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Application Research on Empowering Vocal Music Classroom Teaching in University through Informatization

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Abstract: In recent years, educational informatization has developed rapidly under the support of national policies and the impetus of technological innovation. Significant achievements have been made in infrastructure and resource construction. Information technology has empowered university vocal music education, and its advantages have been utilized in vocal music classroom teaching to explore innovative application paths. This article constructs multimedia and digital media technology, an artificial intelligence-assisted teaching system, big data analysis and real-time feedback, and virtual reality teaching platforms to provide more effective learning methods for teachers and students. At the same time, there are certain challenges in enabling information technology to empower vocal music classroom teaching. Based on this, this article analyzes the optimization path and further confirms the value and significance of enabling information technology to empower vocal music classroom teaching.

Keywords: Teaching reform; Informatization; Vocal music; Classroom teaching; Artificial intelligence; Virtual reality technology

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1. Introduction

Based on the policy guiding documents such as the "Education Informatization 2.0 Action Plan" and the "Opinions on Accelerating the Promotion of Education Digitalization," the Ministry of Education established an education informatization leadership group, further promoting the in-depth development of education informatization. In addition, the country has formulated and released a series of education informatization standards, ensuring the standardized and regulated development of education informatization, and initially establishing a modern distance education technology standard system. The infrastructure of education informatization has also achieved a preliminary scale expansion. The China Education and Research Computer Network has covered the entire country, providing a solid network foundation for education informatization. The higher education literature guarantee system, university humanities and social science literature centers, and the China University Digital

Museum have realized service sharing, providing rich literature materials for education and teaching [1].

Driven by technological innovation, the integration of emerging technologies such as artificial intelligence, big data, and the Internet of Things with education has made teaching and learning processes more convenient and efficient. Under this impetus, university vocal music classroom teaching is also undergoing continuous exploration and reform. For instance, by using big data analysis to customize personalized learning plans, individual learning accounts that can record and store learning experiences and achievements for each learner are established, and personal lifelong electronic learning archives are created. Online platforms and artificial intelligence technologies break geographical barriers, benefiting students in remote areas and addressing the issue of uneven music education resources, thereby enhancing teaching efficiency and quality, promoting students' individualized development, optimizing the utilization of teaching resources, and cultivating music talents who are adapted to the information age [2].

2. Analysis of the current situation of vocal music classroom teaching in colleges and universities

At present, modern music is developing rapidly and its artistic forms are becoming increasingly diverse. However, vocal music teaching has always followed the traditional "one-on-one" teaching mode due to its unique practicality and individualized requirements. With the reform of vocal music courses in higher education institutions, some universities have also introduced the "multiple students per group" teaching mode in an attempt to improve teaching efficiency. However, due to the particularity of the vocal music discipline, this measure has not effectively solved the problem of cultivating vocal music talents.

Vocal music classroom teaching is an art discipline that emphasizes practice and perception. In traditional vocal music teaching activities, there is an excessive reliance on teachers' subjective experience judgments, and students lacking innovative thinking have difficulty synchronizing with the teachers' teaching, resulting in students developing self-doubt during singing and thus achieving poor teaching outcomes. When formulating training plans, teachers need to customize them based on the different students' vocal conditions and technical levels. However, this requires high professional standards from teachers. For young teachers who are new to the teaching position, there may be a lack of teaching experience and objective quantitative standards, leading to a low degree of personalization in the training plans. Currently, in the vocal music classroom teaching of some universities, although some universities have equipped multimedia classrooms, due to weak application of technology, in teaching, they mostly only use multimedia equipment to display teaching content or play audio, and do not deeply integrate information-based teaching resources. Some vocal music teachers, due to the reason of teaching duration, focus their teaching on the training of singing techniques, lacking and neglecting the teaching of singing-related theories and the history, culture of vocal music art.

At present, in the vocal music classroom teaching of universities, there are still conflicts between the demand for large-scale education and the inherent characteristics of vocal music teaching, as well as problems such as the scarcity of high-quality teachers and insufficient hardware facilities. These issues have also affected the improvement of teaching quality and efficiency. Therefore, university vocal music teaching needs to maintain its professional characteristics while exploring new models that are suitable for large-scale education, and solve the integration of information resources and the application of vocal music practical teaching.

3. The innovative application path of informationization in vocal music classroom teaching

Information technology has brought new opportunities to vocal music teaching. In vocal music classroom teaching, integrating information technology to update teaching concepts, innovate teaching methods and approaches, and explore intelligent auxiliary teaching systems and other series of measures have further improved the teaching quality, endowed vocal music teaching with diversity, and enabled the deep application of information technology in teaching to be implemented specifically.

3.1. Multimedia and digital media technology

Introducing computer visualization technology into vocal music classroom teaching integrates audio, video, pictures and animations. For example, when the teacher uses software to record audio, they simultaneously convert the sound characteristics into visual image data and capture and save it for comparison with the exemplary performances of famous singers. Students can directly observe their own voice waveform characteristics to intuitively and scientifically adjust and learn their voices (breath control and vocalization position, resonance cavity), thereby significantly improving their control and perception abilities of voice stability. Moreover, this digital teaching method can preserve students' learning and growth-related data at various time periods for a long time, facilitating teachers to scientifically and promptly adjust individualized training plans.

The vocal music discipline can also collaborate with related majors such as medicine and animation design to create micro-lessons. Through more intuitive three-dimensional animations, it can present the working conditions of various organs in the human body during singing (such as the operation of the breath, the muscle working conditions of the larynx and diaphragm and other parts, the opening state of the mouth, etc.), making the vocal music classroom teaching shift from abstraction to science and objectivity, effectively improving the communication efficiency between teachers and students, and optimizing teaching methods and approaches.

3.2. Artificial intelligence-assisted teaching system

We can leverage the vast teaching platform of universities to explore new paradigms for "artificial intelligence + education" application scenarios, and promote the deep integration of large-scale models with education and teaching [3]. A specialized large-scale artificial intelligence model is established. It is extensively trained using the vast database of universities (including data on teachers' teaching and students' growth). Combined with relevant medical equipment and 3D scanning devices, a visual analysis report is formed for students' breathing frequency and stability, diaphragm movement trajectory, facial expressions, and vocal cord muscle state during singing. When the operation of a certain vocalization part by a student is unreasonable, an alert is issued and targeted improvement training videos are pushed. At the same time, the analysis report and training data are retained to form an exclusive growth file. This visual teaching method can provide students with a "leveling up, defeating monsters, and progressing" gamification experience, enhancing their learning enthusiasm. Teachers can also directly obtain students' problem feedback and long-term learning assessment reports and promptly adjust the teaching plan to achieve personalized teaching and improve teaching efficiency [4].

The deep learning capabilities of artificial intelligence have brought new impetus to vocal music teaching, further promoting the diversified teaching of "tailored education". By using large-scale artificial intelligence models to analyze the growth data of students at different stages, combined with the growth data of outstanding students over the years and renowned singers, and based on the students' vocal characteristics and their mastery

of the key points and difficulties in singing techniques during the learning process, personalized dynamic learning paths are automatically generated. Moreover, the singing style tendencies of students (such as suggesting whether to extensively train Mozart's art songs or opera arias) can be identified. This enables professional teachers to formulate more scientific and precise training plans, conduct real-time tracking of students' training and growth data, and make real-time personalized adjustments.

3.3. Big data analysis and real-time feedback

The intelligent classroom system is constructed. Millimeter-wave radar and 3D motion capture systems are employed to detect and record body postures and body language during singing. Infrared thermal imagers are used to detect temperature changes in organs. Professional equipment is utilized for audio recording, and data, such as visual sound waveform diagrams, are generated. Through real-time processing by artificial intelligence, a three-dimensional evaluation report of "physiology-acoustics-behavior" is formed, and personalized teaching plans are formulated. Based on this, the recordings and videos of students in class, artificial intelligence evaluation reports and improvement suggestions, teachers' comments, and the situation of lesson reviews are uploaded for evidence storage to construct a traceable growth record. This record is applied to the enrollment of vocal music majors. Colleges and universities can view candidates' previous growth records through authorization to evaluate their professional development potential.

Currently, the vocal music teaching evaluation system is undergoing a significant transformation from subjective experience to objective quantification. The realization of this transformation depends on the construction of large artificial intelligence models and the systematic collection of teaching data. Three core components form the basic framework of this evaluation system: the data collection unit is responsible for recording students' singing posture characteristics and sound wave morphological parameters; the intelligent analysis unit compares and calculates the collected data with the standard data parameters stored in the model; the evaluation feedback unit finally generates a visualized evaluation and analysis report. Teachers' teaching activities can cooperate with this system to formulate precise personalized training plans, improve teaching efficiency, and reduce the cost of talent trial-and-error.

3.4. Virtual reality teaching platform

Virtual reality technology can enable three-dimensional interactive communication with students in teaching. By leveraging the immersive, interactive, and open characteristics of virtual technology, it guides students to engage in in-depth, interactive, and autonomous learning, bringing breakthroughs in aspects such as contextualization, visualization and cross-temporal communication in teaching [5]. Through the combined application of virtual reality technology, spatial audio systems and precise positioning devices, the acoustic environment of various performance venues such as concert halls, theaters, and open-air stages can be highly replicated. The deficiencies in the hardware facilities of some universities have thus been effectively improved, and students' adaptability to diverse performance environments has also been enhanced. The three-dimensional holographic projection technology can visually present key elements such as the trajectory of breath flow, vocal cord vibration patterns, the degree of cavity opening, and related muscle force characteristics during singing, providing scientific and objective references for vocal music classroom teaching practices. The combination of digital archaeology and three-dimensional modeling technology enables the reenactment of historical scenes and cross-temporal artistic dialogues, such as recreating the grand scene of Tang Dynasty court music and dance, and holographic interaction with famous singers like Pavarotti and Monacchi. These innovative forms provide new ways for

enhancing students' emotional perception and artistic expression ability in singing, and comprehensively improve the innovation ability of vocal music teaching.

Based on the concept of the metaverse, building a permanent and open virtual music space is the future trend. In the future, students from different regions can hold solo concerts or performance activities, participate in vocal master classes, or observe others' singing in this space, breaking the barriers of real space. This will greatly improve the efficiency of learning and teaching. With the development of technology in the future, the immersive experience of the virtual music space will cover more sensory dimensions, providing a more comprehensive training and learning environment for vocal music classroom teaching.

4. The challenges of enabling music classroom teaching with information technology

4.1. Technical integration bottleneck

The informatization of university vocal music classrooms faces dual challenges of hardware and software. The procurement costs of equipment such as artificial intelligence, big data, and virtual reality have become significant obstacles. These devices have very high requirements for data entry accuracy, which leads to the high cost of individual sets of equipment, such as audio recording and motion capture devices, which most universities cannot afford and thus are difficult to achieve large-scale implementation. Only a few vocal music laboratories can be built, and eventually, either "equipment idleness" or "students queuing up for waiting" situations may arise.

In terms of software, currently, artificial intelligence still needs further improvement in the aspect of emotion analysis. There are still deviations in the quantitative assessment of some abstract elements of vocal techniques; in the data collection process, high requirements are placed on data quality, and strict requirements are imposed on environmental noise, equipment sensitivity, and accurate recognition of human voices; the standard data for conducting horizontal big data comparison analysis after data collection should be established based on differentiated evaluation models for different periods and musical genres of singing styles; currently, related technologies such as spatial graphic modeling in virtual reality are not yet mature, and some people may experience varying degrees of dizziness when wearing virtual reality devices for a long time; most platforms have problems such as audio algorithm compression causing sound quality distortion; and the software interface with professional spectrum analysis and pitch correction is complex and rarely has a Chinese operation interface, which increases the usage threshold for teachers; continuous information collection during the generation of growth reports may lead to privacy leakage risks.

4.2. Teacher-student adaptation disorder

In traditional vocal music teaching, the subjective experience teaching model of "oral instruction and heart-to-heart guidance" is adopted. Teachers guide students based on their teaching and singing experience. After integrating artificial intelligence, teachers not only need to refer to the visualized analysis reports provided by artificial intelligence in their teaching activities, but also need to promptly identify and analyze the occasional mistakes made by artificial intelligence. In the early stage, difficulties in changing teaching concepts, significant investment of time and energy, and doubts about new technologies can all lead to poor teaching results. During the learning process, students may also encounter problems such as poor ability to use new technologies, unsuitable learning habits, and deviations between the rational analysis reports of school equipment and artificial intelligence and the teaching concepts of teachers.

4.3. Optimization path

Construct a hierarchical artificial intelligence participation plan based on the different requirements of vocal music teaching scenarios. For example, in daily vocal music professional courses, incorporate basic multimedia technology tools for pitch and rhythm training; gradually add an advanced artificial intelligence-generated system assessment report every month, compare it with the previous month and form a long-term archive; use virtual reality technology equipment to develop dedicated scenario training modules for different styles and periods of works (such as classical, ethnic, opera, and pop), and introduce haptic feedback technology to enhance the participation in immersive training.

Conduct specialized training on information technology teaching for teachers, enabling them to master the use of spectrogram analysis tools, adapt to the blended teaching activities after integrating with artificial intelligence, and adjust teaching plans in real time based on students' growth reports. Schools should increase investment in infrastructure for information technology construction, encourage cooperation between schools and enterprises to develop applicable tools, select mature and stable platforms and technologies, attach importance to data security, establish a dynamic evaluation system, and conduct comprehensive evaluations based on teacher and student satisfaction, students' growth reports, classroom observation records, and winning rates of performances and competitions. Emphasize the principle of "technology serving art," pay attention to the scientific and artistic nature of vocal music classroom teaching, gradually promote teaching innovation, and strengthen teaching reflection and research.

5. Conclusion

With the advancement of science and technology and the development of information-based teaching, the application of information technology in college vocal music teaching is gradually changing the traditional teaching model. However, the core concept of informationization in college vocal music classrooms should be centered on students, with technology serving as an enabling tool rather than replacing teachers. It should be deeply integrated online and offline, emphasizing interaction, personalization, data-driven, and contextualization. In the future, a more complete information-based vocal music teaching ecosystem should be constructed to promote standardization and resource sharing, establish a dynamically updated "vocal music knowledge map," associate resources such as masterpieces demonstration, singing techniques, and work analysis into an organic system, and develop a "virtual faculty database." Through audio and video recording and motion capture technologies, it records the models of Chinese and foreign vocal music performers, supporting teachers and students to call upon them as needed for reference. Develop a virtual music space to break geographical restrictions, improve cross-space collaboration efficiency, and achieve teaching resource sharing. Adhere to information technology as a tool to enhance rather than replace the artistic judgment ability of people, establish a digital civilization view that balances innovation and responsibility, ensure that technological innovation truly serves the all-round development of people, and achieve the dialectical unity of technology empowerment and vocal music teaching.

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