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# Research on Online Vocal Music Smart Classroom-Assisted Teaching Based on Wireless Network Combined With Artificial Intelligence

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## ABSTRACT

With the rapid advancement of information technology, online education based on big data and artificial intelligence is a hot research topic in education. This study focuses on applying big data and AI in online vocal wisdom classes to enhance personalized teaching and effectiveness. It aims to address issues in traditional vocal education like lack of personalized guidance and poor outcomes. The research proposes an intelligent learning system for vocal education, featuring modules for data collection, analysis, and intelligent recommendations. Functions include personalized learning paths, teaching assistance, real-time feedback, and assessment. Experiments show significant improvements in student outcomes and satisfaction. This innovative approach contributes to enhancing vocal education through personalized and intelligent teaching, offering valuable insights for future education development. Online vocal wisdom classrooms leveraging big data and AI represent a crucial direction with broad application prospects.

## KEYWORDS

Big Data, Vocal Music Teaching, Artificial Intelligence, Teaching Innovation, Online Platform

## INTRODUCTION

In contemporary society, the rapid advancement of networking technology is instigating profound transformations across various industries. The educational sector, too, is actively exploring the integration of online technologies to revolutionize teaching methodologies and enrich learning outcomes. With the advent of big data and artificial intelligence (AI), novel approaches to augment online vocal music education have emerged (Yousefi Noorale et al., 2020).

Historically, music education predominantly took place through conventional face-to-face interactions. However, this traditional paradigm was constrained by factors such as time, geographical limitations, and resource availability. Nevertheless, with the widespread accessibility of the Internet and technological progress, online education has swiftly risen, offering learners flexible and convenient avenues for learning. Online vocal music education, representing an innovative facet of music instruction, has progressively gained traction among learners (Xu et al., 2019). Nonetheless, online education encounters certain challenges, including the provision of tailored learning support and the enhancement of learner engagement and satisfaction. It is within this context that big data furnishes novel solutions for online vocal music education.

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Big data refers to a collection of massive data, including structured data (such as table data in databases) and unstructured data (such as text, images, and audio). These datasets are typically so large that traditional data processing tools struggle to handle them. Big data technology refers to a series of techniques and tools used to collect, store, process, and analyze these massive datasets. It includes, but is not limited to, distributed computing, data mining, machine learning, and AI (Bartlett et al., 2019).

In online learning, big data technology plays a crucial role. First, it helps platforms collect and analyze various data generated by students during the learning process, including learning behaviors, progress, and mastery of knowledge points. Educators can better understand students' learning needs and behavioral patterns by analyzing the data, enabling personalized teaching and guidance. Besides, big data technology assists online learning platforms in optimizing course design and teaching methods. Potential issues or bottlenecks in courses can be identified by analyzing vast amounts of learning data. Moreover, adjustments can be made to course content, teaching methods, and assessment methods, making the courses more tailored to students' needs and learning styles. Additionally, big data technology can support online learning platforms in predictive analytics, such as predicting students' learning outcomes or predicting the risk of student dropout, enabling corresponding measures to improve learning outcomes and retention rates.

Therefore, big data technology is highly relevant to the course design and research of online learning. It helps educators better understand students, optimize teaching, improve learning outcomes, and ultimately advance the development of online education.

AI technology, constituting a vital component of big data, has the capability to emulate human intelligence and behavior, thereby furnishing intelligent learning support for online vocal music education (Wang, 2022). For instance, voice recognition technology can aid learners in rectifying pronunciation errors, while voice evaluation technology can assess their singing proficiency and offer personalized guidance. Moreover, virtual reality and augmented reality technologies can offer learners an immersive music learning experience, heightening their engagement and interest (Shen et al., 2023).

Leveraging big data as a technological scaffold, this study explores its complementary role in the realm of network technology music instruction. A large-scale open network course teaching platform serves as the implementation medium for investigating the teaching strategy that amalgamates AI and big data with music (Guo, 2023). Users were interviewed via a questionnaire format to delve into the efficacy of this methodology, with the aim of completing the study. Through this endeavor, it is envisaged to furnish valuable lessons and insights for enhancing teaching practices within the domain of online vocal music education. The integration of big data is poised to deliver superior learning experiences and outcomes for learners, thereby propelling online vocal music education to greater heights.

This work aims to explore the utilization of big data technology in conjunction with AI to construct a teaching assistance system for an online vocal wisdom classroom, aiming to enhance the personalization and effectiveness of vocal education. By analyzing massive datasets generated by students during the learning process and utilizing intelligent algorithms, precise monitoring and analysis of students' learning behaviors, progress, and knowledge mastery are achieved. This, in turn, provides teachers with personalized teaching guidance and offers students intelligent learning paths and content recommendations, ultimately realizing the intelligence and optimization of vocal education.

## RELATED WORK

Under the impact of this new network technology, rich and diverse network teaching methods have gradually evolved. For example, Weng and Chen (2020) discussed the role of deep learning (DL) technology in the sustainable development of the music production industry and found that DL awakens consumers' awareness of music quality, actively enhances the unique value of their own art,

and strengthens cooperation between industries (Weng & Chen, 2020). Yang (2021) designed and implemented a mobile classroom based on the cloud computing platform, which provides storage space for music cloud storage. It can meet the individual learning needs of students, enhance the interaction between teachers and students, and realize the flow, sharing, and fragmented organization of music teaching resources (Yang, 20221). Lv et al. (2020) simulated and applied virtual information such as text, images, 3D models, music, videos, and so on, to the real world, attracting the attention of researchers in the fields of machine vision, computer graphics, and computer vision and enhancing their wish (Lv et al., 2020). While Paniagua et al. (2020) used acoustic features automatically extracted from speech recordings to identify risk groups and manage preventive or corrective actions, it was feasible to develop and apply a preventive speech program for university lecturers using automatically extracted features from speech recordings (Paniagua et al., 2020). As for the music and vocal music, taking Wei's (2021) tourism VR intelligent teaching system as an example, the voice recognition technology and voice evaluation technology in intelligent voice technology are applied to the actual training and teaching of tourism commentary. Through experiments, it was found that it can provide students with a virtual experimental space, enhance its operation function, and improve the current situation of experimental teaching, thereby improving the efficiency of experimental teaching (Wei, 2021). In terms of novel technologies, Qolomany et al. (2019) considered that machine learning and big data analytics will undoubtedly play a key role in providing such smart services, offering residents new possibilities for convenience, comfort, and efficiency (Qolomany et al., 2019). Therefore, big data will play a role in teaching as new network technology.

The integration of big data technology and AI in the field of music education has been a topic of interest in recent research. Gu et al. (2020) explored the application of virtual reality (VR) technology in music education under the background of the internet, emphasizing the use of big data screening, AI technology, 5G network, and VR to optimize teaching modes and cultivate more music talents. Similarly, Li et al. (2020) studied a student-centered AI online teaching model during the COVID-19 pandemic, highlighting the importance of AI technology in creating effective online learning environments. Hsieh et al. (2020) focused on designing ARCS-assisted teaching robots based on anticipatory computing and emotional big data to improve sustainable learning efficiency and motivation. This study demonstrates the potential of AI in helping students overcome academic difficulties. Shrestha et al. (2020) discussed the implementation of the Internet of things (IoT) for smart learning, emphasizing the use of IoT devices and technologies such as machine learning and AI to enhance the online learning experience. Liu et al. (2020) evaluated user concentration in an AI-assisted English online guiding system, showcasing the integration of smart technologies in online teaching environments. He (2021) and Dai (2021) further explored the use of AI technology in music teaching, highlighting the benefits of intelligent instructional design and the integration of information technology in music education.

## MATERIALS AND METHODS

### Big Data Technology

Music is both traditional and global. Big data serves not only as a technical tool but also as a conduit from everyday life to music (Trenado et al., 2021). While upholding the traditions and essence of music, it is essential to adopt an open-minded approach and utilize the Internet to instill the concepts of music and its future in the hearts of young musicians.

Within this context, traditional vocal music instruction should leverage the advantages of big data and continually innovate its teaching methodologies to foster the ongoing progress and development of vocal music education (Sun, 2020). The novel model of vocal music education in the era of big data is chiefly manifested in modern online classrooms, mobile applications, and online platforms (Gao et al., 2021). Modern online teaching platforms restructure teaching modes and teacher-student

**Table 1. Meanings of the characteristics of big data**

| Characteristics | Meanings |
|---|---|
| Massive content | The amount of data used by big data is very large |
| Diverse content | Big data uses various types of data, involving all levels of society |
| Quick content | Big data uses network technology to transmit data very fast |
| Value content | In the massive scale of data scale, the value of data becomes low density |

relationships, transcending spatial constraints and enabling the widespread dissemination of abundant vocal music teaching resources in a timely and extensive manner.

The emergence of the big data era has ushered in significant changes globally, integrating data networks that were previously disparate. Metaphorically speaking, today's world, akin to the Earth, is enveloped by an extensive network known as big data. Regardless of the user's location (Saki et al., 2019), they can access information from any facet of the world through Internet-enabled devices. The characteristics of big data technology are illustrated in Figure 1.

Each of the four characteristics of big data has different meanings; see Table 1 for the explanation of these four characteristics (Óskarsdótti et al., 2019).

Every technological innovation in history will lead to the birth of revolution and the transformation of social structure, but they are all people-centered; making education more precise has also caused a series of technical operations and data security issues. However, in comparison, the possible changes brought about by new technology are far greater than the existing problems. As shown in Figure 2, it is the change brought by big data to the development of the world.

Experts and scholars delineate the essence of autonomous learning into two dimensions: a broad sense and a narrow sense. Broadly speaking, autonomous learning encompasses the deliberate and selective learning activities individuals undertake through various methods to foster their self-directed development. In its narrower interpretation, autonomous learning pertains to students engaging in

**Figure 1. The characteristics of big data technology**

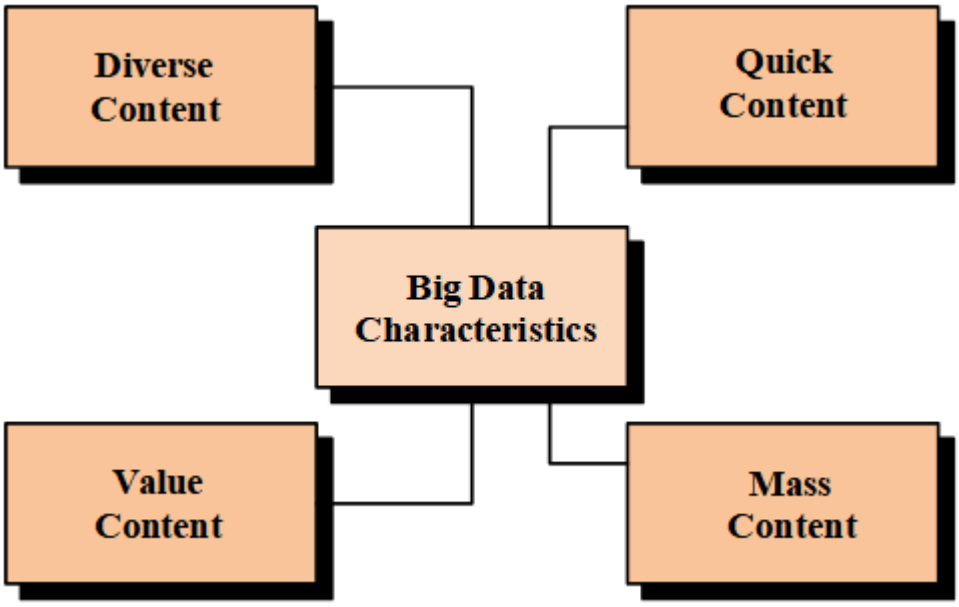
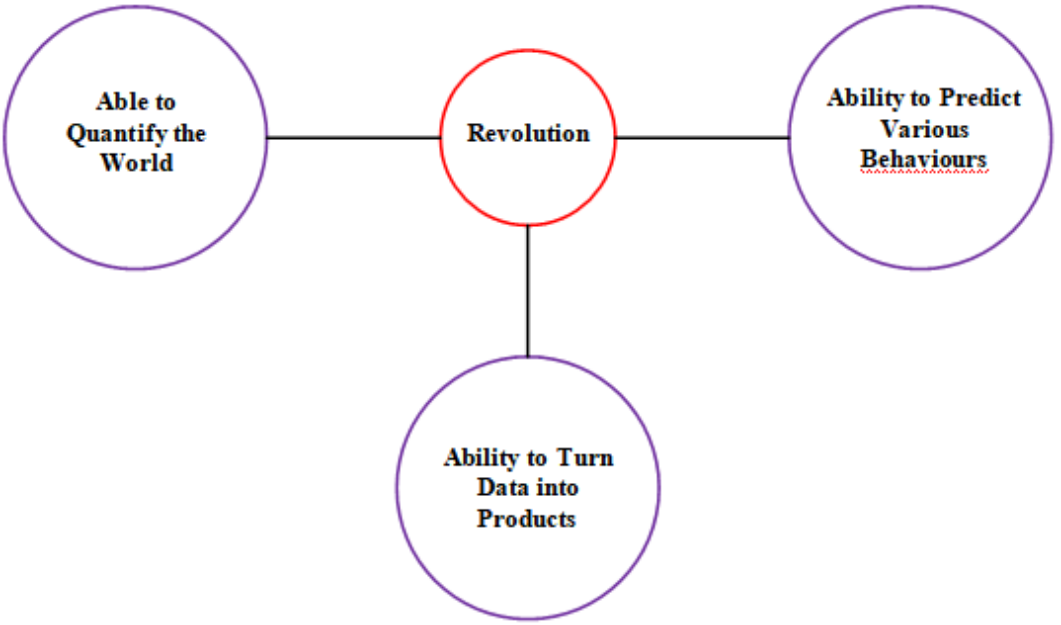


Figure 2. Changes in the era of big data




independent, proactive, creative, and selective learning endeavors under the guidance of educators (Aminatun & Oktaviani, 2019).

Throughout the process of autonomous learning, students can augment their capacity for self-monitoring, decision-making, and self-reflection, thereby enhancing their intrinsic motivation and self-efficacy. Students can accurately assess and evaluate their learning motivations (Khotimah et al., 2019). The distinct search capability of big data is depicted in Figure 3.

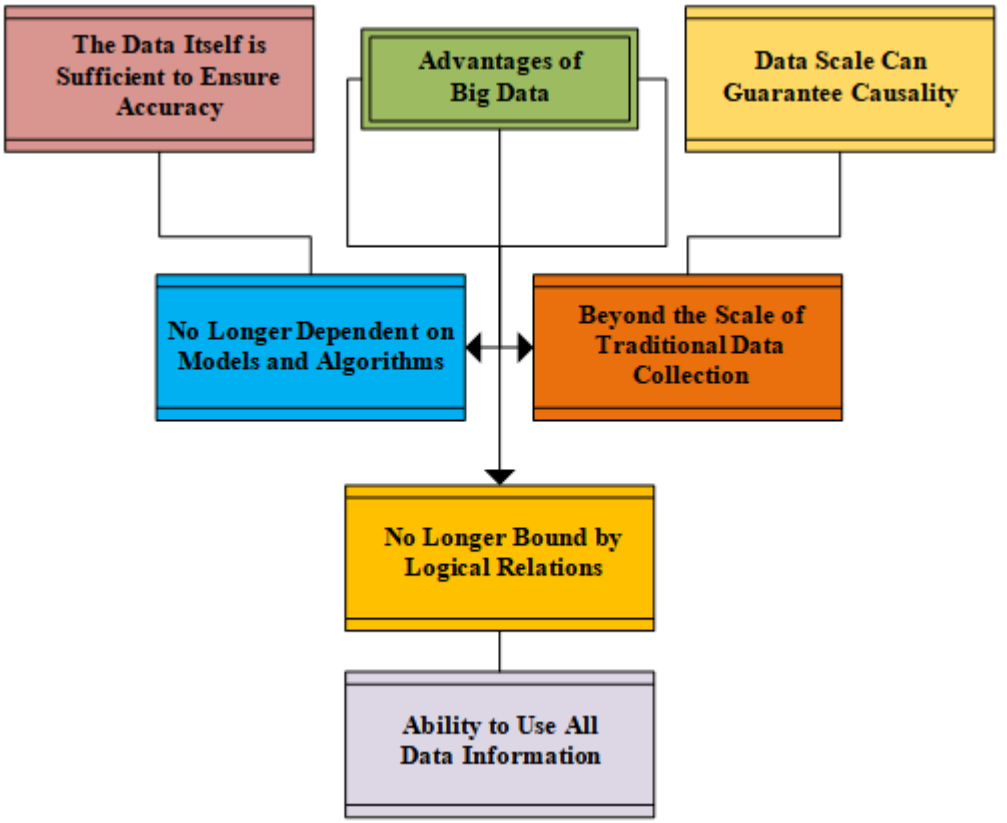
The various characteristics of online education are also reflected in online music education. Online music education no longer follows the traditional music teaching model and is not limited by time and space, making music learning more convenient. Online music education has established a platform for teachers and students to communicate with each other, making it easier for students to find groups with the same interests and hobbies that can resonate with each other, thereby promoting music exchanges between them.

## Music Teaching Strategies Using Network Technology

Technology has always been the driving force of social development, and the rise of any new technology has the potential to reconstruct the social structure. In terms of education, the Internet, as the link of current information dissemination, reconstructs the existing form of knowledge, thereby generating new knowledge. As knowledge changes more rapidly (Wu, 2020), the knowledge imparted to students by teachers in the process of teaching should never be limited to the accumulation of personal experience. Some test-oriented teaching methods are shown in Figure 4.

Under the influence of industrial civilization, music education in China deviates from the essence of education. The responsibility of real education must be to guide learners to become a complete person, with the purpose of developing human nature, cultivating personality, and improving life. At present, too much time is used to practice singing and performance skills, ignoring the connotation of music and the emotional expression of students (Serikbol et al., 2022). The difference between current online music teaching and traditional offline teaching is shown in Table 2.

Figure 3. The unique search feature of big data




Online music education is built on the foundation of online education. In the era of big data, smart teaching, smart musical instruments, and AI systems have been gradually improved and integrated into our daily life. Online music education is also accepted and recognized by people (Ng et al., 2022). The advantage of online music teaching is shown in Figure 5.

Figure 4. Test-oriented teaching mode

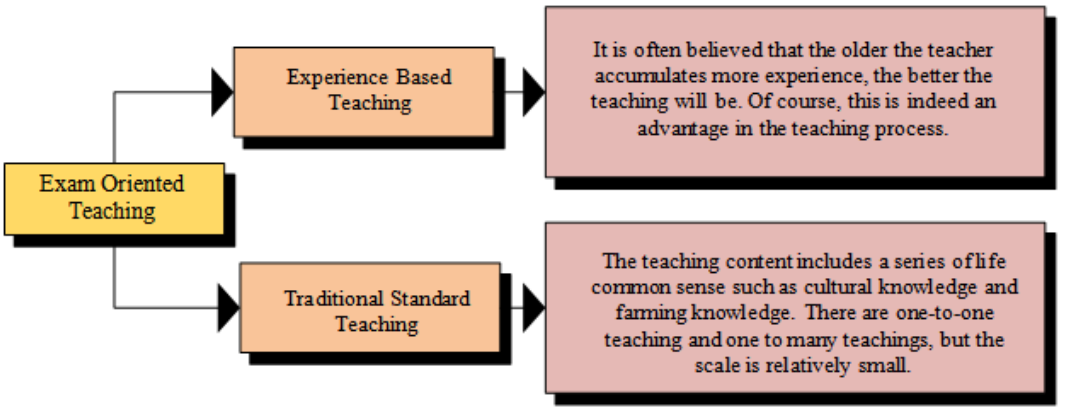
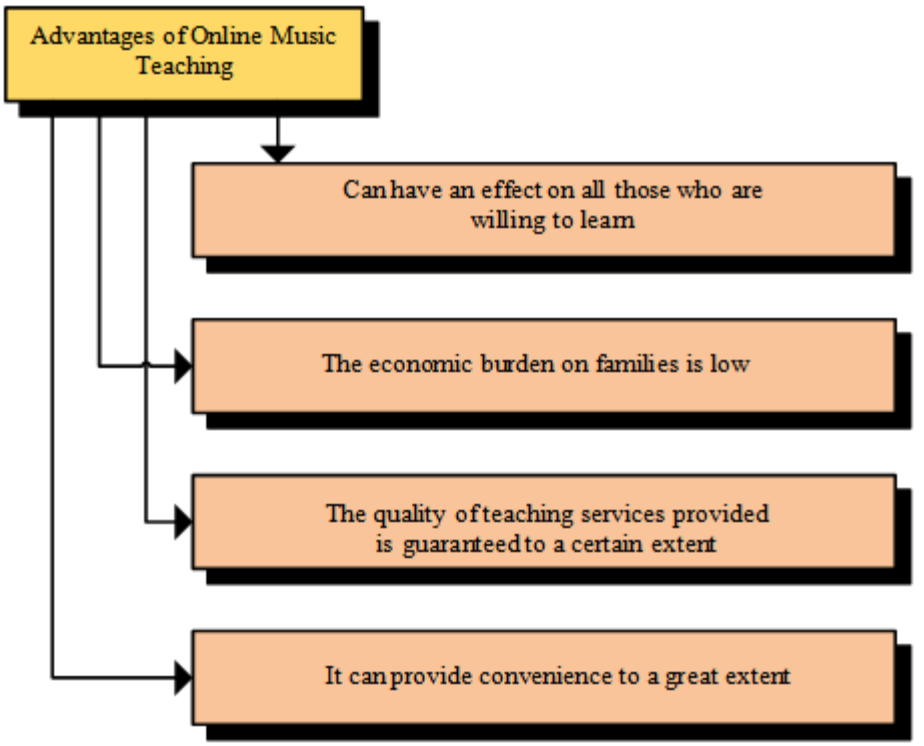


**Table 2. The difference between online teaching and traditional offline teaching**

| Teaching difference | Teaching methods | |
|---|---|---|
| | Online teaching | Offline teaching |
| Teaching platform | Mainly through online platforms, such as MOOC, Xuetong, DingTalk and other online course software | In a traditional classroom, live teaching in the form of one teacher and multiple students face-to-face |
| Teaching tools | Due to the use of online course software for teaching, the advantages of computers and multimedia can be brought into play, and music can be appreciated and evaluated at any time. | Generally, only teachers use live musical instruments or blackboards to display; students cannot choose and appreciate independently, but passively accept knowledge. |
| Teaching limitations | Online teaching is not limited by time and space. For example, offline teaching cannot be carried out during the epidemic. Online teaching can be learned as long as there is network coverage, and you can also watch the recording after the online class is over to achieve the effect of learning anytime, anywhere. | Teachers and students can only conduct teaching by agreeing on a time and place in advance. The space will be affected by various objective factors. Time must also ensure that everyone can have free time. If any element cannot be achieved, teaching cannot be carried out. |
| Students' interest | The content of online teaching is more abundant, learning is more fun, the students' interest in learning is more easily stimulated, and the self-learning efficiency is higher. | In traditional teaching, students passively accept knowledge, have no choice, and cannot guarantee attention, so their learning efficiency is poor |

Online music education, a product of the Internet, introduces a broad and innovative method

**Figure 5. The advantage of online music teaching**



of learning via the web, offering convenient avenues and diverse learning opportunities for knowledge-hungry individuals (Saidova, 2022). With access to a computer or any Internet-enabled mobile device, learners can engage in music education at any time, anywhere they can connect to the Internet.

As a result, research into online music education is becoming increasingly prevalent. This approach disrupts the traditional model of music education, which typically relies on face-to-face interaction between students and teachers. Instead, online music education allows students to access learning platforms and applications at their convenience, facilitating interaction with peers. This approach holds particular significance for students unable to access in-person classes with experienced teachers, providing them with a wealth of learning resources.

## Factors of Vocal Evaluation in Online Teaching

The song structure of vocal music is used to describe the paragraph structure of a piece of music. Different ballad samples can be arranged and combined to obtain the structural relationship of the whole piece of music according to specific rules. At present, many types of ballads have diversified development methods. It is difficult to compare the number of compositions according to the current one-segment, two-segment, and three-segment styles, and the structure of single-voice or multi-voice can be better displayed (Ting, 2021). The teaching structure of online vocal music creation is shown in Figure 6.

Online music education offers significant savings in both time and money. Many schools face challenges in hiring exceptional music teachers for on-site instruction due to constraints such as geography and scheduling, which can be more arduous and costly. Online platforms effectively address these obstacles, reducing learning expenses while enhancing efficiency.

In music theory, the difference in pitch between two notes or scales is termed an interval, with an octave comprising twelve semitones (Gómez-Cañón et al., 2021). Assigning values to the notes (C, D, E, F, G, A, B) as (0, 2, 4, 5, 7, 9, 11) respectively, the calculation of intervals is demonstrated in Equation (1):

$$Interval = Firstnote - Nextmote + 12*(Firstup - Nextup) \tag{1}$$

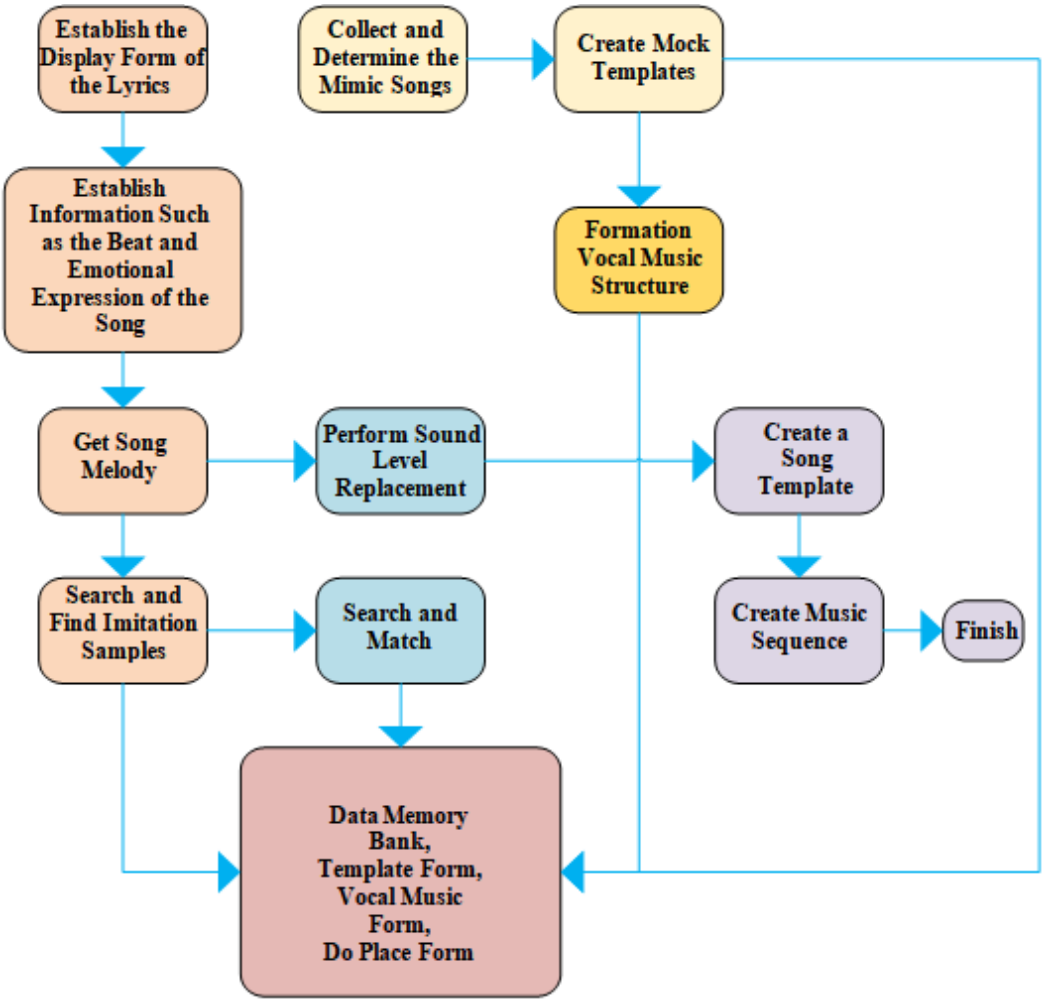
In Equation (1), *Firstnote* and *Nextmote* represent the values from 1 to 12 corresponding to the previous note and the next note. *Firstup* and *Nextup* refer to the sharps and flats of the preceding and following notes, and 12 means 12 semitones. According to different clefs, sharps and flats, the ordinate of the Do note is calculated [23], which is called the "Do Place" value. Assuming that there is a high note P in a ballad in the key of X, (r, j) is used to represent the pitch level of the entire note, the calculation is shown in Equation (2):

$$7r + j = 1 + DoPlace - P \tag{2}$$

Following this, the corresponding pitch value for the tonic note can be determined by considering the number of clefs, sharps, and flats in the given musical piece. Subsequently, the position of the last non-rest note in the song is identified using a reverse method, and its ordinate value is noted as the Last Note. Utilizing the aforementioned equation, the pitch value of the primary note, denoted as Main Note (Jacoby et al., 2019), can be computed, as depicted in Equation (3):

$$MainNote = (-1)*(LastNote - DoPlace) + 1 \tag{3}$$

Figure 6. The teaching structure of vocal music creation




The actual effect of knowledge and content in the teaching time period is determined by future knowledge in the actual situation, and this teaching method is defined and explained. From the gap between the teaching objects of teaching knowledge, teaching knowledge can be divided into two types.

The value of network knowledge:

$$V_t = \sum_{t=1}^{n} \frac{FCFF_t}{(1+WACC)^t} \tag{4}$$

The value of offline teaching knowledge:

$$V_t = \sum_{t=1}^{n} \frac{FCFF_t}{(1+K_c)^t} \tag{5}$$

In the above equation, $V_t$ is the value, FCF is the knowledge and content of free teaching, WACC is the weighted average loss, $K_C$ is the cost, F is the actual effect of the students in the process of teaching, and t is the time. These two represent different ways of knowledge processing.

The cost is generated during the teaching process, that is, the weighted average loss, the calculation is shown in Equation (6):

$$WACC = K_b \times \frac{B}{V} \times (1\text{-}T) + K_s \times \frac{S}{V} \tag{6}$$

In the above equation, $K_s$ is the pre-class knowledge, $K_b$ is the after-class knowledge, S is the effect of course, B is the teaching time, and V is the total knowledge of the course.

Through the research results of related concepts proposed in the West, the accuracy and generality have been improved. In the 1970s, a B-S model was proposed. The basis of the concept is the value of teaching content. After optimization, this model is applied in practice. The teaching value of practical work, the methods, and principles are explained.

In the evaluation process, the widely used B-S model belongs to a binary tree model, and its calculation model is shown in Equation (7):

$$C_0 = S_0\left[N\left(d_1\right)\right] \text{-} X e^{-r_s t}\left[N\left(d_2\right)\right] \tag{7}$$

Its calculation model is also shown in Equation (8):

$$C_0 = S_0\left[N\left(d_1\right)\right] - PV\left(X\right)\left[N\left(d_2\right)\right] \tag{8}$$

The calculation of $d_1$ is shown in Equation (9):

$$d_1 = \frac{\ln\left(S_0 \div X\right) + \left[r_c + \left(\sigma^2 \div 2\right)\right] t}{\sigma \sqrt{t}} \tag{9}$$

It can be expressed as shown in Equation (10):

$$d_1 = \frac{\ln\left[\frac{S_0}{PV(X)}\right]}{\sigma \sqrt{t}} + \frac{\sigma \sqrt{t}}{2} \tag{10}$$

The calculation of $d_2$ is shown in Equation (11)

$$d_2 = d_1 \text{-} \sigma \sqrt{t} \tag{11}$$

In the above equations, $C_0$ means the actual knowledge point of teaching, $S_0$ refers to the level of knowledge mastered by students, and $N\left(d_1\right)$ indicates the dispersion of the normal distribution less than d. X denotes the student's grade, $r_c$ shows the point of continuous knowledge imparting, t indicates the teaching time, and $\sigma^2$ is the variance of the achievement rate of knowledge.

## Questionnaire Design for the Effect of Online Vocal Music Teaching

Technology-assisted teaching can provide students with more diverse learning resources and improve learning outcomes and experiences through various technological means such as video instruction, audio demonstrations, interactive software, and more. In an online vocal wisdom classroom, big data analysis can be utilized to understand students' learning behaviors and performance,

**Table 3. The design of the questionnaire**

| **Basic Information** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Grade** | | **Gender** | | | | | |
| **Specific major** | | | | | | | |
| **Question No.** | **Content** | | **Options:A very agreeB agreesC neutralD disagreeE against very much** | | | | |
| 1 | When you use the online teaching platform, you feel very satisfied with the effect | | A | B | C | D | E |
| 2 | The online teaching platform is of great help to your music teaching effect | | A | B | C | D | E |
| 3 | Online teaching is better than offline teaching | | A | B | C | D | E |
| 4 | The online teaching platform will use big data to summarize and serve your learning effect | | A | B | C | D | E |
| 5 | Online teaching can timely feedback your doubts and replies | | A | B | C | D | E |
| 6 | The online teaching platform is highly interactive | | A | B | C | D | E |
| 7 | The learning resources of the online teaching platform are very diverse | | A | B | C | D | E |
| 8 | You can use the online teaching platform to get a good learning effect | | A | B | C | D | E |

offering more precise feedback and personalized guidance for teaching. Additionally, AI technology can be employed to develop an intelligent learning system that tailors learning paths and content based on students' learning needs and progress.

Furthermore, technology-assisted teaching expands students' learning space and time, enabling them to learn anytime, anywhere and engage in communication and collaboration with students and teachers globally. This teaching approach not only enhances students' learning outcomes but also fosters their creativity and collaborative spirit, contributing to the development of their competitiveness and innovation capabilities in the future field of music.

The development of educational principles serves as the foundation and guiding principle for implementing educational practices. Despite the widespread embrace of technological advancements, immediate shifts in concepts, perceptions, and behaviors pose challenges. Therefore, a questionnaire has been devised to assess students' experiences in online vocal music classrooms and to evaluate the learning outcomes, thereby leveraging big data to gauge the teaching efficacy of these virtual learning environments. Table 3 presents the questionnaire content.

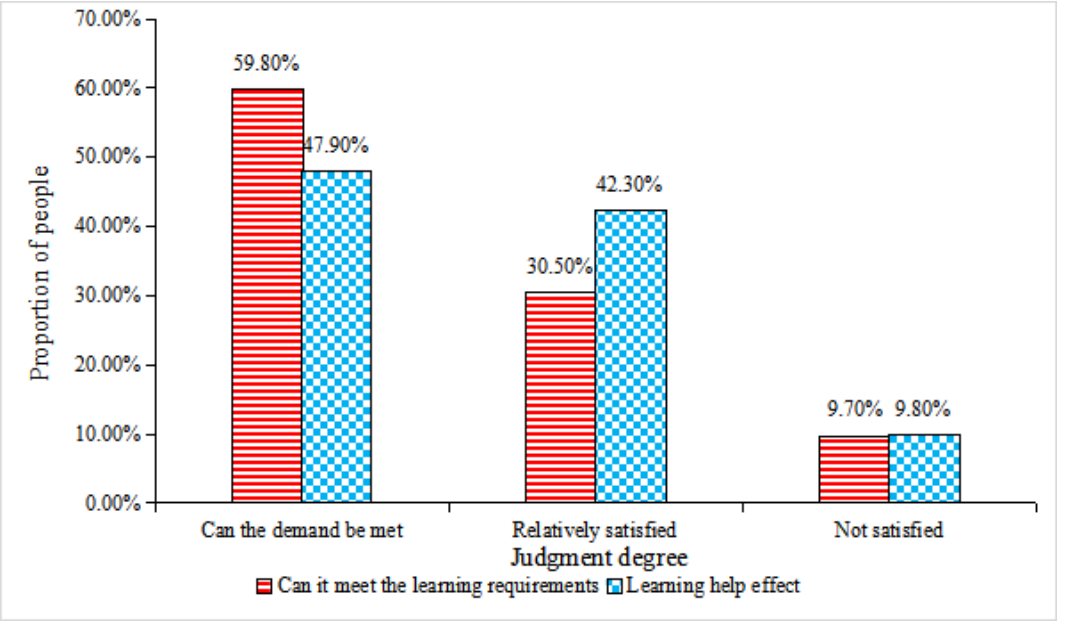
Generally, the so-called reliability is the alpha coefficient. This indicator is actually a test of the internal consistency of the questions used in the questionnaire, that is, a test of internal correlation. The higher the correlation, the better the reliability (Lee et al., 2020). Through SPSS software calculation, the alpha coefficient of the questionnaire is 0.8, indicating that the reliability is good, and it can be used. A total of 80 questionnaires were distributed to a music academy, and 68 questionnaires were returned after a period of one week, of which 62 were valid questionnaires. The questionnaire results were counted and analyzed.

## RESULTS AND DISCUSSION

### Analysis of the Results of the Questionnaire

This section will analyze the results of some questions in the questionnaire, and the analysis items include: “whether the online vocal music platform can meet the learning requirements,” “the

**Figure 7. The teaching effect of the online music platform**




*Note.Figure 7(a) presents the results for whether the online platform meets learning requirements and for learning effect. Figure 7(b) presents the results for questions and services and for the platform interactivity.*

learning effect of the online vocal music platform on students," "online teaching platform will answer and serve students' doubts," and "interactivity of online vocal music platform." By drawing them into statistical graphs and analyzing the results, the drawn result data is shown in Figure 7.

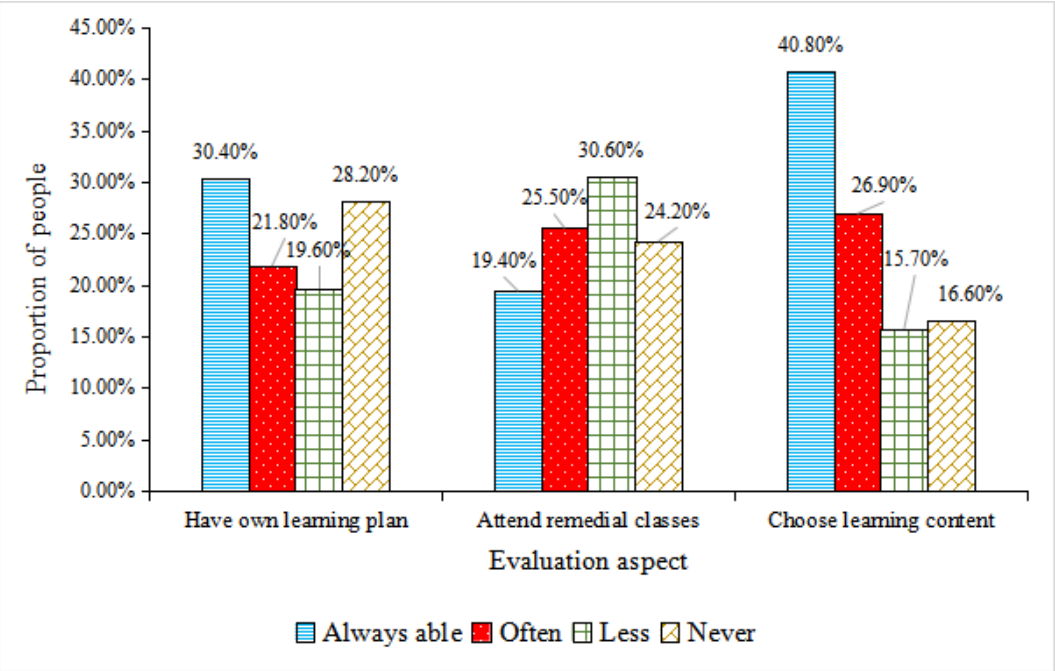
Figure 7 indicates that, regarding the online vocal music platform's ability to meet learning requirements, 59.8% of students find it satisfactory, 30.5% believe it meets requirements adequately, and only 9.7% feel it falls short. Concerning its impact on learning, 47.9% of students find it helpful, 42.3% somewhat helpful, with only 9.8% finding it unhelpful. Regarding the platform's ability to address issues, 40.9% of students believe it offers effective solutions, 38.23% find it somewhat effective, and 20.87% feel it lacks effectiveness. Lastly, regarding interactivity, 51.3% and 42.81% of students, respectively, find the platform's interactivity satisfactory, with only 5.89% perceiving it as lacking. Overall, the big data-driven online vocal music teaching platform appears to provide valuable learning assistance and responsive support, although there are noted deficiencies in its reply function.

## Analysis of the Effect of Students' Autonomous Learning

In the previous section, we conducted data analysis on the impact of the online vocal music teaching platform using the questionnaire. The findings revealed that the platform, empowered by big data, significantly enhances learning outcomes and provides robust interactive question-answering services. Therefore, in this section, we aim to evaluate students' autonomous learning abilities following their utilization of the online vocal music teaching platform. The analysis encompasses three dimensions: "presence of a personalized learning plan," "engagement in supplementary coaching sessions," and "selection of learning materials." The results are illustrated through statistical charts, as depicted in Figure 8.

Figure 8 denotes that in terms of self-learning planning, 30.40% and 21.8% of students have their own plans, while 19.6% and 28.2% of students hardly plan their own learning plans. A total of

**Figure 8. Results of students' autonomous learning ability**




19.4% and 25.5% of students will often participate in extracurricular cram school, and 30.6% and 24.2% of students will hardly participate in cram school. This phenomenon shows that the main online classes can enable students to master most of the knowledge. Therefore, the frequency of participating in extracurricular cram school will be greatly reduced. Finally, in terms of independent choice of learning content, 40.8% and 26.9% of students have the ability to choose independently, and 15.7% and 16.6% of students cannot choose independently. The vocal music teaching platform has a certain improvement effect and exercise effect on students' autonomous learning ability, which further proves the good effect of the teaching platform. The above experiments involve the statistical analysis of questionnaire results, with each experiment repeated twice, and the results are consistent with the previous ones.

Sixty-two students were sampled for technology-assisted teaching in the online vocal wisdom classroom, and their satisfaction with the course was assessed using a five-point scale ranging from 1 to 5. It is assumed that there is a mean satisfaction score of 3.5 and a standard deviation of 0.8 for the sample. The objective was to determine whether enough evidence suggests that students' satisfaction with the course is higher than the average level (3 points) and demonstrate the statistical significance of the results. Table 4 provides the outcome.

Students were asked to measure their satisfaction with the online teaching platform by assessing their level of understanding of course content, their ability to apply their knowledge, and feedback on their teaching methods. They needed to consider whether the online instruction provides sufficient resources and support to help them progress in their music learning. Also, they assessed whether the online teaching platform provides them with easy access to materials and instruction and whether it offers a personalized learning experience. They also compared the differences between online and traditional offline instruction in terms of flexibility, interactivity with teachers and classmates, and ease of access to feedback and support. In addition, students assessed whether the online teaching platform applies big data to analyze learning data in order to provide personalized learning advice and services and considered whether the timeliness and interactivity of feedback, as well as the

**Table 4. Test results**

| Test indicators | Value |
|---|---|
| Sample Mean | 3.7 |
| Sample Standard Deviation | 0.8 |
| Sample Size | 62 |
| Significance Level α | 0.05 |
| t-statistic | 2.68 |
| t-critical value | 1.699 |
| p-value | 0.008 |

diversity of learning resources, met their learning needs. Ultimately, students evaluated their own learning outcomes on the online teaching platform, including whether they feel that they have made progress in their learning, whether they are able to apply what they have learned, and whether they are satisfied with their learning outcomes.

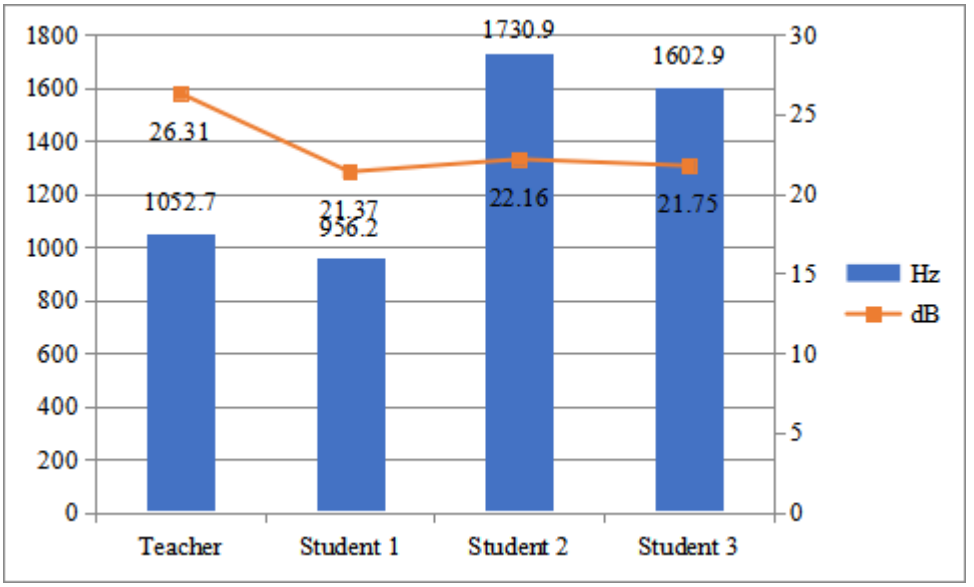
In conclusion, the t-statistic (2.68) is greater than the t-critical value (1.699), indicating statistical significance in the results. Additionally, the p-value (0.008) is less than the significance level (0.05), further supporting the statistical significance of the results.

Finally, testing was conducted on the assisted teaching mode of online vocal classroom, which combines big data technology with AI. Vocal teachers input their demonstration audio using the same method, creating level-effect graphs and comparing them with students' vocal images. Using CUBASE software allows for a visual representation of the differences in sound waveforms. Moreover, it enables continuous playback of both teacher and student audio, creating a dual-track comparative format for both auditory and visual analysis. This enables students to quickly understand the teacher's requirements and identify issues in their own voice. Subsequently, under the teacher's guidance, students coordinate and adjust their body skills to find the correct sound, engaging in repetitive comparisons and thoughtful reflection. The optimal teaching effect can be achieved only by mobilizing students' subjective initiative. Figure 9 depicts the test results.

The results of the sound wave test reveal that students exhibit some issues in terms of sound quality, pitch, and rhythm. Regarding sound quality, some students have poor clarity, displaying characteristics of blurriness or noise, which may affect auditory experience and learning effectiveness. In terms of pitch, some students show instability in pitch, particularly in the high-frequency range, indicating a need for enhanced practice and training. Additionally, the sound wave test also highlights deviations in rhythm control among certain students, manifested as insufficient stability in rhythm or lack of coordination with the accompaniment.

The reflections from the sound wave test results indicate some potential issues and challenges in students' vocal skills. First, sound quality issues may be related to students' vocal modulation and vocalization techniques, requiring improvement through vocal training and guidance. Moreover, pitch and rhythm issues may be linked to students' foundational training and musical perception abilities, necessitating reinforcement in basic exercises and theoretical learning. Furthermore, the analysis of sound wave test results, combined with big data technology and AI, can further explore students' learning behaviors and performances, providing more precise guidance and support for personalized teaching. For example, based on the sound wave test results, instructional content and training plans can be specifically tailored, offering personalized coaching and feedback to facilitate comprehensive enhancement of their vocal skills.

**Figure 9. Sound wave test comparison**




## CONCLUSIONS

Innovative network technologies such as big data and AI have been gradually integrated with our daily life. All walks of life have begun to study ways to combine and expand their own work with network technology, and pedagogy is no exception. From the perspective of the teaching development of China's music industry, the idea of vocal music teaching mode, in the current rapid development of network technology, if the new technology that innovates the teaching methods of students wants to be fully utilized. This is also the task of innovative teaching work currently required by China. Therefore, from the aspects of big data and AI, to explore the combination of big data technology and vocal music teaching work. Combined with the relevant knowledge of vocal music and the calculation method of teaching, a vocal music online teaching platform supported by big data is proposed by expounding the relevant characteristics of big data technology and based on the relevant requirements for online vocal music courses in the Internet age, as well as the evaluation standards for vocal music classrooms. A questionnaire was designed to investigate the learning effect of students. Analysis of the results indicates that the online vocal music platform has rich interactivity and provides students with relatively complete teaching services and question answering services. After learning through this platform, students' autonomous learning ability has also been greatly improved, providing design ideas for the online vocal music smart classroom. However, due to the small number of respondents in the questionnaire, the results have certain particularities, so the number of surveys will be expanded in the follow-up research to obtain more general results.

## DATA AVAILABILITY

The figures and tables used to support the findings of this study are included in the article.

## CONFLICTS OF INTEREST

The author declares that there are no conflicts of interest.

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