In classroom teaching, traditional teaching generally describes the essentials of skills in a vague and uncertain way, such as breathing to support and relax. There is no intuitive standard or image description. The design of music skill computer-aided system relies on the powerful computing power of the computer. On the basis of some basic physical laws, the complex details in reality are simulated and restored through calculation. Relying on this, the analysis results that are difficult to express in reality are obtained through the computer, thereby greatly shortening the practice time and quickly breaking through the technical bottleneck. To make students gradually get rid of the so-called "music learning can only be understood, not utterable" concept. Make pitch, rhythm, strength and weakness, breathing, expression, resonance and many other factors have a reference data, turning obscure concepts into intuitive data or charts, so that teachers add a lot of reference data in the teaching process to explain the changes it was easy and accurate, and the teaching method was changed. Computer-centric music skill computer-aided system provides us with huge data storage, it can record all the practice, competition and performance of a music major. Music skill training has the characteristics of personalization. Each teacher uses different training methods and pays different attention to the feedback from students. Therefore, the training data has a great auxiliary effect. On the platform of this auxiliary training system, we design the traditional music training index analysis methods and teaching content into the software, which can help students and teachers master and expand professional knowledge in daily training and management to achieve a teaching effect. Using the stored data on the same platform, we can further analyze these data, and then assist in the development of each student's exercise plan, summarize the skills training laws, and verify the experience to make the training reach Scientific and systematic. Build a complete auxiliary training analysis system and apply computers and peripheral equipment to the daily skills training of music majors. In this way, the traditional learning process has changed. Based on the traditional training process, we propose a computer-aided training process and teaching model for music skills, as shown in Figure 1.
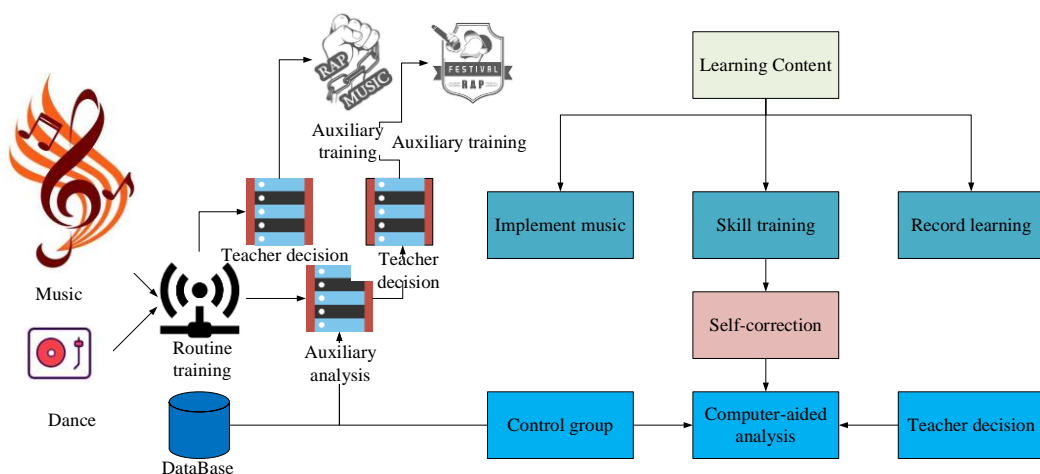

Figure 1: Computer-aided process and teaching model of music skills.

Figure 1 shows that the computer-aided training process of music skills consists of two closed loops. The inner loop maintains the loop of the traditional training model, the outer loop is a self-correcting loop, and the two loops are nested together. The "database" records all the content and effects of the students' previous training for analysis. With the support of the "database", methods such as data index analysis are used to replace the teachers 'analysis of students' physical conditions and other content. The outer loop is a newly added loop, in which "conventional training method" is a fuzzy concept, which includes training plan, training methods, technical actions and training learning methods and other related elements of music performance skills. After the system obtains various data, it compares with the control group to show the changes and gaps in skill level. By interacting with the computer-aided system of music skills, the trainer can change the training elements and achieve the purpose of self-correction.

2.2   Structure of Music Skill Auxiliary Training System

The computer-aided training system for music skills is composed of data acquisition, storage, analysis, display, and decision-making recommendations (its structure is shown in Figure 2).
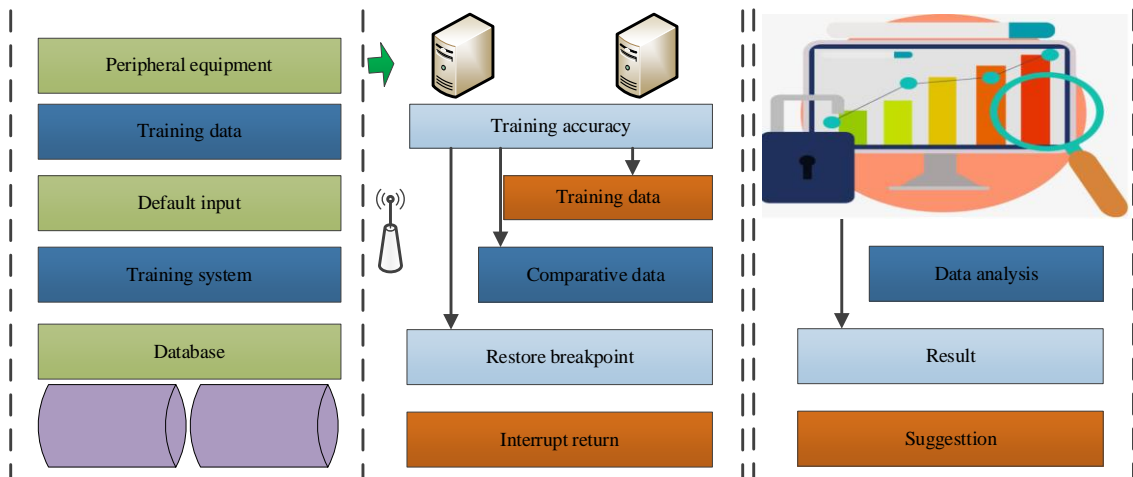
Figure 2: Structure of a computer-aided system for music skills.

The data input by the system includes preset training content, data recorded by peripheral equipment, and comparison data. The input uses a multi-channel method, and the system output is mainly based on images and sounds.

In addition, the system can be divided into three parts from the structure: The first part is the training management system part with the database as the core, including data entry and display, training progress management, mainly responsible for daily skills training information management; the second part is The auxiliary system part with the analysis of practice data indicators as the core helps teachers to monitor the students' status and propose training content; the third part is the system part with the playback demonstration as the core to help teachers and students improve training programs. The training management system is the core of the entire system, mainly corresponding to the database; the auxiliary analysis subsystem corresponds to the inner loop; the playback suggestion subsystem corresponds to the self-correcting outer loop.

2.3   Function of Music Skill Computer Aided System and Frame of External Equipment

The design of the system needs to analyze the basic elements of the basic skills of music. Taking vocal training as an example, we should study the physiological mechanism of singing. Vocal music

is a singing skill, and vocal training is a systematic training around this skill. The correct utterance is made by the coordination of breathing, pronunciation, resonance, and language, but they are also mutually constrained. No single factor can exist alone in utterance. Whether our training process starts with breathing or resonance, it should ultimately be the accumulation of the entire singing body in the best singing state [13]. Therefore, the computer-aided system of music skills takes into account many elements of both sound and physiology when applied to vocal training. These elements require different external devices to be connected to the computer to collect.

The sound module is mainly composed of recording equipment and its corresponding recording software, audio analysis software, and integrated platform. The system can process the signals generated by the students' singing and performance in real time. The sound is collected by the recording equipment and recording software, the sound is analyzed by the spectrum analysis software, and the musical training elements such as pitch, rhythm, resonance state, etc. are refined, and then the playback function is realized by the recording equipment. Make a comparative analysis of the pitch, rhythm and singing methods of the sound, and finally point out the key to the problem.

It can quickly collect students' singing morphology, breathing process, laryngeal biological characteristics and other indicators about singing and quickly analyze and compare the relevant data. The system establishes a data database for each student. On the basis of combining traditional teaching experience, the content of each stage of teaching is quantitatively analyzed. The statistical analysis and results of a large number of data provide teachers and students with a comprehensive training reference data (Its framework is shown in Figure 3).
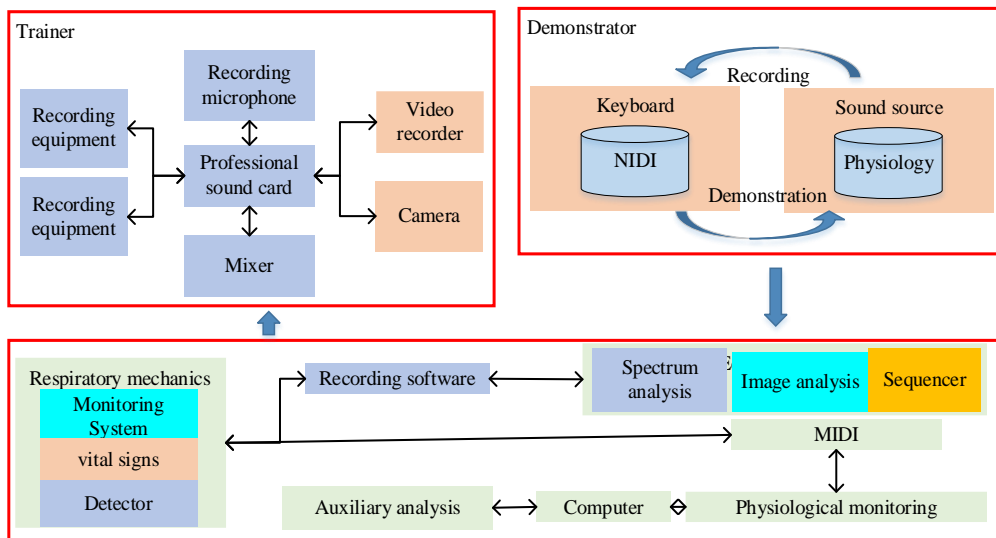
Figure 3: Music skills computer-aided external device framework.

3 CONSTRUCTING A NEW PUBLIC MUSIC TEACHING MODEL IN COLLEGES AND UNIVERSITIES

3.1 Questionnaire Survey on Teaching of Sight-Singing and Ear Training

First of all, I conducted 200 questionnaire surveys on "teaching" and "learning kisses" in the music department (undergraduate, music education major) of two ordinary colleges and universities. It mainly involves two schools the basic conditions of the curriculum, the basic conditions of the singing and ear training activities, and the basic conditions of the students 'learning. The questionnaire survey is for students in the first and second grades of the two colleges, respectively.

There are 206 undergraduates who are taught by four different teachers in sight-singing and ear training. Among them, the Music Department of Hunan Foreign Economics Institute surveyed 56 students in 2012; 55 students in 2011; the Music Department of University of Science and Technology investigated 52 students in grade 2012; 47 students in grade 2011. A total of 200 questionnaires were distributed, and 190 valid questionnaires were withdrawn, with an effective rate of 95%. The specific contents of the questionnaire are shown in Table 1:

No.	Questionnaire question	Options and percentage		
1	Do you think that there are 2 ears of sight-singing a week, is there enough time?	A is 25%	B is not enough 44%	C is almost 31%
2	Do you like singing and training?	A likes 56%	B doesn't like 8%	C is generally 34%
3	Do you think that the number of people who listen to and practice ear singing will affect you?	A has an impact of 55%	B did not affect 12%	C slightly affects 33%
4	Do your solfeggio classes involve knowledge of music theory or other subjects?	A involves 65%	B does not involve 2%	C slightly involved 33%
5	What do you think is the most difficult thing to learn in solfeggio?	A fixed treble 45%	B sight singing 2%	C Comprehensive Factor Analysis 53%

Table 1: Questionnaire survey on the "teaching" and "learning" of the solfeggio training.

From the statistical data of the sample survey in Table 1, it is not difficult to see that there are more or less some problems in the sight-sounding ear training in our colleges and universities that we need to correctly view and solve. Sight singing and ear training is a course that emphasizes both theory and skill training, in which training of skill and skills is an important part of teaching. It is this characteristic that tends to make teachers give too much instrumental color and technical significance to the teaching of sight-reading and ear training, focusing too much on pitch, rhythm, melody, harmony, melody, texture, repeated training in polyphony and other technical aspects has little connection. As a result, our students, like a blind man, seem to be struggling forward on the road of learning cognitive music under the guidance of a teacher. Without knowing it, it is difficult to experience the beauty of music and cultural connotation. It must be understood that the ultimate goal of our continuous in-depth analysis of these musical elements is to accumulate more musical languages, so as to better understand the inherent laws of music, in order to achieve the purpose of understanding music, enjoying music, cultivating sentiment and enhancing the aesthetic ability of music.

3.2 Singing Physiological Analysis of Singing Skill Training

Several physiological monitoring devices are used in the music skill computer-aided system, the main function of which is to monitor the movement status of breathing and respiratory muscle groups. The breathing equipment includes a breathing mechanics monitor, which can perform mechanical monitoring of breathing. Incorrect breathing is actually the wrong movement of the breathing muscles. Monitor the activity of respiratory muscles, and make adjustments to achieve a breathing state that is conducive to singing. The singer's breathing curve and myoelectric curve have been shown in Figure 4.
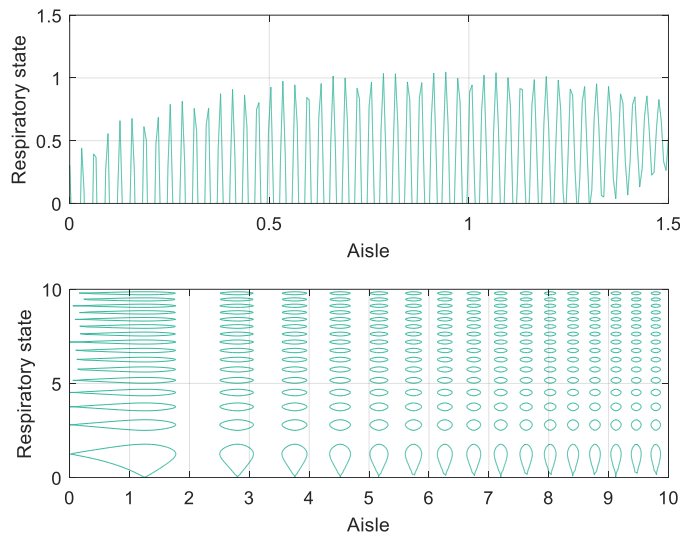
Figure 4: Breathing curve and EMG curve.

The data source of motion analysis is digital video, so we must first understand the composition of digital video. Mathematical video can be regarded as a time-varying image, which is composed of multiple consecutive image sequences, and its structure is shown in Figure 5. Among them, t uranium represents the time axis. In general, the use of the persistence of human vision can form a sense of continuous movement.
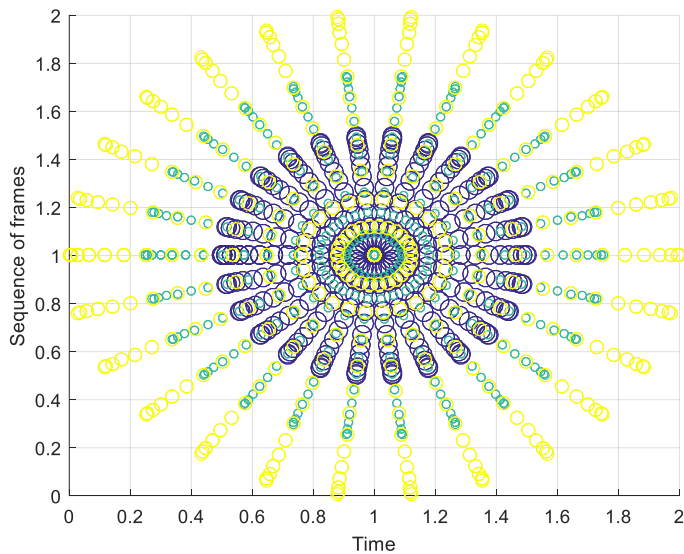

Figure 5: Breathing curve and EMG curve.

The motion analysis subsystem focuses on accuracy, and the system is similar to a motion capture system. Motion analysis segments human parts in an image and tracks and analyzes joint movements that need attention in the image sequence, which facilitates the establishment of a

geometric model of the human body and explains the mechanism of human movement behavior. There is a great similarity between action analysis in music and sports. Through the camera, we can record the trajectory of the finger movement, record each action process, and help us observe the finger skills. Whether it is a piano, a violin or other musical instruments, it is related to the movement of fingers. Each instrument plays different hands and movements, but the equipment and analysis principles are the same. With the video sequence that changes over time, J-, our analysis is much more comprehensive.

The decomposition of dance movements can be completed by high-speed cameras and image analysis software. Three cameras are used in the system to record the dance process from three directions, and the image analysis software is used to analyze the images and display them in frames, as shown in Figure 6. Through the playback, students and teachers can use the knowledge of dance training science to study the problems in the movement. Through repeated training, the purpose of improving the accuracy of movements is achieved.
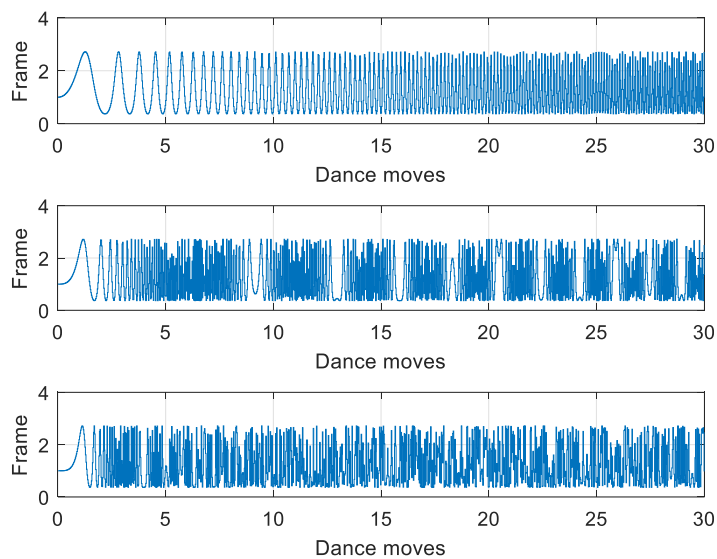
Figure 6: Dance movement analysis.

The singing voice is a complex compound sound. The pitch frequency is of the human voice when singing is generally in the range of 100 Hz to 1500 Hz. In addition to the pitch frequency, the singing voice also contains rich overtones and partials. Traditional teaching and training mainly rely on experience and use "functional hearing" to judge abstract concepts such as "chest cavity, head cavity, pharyngeal cavity, oral cavity, high position resonance". The audio frequency spectrum analysis function of the virtual instrument in the music skill computer-aided system can analyze the sound. After spectrum analysis of the sound, the sound intensity of the fundamental tone (pitch factor) and various overtones and partials (timbre, resonance factors) of the music in different frequency bands can be observed. Here we give a more specific "sound form" frame of reference from the point of view of music acoustics, so that we can not only hear the sound, but also see the sound changes in the visual graph of sound conversion. The characteristics of this analysis method are more specific, intuitive and accurate. But also assist the auditory to carry out a deeper analysis of factors such as the timbre and resonance of singing, as shown in Figure 7.
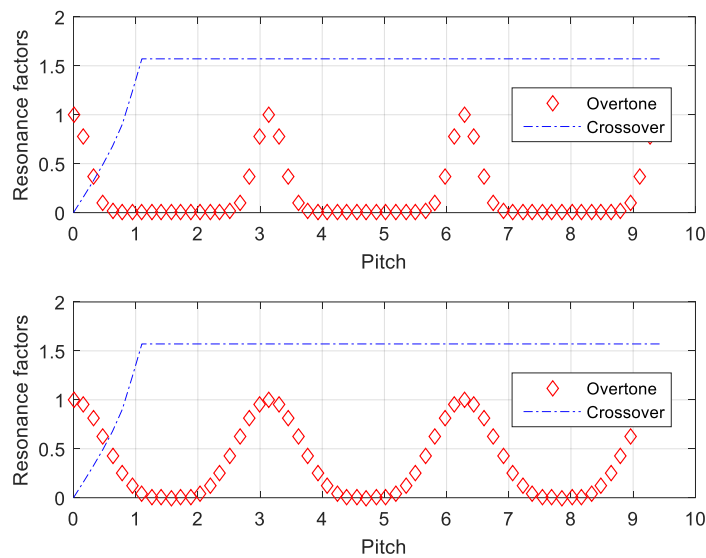
**Figure 7**: Resonance spectrum analysis.

3.3 Remote Interaction

Music skill training is a practical and operable field. Learning generally needs to be face-to-face. If the system realizes remote synchronization, it will change the traditional classroom teaching method and realize remote music skill learning. The teaching aid can also become a platform for distance teaching. Set up "Chorus Lesson", "Wind Instrument" or "Folk Musical Instrument" courses in the comprehensive practice course to expand students' musical skills and extend the learning of musical skills

In the field of study, these expansions can diversify the distribution of music skills courses and increase students 'interest in learning. They are connected to the kindergarten courses. Of course, they can be dynamically adjusted according to the actual needs of the kindergarten courses. As shown in Figure 8.

Teachers and students connect the two music skills computer-aided systems through the network platform to achieve synchronization. After the system starts to work, the platform used by teachers and students can receive each other's voices, images, and various analysis data in real time. It is suggested that students can compare their own data with teacher data to learn and realize distance skills teaching. The technology of remote connection has been realized.

4 CONCLUSIONS

Study the characteristics of music skill training and establish a music skill computer aided system for different skill training points. Similar to a digital intelligent expert system, a computer is used to replace some of the music expert's work. Make abstract concepts and skills intuitive, display some vague concepts with computer data or images, and transform passive learning into active cognition. It can be used for teaching or training, and can also perform tests on performers, so that the music evaluation has a certain scientific basis, and can propose next training suggestions. The significance of establishing this system is also that this brand-new system updates the traditional teaching model and breaks the limitations of traditional music skills teaching. This is for deepening the reform of music teaching. The use of the system can make music training in a scientific and rational direction progress. Times are constantly advancing, and computer technology is constantly improving, creating a new teaching model for music teaching.
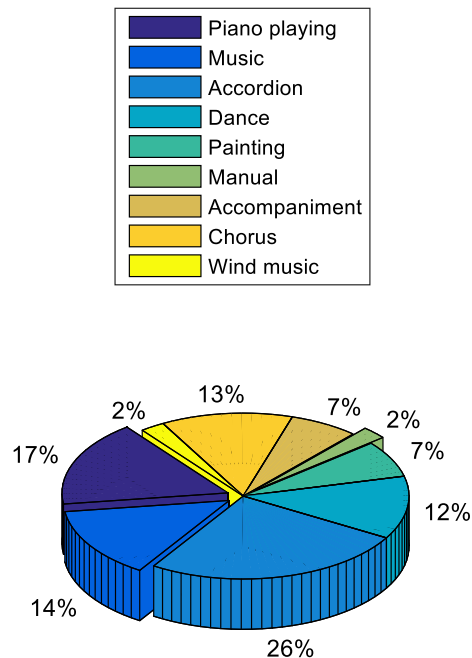
Figure 8: Music skill curriculum.

Digital teaching methods provide great convenience for modern music teaching. With the aid of music skills computer-aided system, it provides references for teachers' teaching and student training, and is convenient for cultivating high-quality music talents for the society.

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