The Application of Computer-Aided System in the Digital Teaching of Music Skills

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Abstract. With the rapid development of computer technology, digital audio technology is more and more widely used in music education. As a new type of teaching method, it is being valued and used by more and more music educators. The use of music computer-assisted systems for music teaching will greatly improve the quality of music teaching. At the same time, the use of new digital teaching models will greatly improve the teaching methods and teaching methods of music. This paper studies a music skill auxiliary training system and a corresponding innovative digital teaching method. The system analyzes the learner's audio, video, and physiological information in detail, saves the actual practice in the database, detects changes in their skill level, and provides intuitive visual information and systematic, comprehensive aspects for teaching and training. The scientific parameters of the technology can turn abstract skill theories and methods into intuitive. The research results show that it can enable students to accurately distinguish their own voices in multi-voice sight singing, so as to feel the relationship between several voices, and promote the study of harmony, polyphony and other theoretical subjects.

Keywords: Computer aided; music teaching; digitization
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1 INTRODUCTION

Computers have been widely used and have gradually penetrated into education and teaching with their unique advantages, namely, fast, convenient, and efficient. Yuan [1] considers the digital music course auxiliary teaching system is necessary. Computer music uses the principles of modern electronic computer digital transmission, adopts international MIDI technology standards, and improves the asynchronous serial connection of a number of electronic musical instruments to form a computer music system. It contains two aspects: MIDI creation and audio processing. In short, MIDI is the digital interface of music equipment, the full name is Musical Instrument Digital Interface, which is a digital communication language, and a technical standard for mutual compatibility and information exchange between related devices. In a well-connected network, MIDI technology enables various software and hardware electronic musical instruments, performance controllers, computers and other devices to exchange information with each other.

Yu et al. [2] think the purpose of music teaching is essentially to cultivate students' aesthetic taste and ability, and the content includes singing, performance, rhythm, appreciation, creation, and the cultivation of relevant basic knowledge and basic skills. This determines the particularity of the music teaching method, which is manifested in the fusion of sensibility and rationality. Therefore, Shi and Wang [3] consider teaching preparation, teaching process and interaction with teaching can all be realized with the help of Internet technology. On the other hand, from the perspective of students, emotions are an important factor that affects students' beauty in the process of learning music. The current traditional teaching mode will restrict students' ability to appreciate music to a certain extent. Therefore, a good learning atmosphere must be created in the music classroom so that students can integrate into the artistic conception of music as soon as possible, thereby improving Learning efficiency. Le [4] think if modern computer technology is used.

Ghous et al. [5] think he use of computer music technology in the teaching of sight singing is of great significance. The application of this novel teaching method to the teaching has proved through practical teaching that the positive significance of using computer music production in the teaching of sight singing mainly includes:

First of all, when singing sight-singing tracks, such as transposition and transposition, the tone can be accurately determined. In the case of shifting or shifting sight singing, the teacher should first explain to the students what the tune is from to what tone of sight singing. In the production process, you should give a hint in the previous measure of the transition or transposition, and give the main chord of the transition in terms of accompaniment. For students with a poor foundation, the teacher can play the decomposed main chord during production, so that students The pitch and tonality of sight singing can be determined very clearly.

Secondly, the use of computer music production technology to produce accompaniment for sight-singing effectively solves the problem of teachers' insufficient improvisational accompaniment ability. Teaching practice shows that for the sight singing that students have already mastered, teachers should not play the main melody, but the accompaniment of the song. This requires teachers to achieve a certain level of impromptu accompaniment. We can use computer music production technology To improve the teaching in this area. The teacher inputs the left and right hand melody separately in the software, and can hear the inconsistency in the accompaniment at the same time, and make timely modifications. When inputting, pay attention to fully express the strength and emotion of the sight-singing song. This teaching method reduces the difficulty of improvisational accompaniment and allows students to have a good auditory effect during practice. At the same time,

it also allows teachers to shift their attention from improvisational accompaniment to cultivating students' sense of music, achieving the effect of sight singing teaching. The effective increase.

Thirdly, it can enable students to accurately distinguish their own voices in multi-voice sight singing, so as to feel the relationship between several voices, and promote the study of harmony, polyphony and other theoretical subjects. Because the teacher replaces each part with a different timbre, students can clearly distinguish their own part when performing sight-singing, and when listening to other parts, there will be no confusion between parts and parts. It is worth noting that when modifying MIDI files, you must be very careful, modify the rhythm, the relationship between strength and weakness, intonation and timing, etc., and train multi-voice sight singing in all aspects.

Figure 1: Music computer-assisted system.

The research and development of music computer-assisted system is a brand-new subject in the field of music skills education, as shown in figure 1. The subject is a complex system engineering across disciplines and fields. This article only involves part of the content due to factors such as the length of the research. Starting with vocal music training, it only elaborates on the design of music computer-aided system, audio support module, and bio-signal recording module. The movement skills training part, platform kernel design, database design, system language, data processing, case study examples, etc. are discussed in other articles [6,7].

In the early 1960s, American psychologist Skinner developed a pedagogical method—procedural pedagogy. At that time, it was implemented in some schools and achieved good teaching results. Music teaching in the United States has developed rapidly, and the pedagogy studied by Skinner is very advanced. He compiles the content to be edited into a program according to certain steps, from simple to highly difficult. Although the content of each step is not much, it can give students a clear understanding of music knowledge. This is a kind of personalized music teaching method. During the learning process, students can ask their own questions according to the program teaching, and teachers can also use the exercises in the program as homework to require students to complete. In this program, you can also do some teaching games to enrich the classroom content [8].

In China, computer music has only begun to develop in the late 1980s, and now it has developed at an alarming rate. However, it has not been developed in basic music teaching, and few teachers can well combine computer music technology with teaching. There are many reasons for this. For example, the computer music courses offered by masters and universities are too short, and many colleges and universities do not currently have this major. Even if the computer music major is

opened, the work that students will do when they leave the school Most of them are arrangers, sound engineers, free musicians, etc. Few people choose to engage in basic education in primary and secondary schools. This has resulted in a very small number of primary and secondary school music teachers who can master various techniques of computer music. A more serious problem is also reflected here. Normal colleges and universities should popularize MIDI technology as a compulsory course like music, piano and other majors. The second reason is that China has a large gap between the rich and the poor. In some economically underdeveloped areas, the teaching equipment is not up to standard, which makes this teaching concept impossible to be implemented at all.

In general, the essence of computer technology-assisted music performance teaching is to design reasonable and feasible teaching plans, use digital audio technology, and combine traditional music teaching models with teaching goals and teaching objects as the starting point in the process of teaching and training. To realize the organic combination of the two in the overall teaching activities, and finally realize the maximization of teaching results. In the teaching practice of music performance major, teachers can use computer equipment to create an open teaching environment, build a brand-new learning platform for students, and closely integrate teaching content and teaching mode. With the rapid development and popularization of computer technology, digital music storage has replaced the early analog music storage. What we usually call computer-assisted teaching refers to the process of teaching activities that use digital audio equipment and recording art with the help of audio editing software. Through this kind of teaching method, the integrity, intuitiveness and dynamic display effect that traditional music teaching cannot meet can be supplemented, and the teaching effect can be improved. Combining the strengths of the two teaching methods can not only improve the effectiveness of teacher-student communication, but also highlight the subjectivity of students' learning, enabling better theoretical and practical learning, and achieving the goal of teaching students in accordance with their aptitude to the greatest extent [9,10].

2 THE GENERAL STRUCTURE OF THE MUSIC COURSE TEACHING AID SYSTEM BASED ON COMPUTER TECHNOLOGY

With the development of art vocational education, various art vocational colleges have explored and reformed the teaching of this major in accordance with the needs of the professional construction and development of music performance, and made corresponding adjustments in the rationality of professional curriculum settings. The school has carried out preliminary reforms to the curriculum and structure of the music performance major. According to the actual requirements of professional colleges, professional music education institutions and other professional positions, the curriculum has increased the proportion of practical skills training and strengthened the teaching hours of practical teaching. , But some schools still follow a relatively traditional teaching model.

According to survey statistics, among the music performance majors offered by art vocational colleges, all majors offered are divided into two categories: Baole singing and instrumental music performance. Among them, the professional direction of vocal music singing includes three kinds of spray methods: ethnic, bel canto and pop; the professional direction of instrumental music is generally divided into four categories: keyboard performance, ethnic instrumental performance, western orchestral performance and modern music performance. Each school is different.

Through the application of digital audio technology, the teaching process can be arranged flexibly, reasonably and in an orderly manner. Digital audio technology has brought many conveniences to the teaching of music performance, the most notable of which is the ability to integrate various teaching resources. By downloading various teaching resources stored on the Internet and the cloud

in real time, suitable examples and demonstration templates can be found smoothly in the teaching process. This process greatly reduces the single teaching direction and inability to adapt due to the teacher's own ability or the single research direction. To the individual phenomenon of each student. Through the application of digital audio technology and computer technology, teachers can find the direction suitable for each student's learning more conveniently and quickly. And find the corresponding teaching resources in all directions to improve the teaching effect. At the same time, digital audio technology can make students' learning achievements in other subjects more convenient to integrate into the learning of music performance, such as students personally interpret their own compositions, etc., teachers can make corresponding teaching plans for them after understanding, Reducing the communication cost of mutual understanding between students and teachers, making teaching more personalized and professional. Through the use of digital audio editing software, teachers can also freely adjust the difficulty of the practice repertoire, and adjust the teaching content flexibly at any time for students of different foundations and abilities, and truly follow the teaching principle of teaching students in accordance with their aptitude. Physiology module is mainly composed of laryngoscope, vital sign monitor, electronic fiber rhinopharyngolaryngoscope and its corresponding image processing software analysis software and integrated platform, as shown in Figure 2.

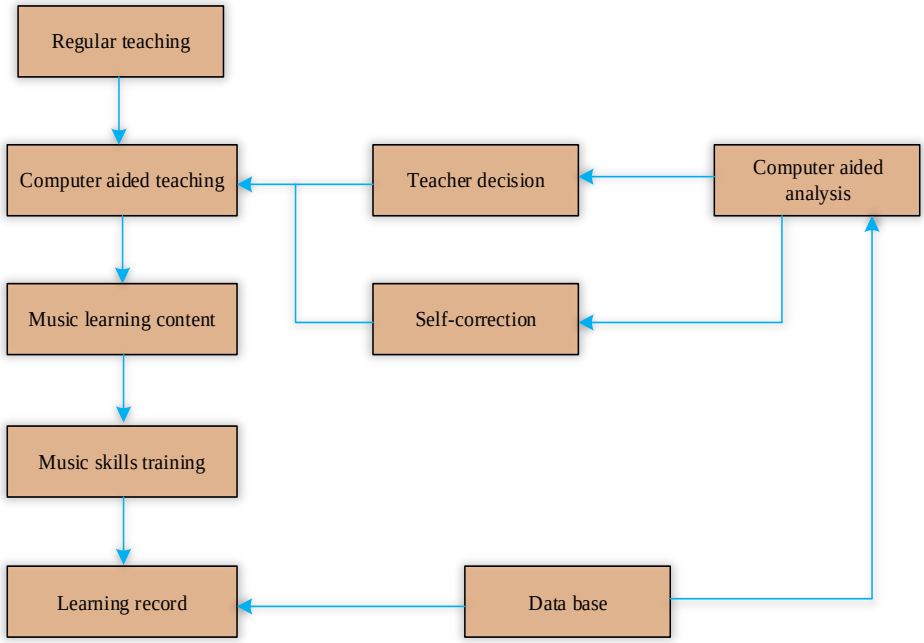

Figure 2: Auxiliary training process of music course teaching.

The music course teaching assistant system mainly includes data collection, storage, analysis, display, suggestion and decision-making, etc.

2.1 System Function

The essence of computer technology-assisted music performance teaching is to design reasonable and feasible teaching plans, use digital audio technology, and combine traditional music teaching models with teaching goals and teaching objects as the starting point in the process of teaching and training. By using his system, the student's posture can be checked, such as throat conditions, musical expressions, postures and movements of performance

2.2 System Main Interface

A large number of external devices in the system are connected to the computer, and the training data is recorded and displayed in the main interface. The windows in the main interface include a score window, a reference waveform window, a training waveform window, a breathing curve window, an EMG curve window, and a recording playback button, etc. These windows display different data for the trainer's reference.

In the music library in the main interface, you can select the track to be practiced and the teaching progress. After the track is selected, the corresponding score will be displayed in the score window. The preset demonstration waveform is displayed in the reference waveform window, and the trainer's waveform is displayed in the training waveform window. The breathing curve window shows the breathing status of the trainer during the training process, and the EMG curve window shows the muscle tension of the trainer. Various playback buttons can play demonstration recordings and trainer recordings. There are buttons for rhythm analysis, pitch analysis, sentence analysis, resonance analysis, etc. in the main interface. These windows can realize the accuracy of intonation judgment, the accuracy of rhythm and strength, the accuracy of pronunciation, the level of resonance and overtones in the singing voice, the amount of breathing and breathing movement parameters, the condition of the throat, the expression of musical expressions, and performance The trajectory of body movements and other functions. The power comparison is shown in figure 3.

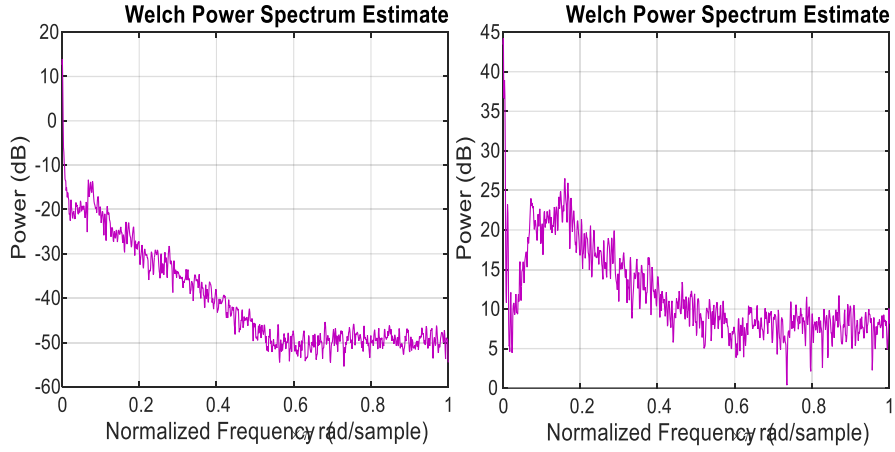

Figure 3: Power comparison.

2.3 Audio Processing

The feature extraction module includes a pitch frequency recognizer and a pitch acquirer. The built-in pitch frequency recognition methods of the pitch frequency recognizer include: cepstrum method, harmonic peak method, cyclic direct method, wavelet transform method and parallel processing method. According to the method of acquiring the pitch selected by the teacher in the teacher guidance system, the pitch frequency data feature is extracted. The pitch acquirer uses the corresponding algorithm to extract the time value of the pitch. The feature processing module includes a frequency-pitch converter, a pitch comparator, and a pitch-length comparator. The conversion method of the frequency-pitch converter is based on the treble and the pitch. For example, the pitch corresponding to 4000Hz is 87.21, that is, the pitch corresponding to 4000Hz is b4+21 cents. The comparison method of the pitch comparator is H=A-B, where A is the pitch of the sound to be checked, B is the pitch of the reference sound, and H is the pitch difference. The comparison method of the pitch comparator is L=C-D, where C is the length of the sound to be checked, D is the pitch of the reference sound, and L is the difference in pitch. Compare whether the pitch and length of each note are the same, and give how much the pitch of the note to be checked is higher and how much lower; give the value of how long and how short the pitch of the note to be checked is. The normalized frequency is shown in Figure 4.

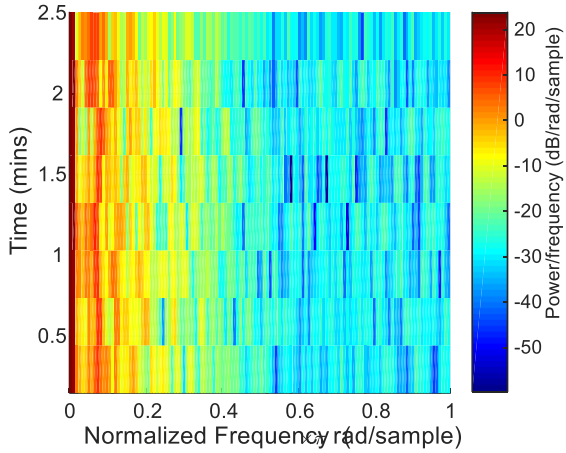

Figure 4: Normalized frequency.

2.4 Sound module

The system can count the key errors, give the reasons for the errors and the improvement methods, so as to achieve the purpose of learning and training through the testing method. At the same time, considering the characteristics of the test and the requirements of learners, the system is real-time.

This module involves the training content of sound, including rhythm and length, pitch, sentence segmentation, resonance and so on. Here we focus on two parts: the comparison of phrase graphics and the analysis of sound resonance spectrum.

(1) Phrase graphics comparison

Phrase graph comparison is a window that compares the waveforms of the reference and the

trainer through the sound waveform. Two sets of waveforms are displayed in the window in real time. During the playback process, students can see the waveform, on the waveform, you can directly see the volume, the point of the lyrics, the rhythm of the graphics, and the integrity of the phrase. By comparing group information, students can find out the problems themselves and then correct themselves (the comparison results are shown in Figure 5).

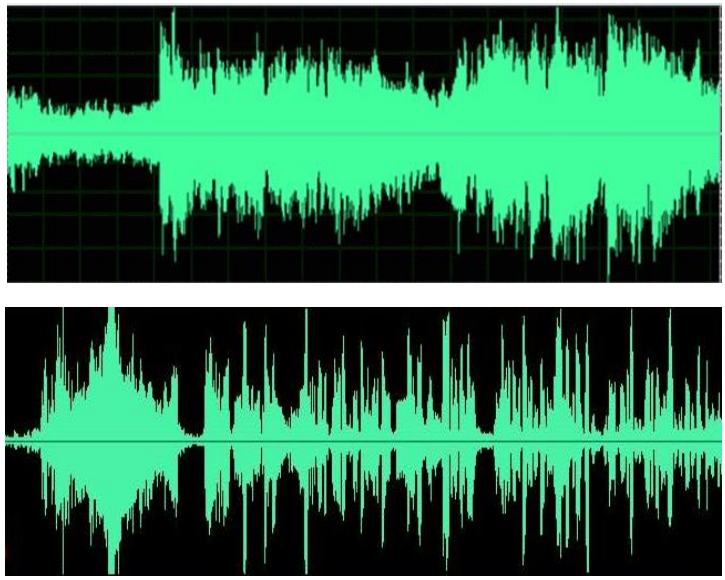

Figure 5: The comparison results.

(2) Resonance spectrum analysis of sound of the FFT analysis is shown in figure 6.

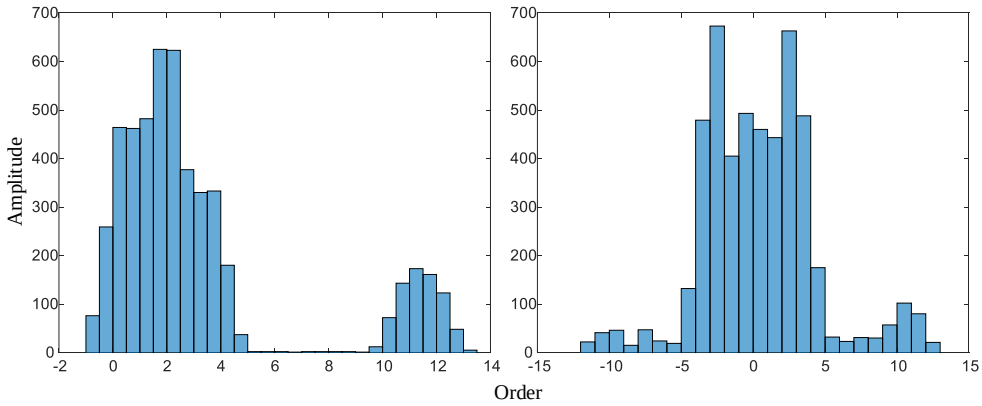

Figure 6: Amplitude.

2.5 Realization of Physiological Function Module

The physiological analysis of singing in singing skills training. Vocal music teaching cannot be separated from material materials. It has many connections with natural sciences, especially the theories and techniques of medicine, acoustics, biology and physics. It has been used in many ways in vocal music teaching. The lack of understanding of the vocal organs brings troubles to people's understanding of the concept of sound. Vocal music teaching activities are the process of freely using the scientific cognition of the human voice, the "musical instrument"—reasonable transformation. Therefore, vocal music teaching and singing skills training start from understanding the physiology of singing. The dynamic contrast graph of waveform is shown in figure 7.

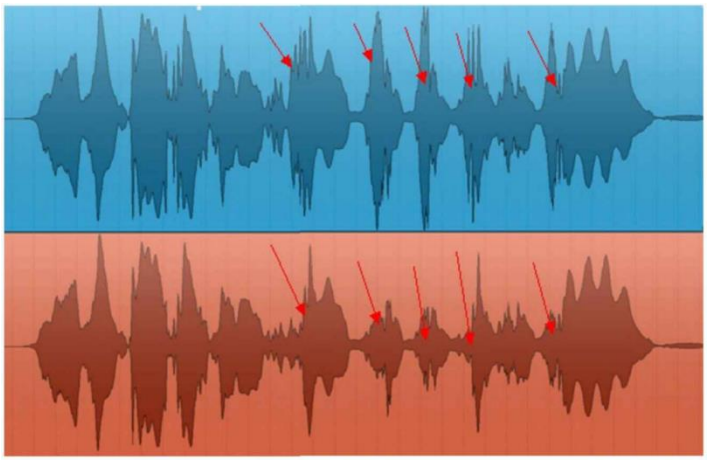

Figure 7: Dynamic contrast graph of waveform.

In the teaching process, multiple CAI courseware are designed in the system, and computers are used to explain, so that students have a certain understanding of singing physiology, and use the pictures in the courseware to introduce people's mouth, throat, vocal cords, chest, etc.; in addition, The system uses fiber rhino-pharyngoscope to observe the student's oral cavity and other parts, combined with the knowledge preset in the CAI courseware, and compares the data information of the two, which allows students to see the physiological structure of their own vocal organs, such as the opening of the vocal cords situation. After students have a detailed understanding of the "musical instrument" structure they use for singing, teachers can better communicate with students during singing training. Experiments have proved that the effects observed through the laryngoscope are the most intuitive and can help students improve their learning effects.

The use of computer music technology in music composition teaching is to create a good learning atmosphere for students and broaden their minds. The most important thing is to allow students to master the learning methods of self-research, and cultivate the consciousness and way of thinking of students' independent learning. Instead of just listening to the teacher blindly teaching. During the listening process, they can record the changes that need to be made, and carry out carefully after class. In this way, the student's learning initiative is fully brought into play. At the same time, it also greatly stimulated students' desire for job hunting and creation.

As can be seen, the system can enable students to accurately distinguish their own voices in multi-voice sight singing, so as to feel the relationship between several voices, and promote the

study of harmony, polyphony and other theoretical subjects. Because the teacher replaces each part with a different timbre, students can clearly distinguish their own part when performing sight-singing, and when listening to other parts, there will be no confusion between parts and parts. It is worth noting that when modifying MIDI files, you must be very careful, modify the rhythm, the relationship between strength and weakness, intonation and timing, etc., and train multi-voice sight singing in all aspects.

3 CONCLUSION

With the rapid development of computer technology, digital audio technology is more and more widely used in music education. As a new type of teaching method, it is being valued and used by more and more music educators. The use of music computer-assisted systems for music teaching will greatly improve the quality of music teaching. At the same time, the use of new digital teaching models will greatly improve the teaching methods and teaching methods of music. This paper studies a music skill auxiliary training system and a corresponding innovative digital teaching method. The system analyzes the learner's audio, video, and physiological information in detail, saves the actual practice in the database, detects changes in their skill level, and provides intuitive visual information and systematic, comprehensive aspects for teaching and training. The scientific parameters of the technology can turn abstract skill theories and methods into intuitive. The research results show that it can enable students to accurately distinguish their own voices in multi-voice sight singing, so as to feel the relationship between several voices, and promote the study of harmony, polyphony and other theoretical subjects. However, this method of combining computer technology and basic music teaching also requires schools to have good teaching equipment and teaching environment. Teachers must have a foundation of computer music production knowledge, and can use computer technology very scientifically and effectively, so that they can produce good products. Teaching content. According to the current situation, due to the limited teaching conditions, this teaching method has not been widely implemented. It can only be used in some schools with good teaching conditions. It is hoped that with the continuous development of the economy and education level, it will be used in music teaching in the future. Among them, schools and teachers can greatly develop this novel and unique teaching method and improve the teaching quality of music lessons. This is also a perfect embodiment of the combination of teaching methods and modern scientific and technological means.

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