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# Music Education and Modern Software: How Using Digital Audio Workstation (DAW) Software Influences Teaching Academic Singing?

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## ABSTRACT

This study explores how well DAW software works for students' 'Academic Singing' training in raising their motivation and academic performance. The practical portion included a case study based on the BandLab DAW system, including its educational analysis. A five-month experiment was conducted with 150 s-year [Harbin Normal University] Conservatory students in the 'Academic Singing' discipline to assess the usage of BandLab. Twenty instructors of the Music Performance Basics course were further interviewed. The collected data were analysed and structured using the key trend measurement method. It was discovered that no DAW technology was previously used as part of the 'Academic Singing' discipline. Additionally, 52% of students began using BandLab for extra practice 2–3 times per week. Every day, 25% of students participated in the programme. Teachers reported an increase in interest from 84% of students. The findings can be used to examine the use of DAW technology in participatory disciplines.

## 1 | Introduction

In today's society, the practical application of digital technologies for entertainment and educational purposes is critical (Abdallah and Farhan 2023). For decades, researchers have attempted to categorise modernised digital developments, determine their impact on the educational process, describe the functions of new digital applications and programmes, and establish boundaries for their potential use in academic settings (Zhang and Yu 2021). Hence, the study of digital music technologies and the analysis of the potential pedagogical implications of their use by the younger generation receive special attention.

The use of digital music applications and technologies linked to the global network of Internet technologies has facilitated the rapid spread of modern teaching methods in various parts of the world: interactive online music education has been used successfully in the United States, Europe, Latin America, and Asian countries (Grajewski and Hamrol 2023). However, the difficulty for educators in the current educational process is determining the best position to foresee the vector of digital technologies and successfully implement them—and, most importantly, timely—into the framework of their teaching practices (Gouzouasis and Bakan 2011).

Since the advent of formal schooling, vocal, particularly academic singing, has been a fundamental discipline and an integral component of music education (Fernández et al. 2023). Academic singing, often associated with classical or operatic traditions, differs from ordinary singing in several key aspects. First of all, academic singing emphasises rigorous vocal techniques, such as breath control, resonance, and precise

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articulation, to achieve a powerful, clear, and sustainable sound. Singers in this discipline are trained to project their voices without amplification, often in large venues like opera houses. Then, the repertoire for academic singing includes classical music, opera, lieder (art songs), and other complex and technically demanding compositions (Sielska-Badurek et al. 2018). This contrasts with ordinary singing, which may focus on popular music, folk songs, or contemporary genres. Finally, in academic singing, there is a strong emphasis on the interpretation of the music and the text, requiring a deep understanding of the historical context, composer's intentions, and the emotional content of the piece. Ordinary singing might prioritise personal expression or the style of a particular music genre over strict adherence to traditional interpretation (Cox 2021).

Between the 4th and 3rd centuries B.C., the famous philosophers Socrates, Plato, and Aristotle were the first formal educators in the West to think that aesthetics was an essential part of education. Thus, music theory and vocal training were held in high regard in most ancient Greek cities alongside oratory, arithmetic, and the study of the military arts (Gudmundsdottir, Beynon, and Ludke 2020).

Modern educational programmes are primarily student-centred and created to address societal needs. It is much easier to study music disciplines without the use of computer technology and digital auxiliary equipment. Liu and Shao (2024) found that seminars in music disciplines using modern computer technology have many advantages over traditional workshops. These advantages include the following:

- Multiple sensory organs are involved at once;
- Improving how quickly new information is remembered;
- Cognitive thinking development;
- Stimulation of creative activity;
- Improving students' abilities to work independently with theoretical material;
- Increased interest in the discipline studied.

Numerous surveys and questionnaires administered to Chinese students reveal the state of music education globally and highlight that the three main questions on the minds of the next generation of musicians are ‘How can I learn?’, ‘How can I learn the material easily?’ and ‘How can I build enduring knowledge and skills?’ (Nart 2016). The introduction of contemporary information and communication technologies (ICTs) as a crucial educational tool in schools and institutions of higher learning, and their skilful use for efficient delivery in the learning process, addresses numerous inquiries of this nature.

In recent times, universities and academies have adopted digital audio workstations to process and record musical compositions in music instruction. This has a positive effect on the artistic comprehension and musical competence development of students. In addition, interactive systems process more information than traditional teaching methods, which improves learning content (Martín-Lucas and García del Dujo 2023; Shi and Ning 2022).

Despite marked educational advancements due to DAW technology, the question of how the interactive and educational systems work together is still open. Contemporary digital technology tools emerge with a high frequency, and educators may not always possess adequate time to optimise their implementation. For example, the vast majority of colleges and universities in China have started using new media for music education due to the country's ongoing educational reform. This has caused a gradual improvement in learning outcomes, and consequently, the music curriculum has undergone extensive transformation (Zhang and Yi 2021).

Simultaneously, there is an issue with how computer technology information is distributed within various disciplines and music streams (Forrester 2018). First, colleges and universities frequently struggle to fund modern media technologies and music resources while meeting curricular reform requirements (Millican and Forrester 2018). Hence, students do not have enough freedom to explore high-impact music (Anderson and Northcote 2018). Second, universities are moving too slowly to adopt new technologies. DAW systems, for example, are primarily used for learning musical instruments and the fundamentals of composition, while other musical areas are underserved (Carey et al. 2018). This study discusses the feasibility of using DAW systems in ‘Academic Singing’ lessons because they are currently not widely used in music colleges and other higher education institutions in China.

### 1.1 | Literature Review

The computer is seen as the core for introducing integrated text, graphics, images, sound, animation, video, and other information in multimedia technology, allowing complex interconnections to express complex and rich ideas (Rivas et al. 2021). Thus, applying digital technology provides students with an ideal contemporary learning tool (Peng 2021). Music learning and teaching are no exception, and digital technology may have influenced them as much, if not more, than other aspects of life. Digital technologies profoundly impact music education and learning, affecting how people create, listen to, share, consume, and interact with music and how they conceptualise musical practices and experiences (Liu 2021). This has sparked a variety of perspectives on what constitutes and should constitute music study and teaching in music education, given the way this discipline is traditionally seen (Ruthmann and Mantie 2017).

The purpose of music education, including singing, goes far beyond teaching performance skills, according to American philosophers (Strachan 2017). The aesthetic and ethical principles that guide music education go hand in hand. Teachers not only impart musical knowledge to students but also provide opportunities for them to practise what many philosophers throughout human history have deemed to be the highest ideals: the pursuit of virtue, being, prosperity, self-realisation, and creativity happiness for the good of oneself and others (Gudmundsdottir, Beynon, and Ludke 2020).



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When the voice is viewed as a musical instrument, it is appropriate to address the mastery of singing, especially academic singing, as a type of complex skill acquisition (Ma and Ma 2023). A singer must learn how to master this instrument well enough to sing the right pitch at the right time to the beat of other singers or instrumental music (Rivas et al. 2021). To learn to sing, people must first hear their voice and dynamically tune it in response to external vocal sounds. However, as evidenced by research by British theorists, social principles like social learning and the acquisition of complex skills also play a role in the technical aspects of singing skill acquisition (Tang 2022). The social environment is a personal factor that affects education quality. The quality can be improved in the modern world by utilising digital technology.

Viewed through the prism of multitrack sessions, the function of the DAW system's sound engineer application in music education settings is simpler to comprehend. Multitrack sessions are typically managed using digital audio workstations (DAWs) like Pro Tools, Logic Pro, or Ableton Live. Each track in a multitrack session can be individually controlled for volume, panning, effects, and other parameters, allowing for greater flexibility and creativity in the final mix. For instance, in music production, different instruments and vocals are recorded on separate tracks, which can then be mixed together to create the final song (Rivas et al. 2021). Thus, instructors can use these apps to give students practice in mixing or re-mixing, voice editing, vocal tuning, and drum amplification. The software also allows users to practise music production skills, such as recording individual voices or instruments for karaoke-style projects (McPherson, Miksza, and Evans 2017).

DAW technology is used in contemporary music education because such programmes do not require the engineer, producer, or songwriter to be in a highly specialised location (recording studio). The following equipment is all that is necessary to operate a DAW, even one from a premium manufacturer: a keyboard, headphones, microphone, computer or tablet with MIDI input, and the presence of installed software. This significantly alters the long-held belief that only those with narrowly focused knowledge and skills can participate in music production and recording (Walzer 2020).

The educators preparing the next generation of content creators must acknowledge that the space and location for music and sound creation have shifted. Chinese academics argue that DAWs eliminate the skill gap between amateurs and professionals, granting creatives the freedom of action formerly restricted to recording studios staffed by skilled technicians (Millican and Forrester 2018).

### 1.2 | Problem Statement

DAW technology is primarily used in music education for composition and instrumentation classes. However, digital technologies have largely ignored academic singing, although it is one of the most basic musical disciplines. This study aims to investigate how well DAW software works in teaching academic singing.

This purpose is achieved by answering the following questions:

> Q1: What is the personal attitude of the student to the DAW usage in 'Academic singing' lessons?

> Q2: How DAW software affects student performance and engagement?

> Q3: What is pedagogical point of view on the DAW software used in 'Academic Singing' lessons?

## 2 | Methods and Materials

### 2.1 | Research Design

The theoretical portion of the study was built on the comparative-historical method of data processing, which offers a comparative analysis of the key trends in the use of digital technology, particularly DAW software, applying to various countries worldwide. In addition, DAW use in Academic Singing studies was maximally updated in light of contemporary music education reform. The practical portion of the study involved using individual survey and interview methods to collect data from the control and experimental groups and the key trend measuring method (Sarmento and Costa 2019) to analyse and structure the data obtained. The survey included ten questions about the discipline's use of the BandLab DAW system. It required a yes or no answer to each of the ten questions.

BandLab DAW system is a digital platform for music creation (Figure 1). The platform is designed with ease of use in mind, so newcomers to music production can easily learn how to create projects. It combines a DAW (digital audio workstation) suite with cloud storage and a collaborative community (Figure 1).

Tools include a MIDI editor, an arsenal of pre-built chords and virtual instruments, AudioStretch transcription capabilities, and a beat maker that includes sample packs with 24 cycles. In 2022, BandLab launched a hardware division—BandLab Machines—the first device was an embedded interface for smartphones. Therefore, the program is convenient in usage both on Android and Windows software. The instrument has a jack/XLR input, a 3.5 mm headphone output and a 3.5 mm TRRS speaker output and comes with a shielded TRRS cable. The built-in 350 mAh battery lasts for 8 h without recharging via USB charging. Link digital and Link digital duo are equipped with 48 V phantom power for microphones + simultaneous two-channel recording (Figure 2).

According to the post-experiment experience, twenty teachers instructing students in the Music Performance Basics programme were also given an additional questionnaire. The questionnaire had open-ended questions, requiring a detailed answer (Figure 3).

### 2.2 | Sample

The study's primary data source was the [BLINDED] Conservatory, China's higher music education institution headquartered in [BLINDED]. This Conservatory and [BLINDED] Conservatory are considered a solid educational foundation for



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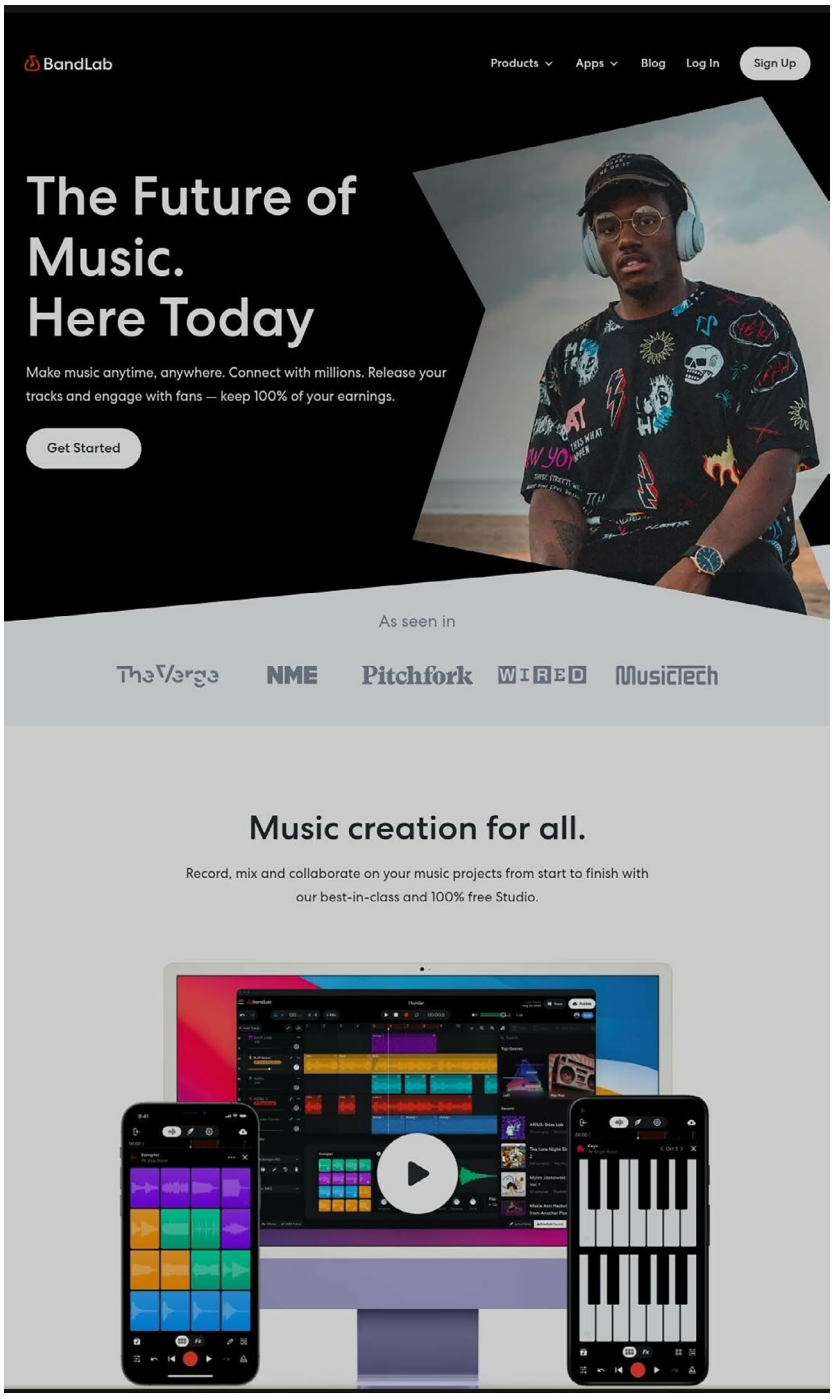



**FIGURE 1** | Interface of BandLab DAW system. *Source:* Developed by the author.

studying traditional Chinese music. For this reason, 'Academic Singing' training at the [BLINDED] Conservatory has been chosen as the subject. In addition, the Musical Performance Basics program is followed when teaching respondents.

As part of the experiment, 300 s-year students from the [BLINDED] Conservatory were selected for the Musical Performance Basics program. The choice was made because the second-year curriculum included the 'Academic Singing' discipline. The students were divided into two groups of 150 people each: control and experimental. To ensure the validity of the results, students were randomly assigned to the control and experimental groups. This random assignment was used to reduce selection bias and ensure that each group was comparable in terms of demographics and baseline abilities.

Notably, the sample consisted of both males and females between the ages of 19 and 21. Males and females comprised 24.7% and 25.3% of the control group, and 22% and 28% of the experimental group (Table 1). The training lasted 5 months, from September 2022 to January 2023. Convenience sampling was utilised due to the accessibility of the student population at the Conservatory, and all participants provided informed consent before the study began. Recruitment was conducted through class announcements and



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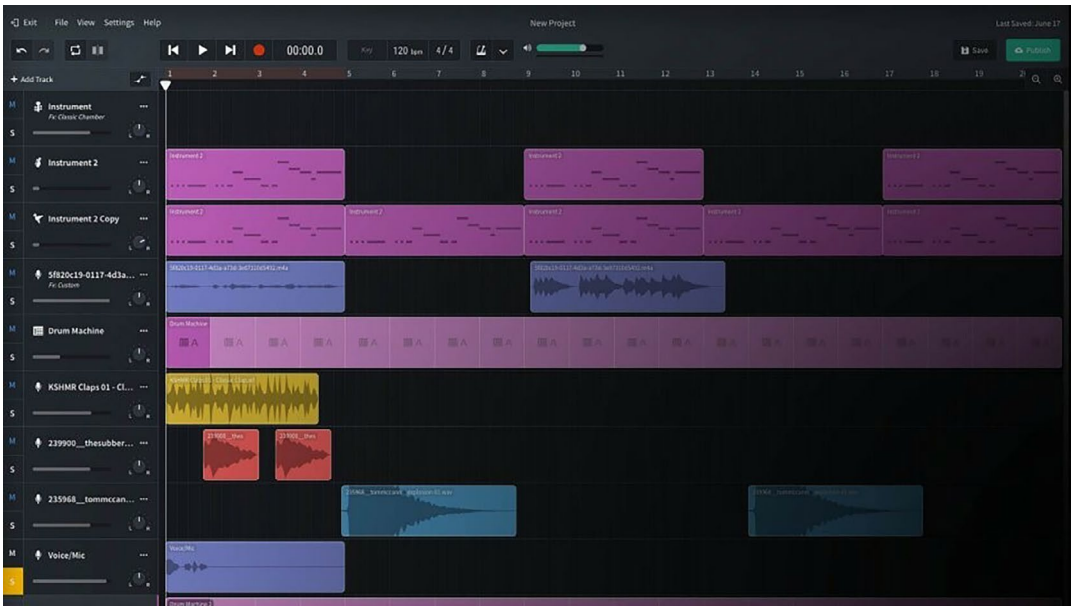



**FIGURE 2** | BandLab mastering process. *Source:* Developed by the author.

What digital technologies do you use in your teaching practice?
What digital technologies do you think are the most important for regular usage?
Have you used DAW technologies in your teaching practice before?
What was your experience?
Was it difficult for you to conduct the experiment with BandLab usage?
How do you think this program influences the academic skills of the students?
Can BandLab program help to change the musical environment of the students?
What were the main results of the experiment?
Are students more interested in your discipline now?
What are the main steps of musical reform in your country, as for your mind?

**FIGURE 3** | Teacher questionnaire. *Source:* Developed by the author.

**TABLE 1** | Respondent's age and gender.

| | Control group | Experimental group |
|---|---|---|
| Age | | |
| 19 | 16.6% ($n = 50$) | 15% ($n = 45$) |
| 20 | 9.3% ($n = 28$) | 15.7% ($n = 47$) |
| 21 | 24% ($n = 72$) | 19.4% ($n = 58$) |
| Gender | | |
| Male | 24.7% ($n = 74$) | 22% ($n = 66$) |
| Female | 25.3% ($n = 76$) | 28% ($n = 84$) |

*Source:* Developed by the author.

informational sessions, where the study's purpose and procedures were explained, and consent forms were distributed and signed.

## 2.3 | Data Analysis

The students were divided into control and experimental groups based on the type of training they received during the experiment. The control group continued to study 'Academic Singing' according to the curriculum. Their primary competencies included performing practical tasks involving pieces from the classical vocal repertoire, getting ready to learn vocal literature on their own, and bringing the idea of a musical work to life in their performances. In addition, the training included independent studies of the textbook Ragan K. A Systematic Approach to Voice: The Art of Studio Application, 2020, attending instrument (piano) classes and a recording class at the conservatoire once per week on a three-day schedule.

A combined teaching method was used with the experimental group. The students followed the same curriculum as their peers, except for an additional weekly BandLab recording session (Figure 4).

BandLab's advanced features make it possible for novice singers to hone their academic singing abilities. The singer can record their voice, combine it with other recordings, and then layer the results on top of one another. Users can also include pre- or post-sound effects (Figure 5). Beginning requires a computer (or tablet), headphones, microphone, and BandLab software.

Students can get more practice outside of school hours by installing a mobile version of the software on a tablet or phone. This also helps them improve their musical skills.



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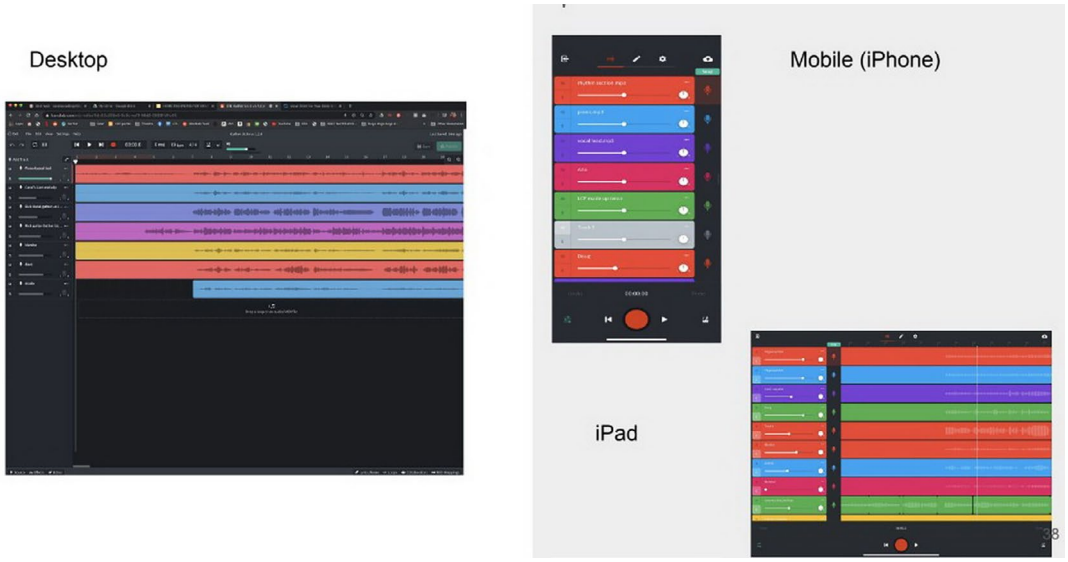



**FIGURE 4** | BandLab interface. *Source:* Developed by the author.

### 2.4 | Statistical Processing

IntroStat was used to analyse all of the survey responses from the students. Students were tested before and after the experiment using EdApp, an automatic knowledge checker. A sample of students can be selected, and the average grade for the control and experimental groups is automatically calculated using algorithms built into the program. The Statistics software determined the key trend in the responses from the teacher questionnaire.

### 2.5 | Ethical Issues

Before the experiment began, all participants (students and teachers) were fully informed of the study's details and stages. They were given written consent forms to allow them to process the survey data. All questionnaires and interviews were confidential (no personal information was collected). The only variables studied were general criteria like age, education, and gender.

### 2.6 | Limitations

The research was based on a single music conservatory. However, to get the most accurate results, the experiment should be done more than once at multiple colleges or universities in the same country or two different countries, like China and the United States.

## 3 | Results

### 3.1 | Students' Survey

The respondents were interviewed using the individual questionnaire method after five months of training on the new programme. The survey included ten questions about the discipline's use of the BandLab DAW system (Table 2). All ten questions in the survey could be answered yes or no.

Given the variety of topics examined, the study's success rate was high. Figure 6 shows, for example, a detailed analysis of the student's responses to the individual questionnaire administered to each student at the end of the 5-month experimental training.

More than 70% of those surveyed said they had previously used DAW technology in their university education. This supports the general modernisation thesis for music education by demonstrating positive growth dynamics. Meanwhile, educators in the 'Academic Singing' discipline did not use DAW software at all. This suggests that the standard method of instruction is still being used for many musical subjects. Thus, there is an uneven distribution of technologies, shaping state funding of educational institutions as a whole.

However, while the academic discipline did not previously involve using DAW software, the teacher frequently used other digital technologies (learning on online platforms and video hosting). A consensus was reached by 54% of the student population regarding this matter. According to statistics, 97% of students found this experiment interesting. Students' interest may wane over time; thus, this highlights the need for more technology and the latest pedagogical practices. This waning interest in education poses a risk to the efficiency of education in general and academic performance in particular.

Each student responded affirmatively when queried regarding their regular utilisation of the DAW software, BandLab. This shows that both the students and their teachers are interested in innovation, even though the teachers occasionally do not have the experience, motivation, or initiative to bring in new technologies. The intuitive and user-friendly interface of BandLab, as reported by 95% of students, allowed them to easily practise their academic singing skills in the classroom and outside of school hours. More than half of the students practised once



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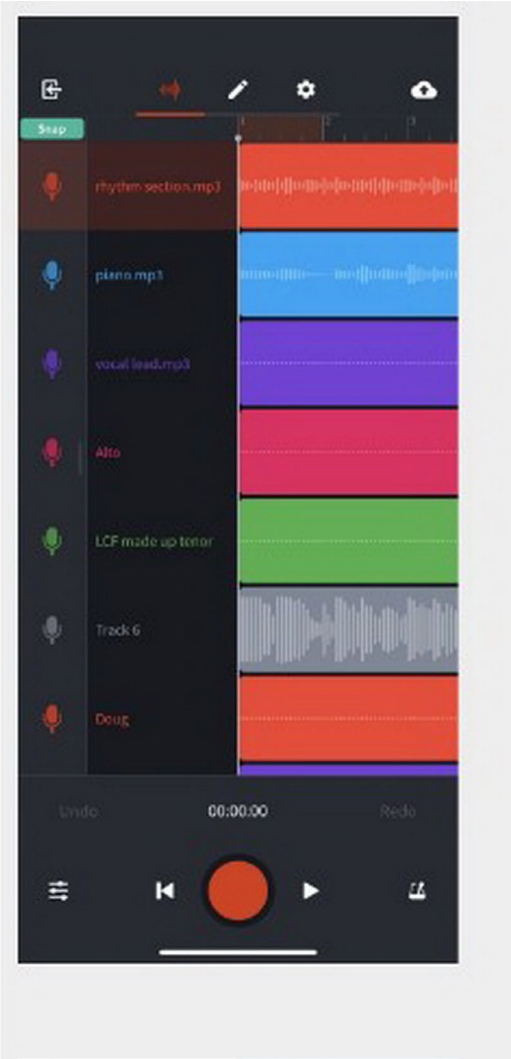



**FIGURE 5** | Recording Process. *Source:* Developed by the author.

every 2–3 days, and a quarter performed daily. Furthermore, owing to the design's accessibility and simplicity, 67% of the participants chose to practise on a tablet or smartphone instead of a computer. Thus, the study discovered that students are interested in introducing new technologies for learning music disciplines and are willing to study at home without teachers' assistance or guidance.

## 3.2 | *t*-Testing

The statistical comparison between the two groups was performed using a paired *t*-test to evaluate the pretest and post-test results. The control group had an average pretest score of 75.3 points and a post-test score of 75.8 points, indicating a slight increase in performance ($\Delta = +0.5$ points). Meanwhile, the experimental group, which utilised the BandLab DAW system, exhibited a more substantial improvement, with an average pretest score of 74.2 points and a post-test score of 80 points ($\Delta = +5.8$ points). The *t*-test results show a significant difference in the performance of the experimental group compared to the control group. The mean increase in scores for the experimental group is statistically significant, with a *t*-value of $X$ ($df = N$, $p < 0.05$), indicating that the implementation of the DAW system positively impacted the students' academic performance. This result confirms the hypothesis that integrating modern technological tools like the BandLab DAW system can enhance educational outcomes in music education (Table 3).

**TABLE 2** | Survey content.

| Questions | Yes (%) | No (%) |
|---|---|---|
| 1. Did you use DAW systems in your university education previously? | 75 | 25 |
| 2. Did you use DAW systems in frames of 'Academic Singing' discipline? | 0 | 100 |
| 3. Did the teacher use any other digital technologies? | 54 | 46 |
| 4. Was the experiment interesting for you? | 97 | 3 |
| 5. Did you practice your academic singing with BandLab every week during your practical lessons? | 100 | 0 |
| 6. Did you practice your academic singing with BandLab every day at home? | 25 | 75 |
| 7. Did you practice your academic singing with BandLab 2–3 per week at home? | 52 | 48 |
| 8. Did you practice your academic singing with BandLab once per week or less at home? | 23 | 77 |
| 9. Did you use your tablet or phone for it? | 67 | 33 |
| 10. Was the interface understandable and easy for you? | 95 | 5 |

*Source:* Developed by the author.

## 3.3 | Teachers' Interview

Some questions were also posed to the teachers. Those concerning the DAW system itself are particularly pertinent to the survey results. Thus, more than 70% of teachers used DAW technology in their classrooms (Figure 7a), although only 50% had some experience with the BandLab application.

> Teacher 2: I believe that the implementation of the BandLab program in academic vocal classes will have a positive effect on students' motivation to study. Personally, I already had experience working with this program.

> Teacher 8: I quite often use the application on the road or on vacation if I want to work, but I don't have access to a PC.

> Teacher 11: I had no experience with this application before, but everything is quite simple and interesting.



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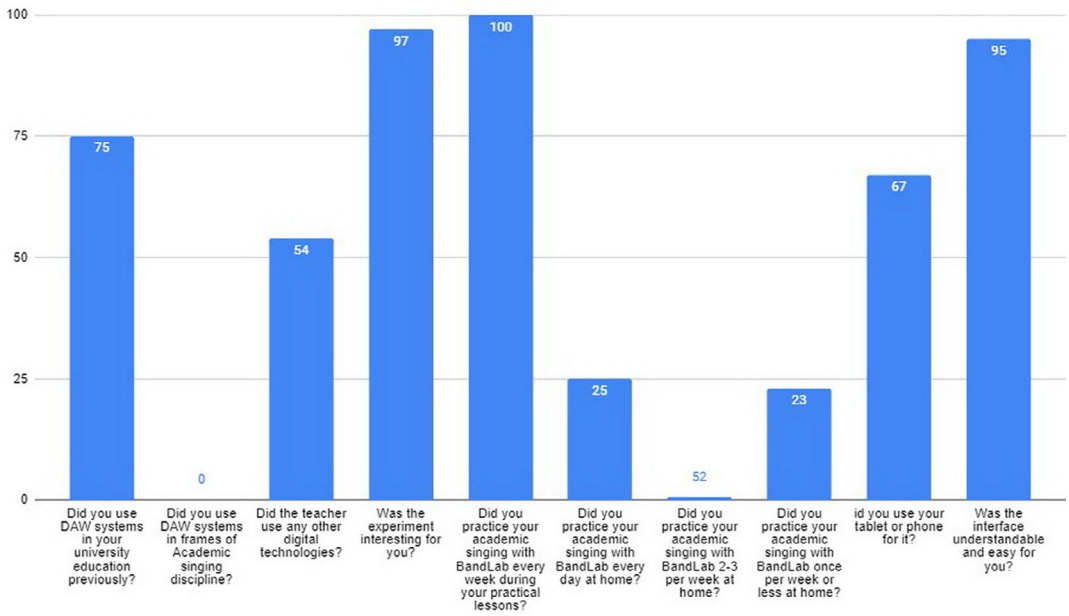



**FIGURE 6** | Survey results. *Source:* Developed by the author.

**TABLE 3** | Average academic achievement of control and experimental groups.

| | Pretesting | Post-testing | *t*-value |
|---|---|---|---|
| Control group | 75.3 points | 75.8 points | $p < 0.05$ |
| Experimental group | 74.2 points | 80 points | |

*Source:* Developed by the author.

This evidence suggests that the teaching staff is not sufficiently mobile or knowledgeable about digital music technologies. However, most saw the experiment as a chance to improve their skills. Teachers also said that by the end of the experiment, 84% of the students were more interested in the subject they were learning and wanted to study independently (Figure 7b).

> Teacher 11: I personally noticed changes in the students' behaviour. They have become more cheerful, active, constantly asking about something in class. We seem to have a new common vector of action.

> Teacher 4: I would like to note the increased interest of students in learning. Success rates have changed, and most importantly, knowledge has appeared. The evidence above shows that student motivation to learn new information has improved. Teachers are aware that the success of the ongoing music reform relies not solely on curriculum choices, textbooks, and student performance but also on their proficiency in effectively utilising modern technology.

## 4 | Discussion

People, creativity, and information are the three most fundamental factors in modern music education. People are the most critical component because they create music. Music is a phenomenon that permeates the hue of human nature as the essence of educational practice for the vast majority of human action and the existence of art. People's understanding of the humanity embodied in music is deeper and more complete. More people now understand that music is a form of art and culture (Li 2021; Stapp and Hall 2020).

According to German researchers, music learning has been linked to higher academic achievement and executive function in behaviour. Normalised English and maths test results were used to assess educational attainment. According to the study, students who had received music training had higher IQ scores (Holochwost et al. 2017). A sample of students can be chosen, and the average grade for the control and experimental groups is calculated automatically using algorithms built into the program.

The American scientist Tounsi (2021) found that music significantly benefits students' behaviour. Partti (2017) explains this as a 'radical pedagogy' when students feel free and view pedagogical staff rather as critical companions who can help them to prioritise rapid musical growth by adding some theoretical basis to computer practice that can be received from DAW. According to this type of pedagogy, students' practical exploration with the usage of modern DAW systems contributes to general knowledge better than standard lectures and practical lessons format. Partti (2017) describes Dewey's philosophy as a basis highlighting that a class should be a natural student community where all pupils can feel aspiration and creative support. Such a thesis can be opposed to standardisation of curriculum, that's why DAW system implementation should be viewed as a critical one.



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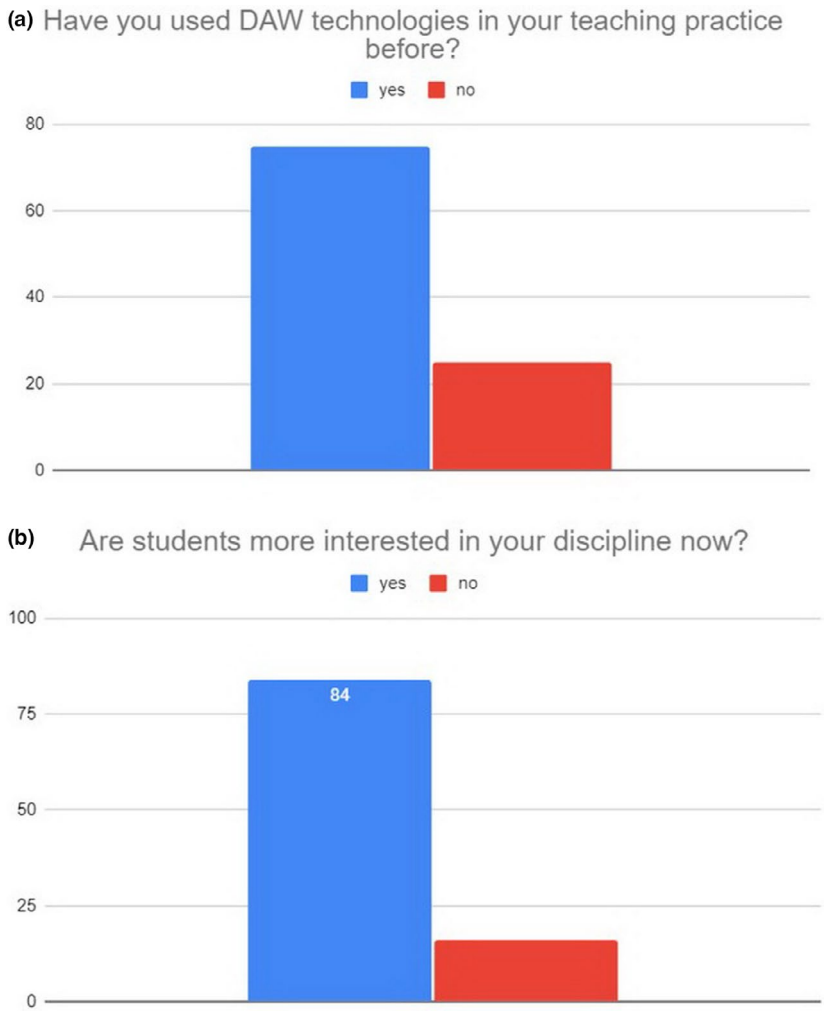



**FIGURE 7** | Questionnaire results. *Source:* Developed by the author.

Regarding the test subjects, their receptivity towards the learning process significantly heightened when they were allowed to engage with the BandLab system both within the classroom and in their home environments. The integration of digital audio workstation (DAW) technology in the educational setting, as posited by Canadian music education theorist Bell (2018), enhances aesthetic engagement and simultaneously empowers students as co-producers with shared responsibility for the ultimate musical output. The student exercises with DAW software, experimenting with shifting soundtracks and altering vocal effects. In this case, the teacher's job is to guide and give ideas, but the primary interaction is between the student and the DAW system.

Therefore, the DAW tools will enable the instructor to edit live vocals while the lesson is taught. The student can sing in a microphone attached to the device while hearing the processed voice over the loudspeakers. Depending on the style and genre of singing, the student and teacher can select different effects to create the desired vocal processing, resulting in the best possible combination of melody and voice. Why is it required? Vocal timbre and volume are adjusted and balanced by effects processing, significantly positively affecting the vocals. This increases the student's motivation because they can immediately hear all the subtleties in their vocals and later correct their errors.

Bernabé-Valero, Blasco-Magraner, and Moret-Tatay (2019), an Italian scholar, investigated the factors that influence the motivation of music students, including judgement about their abilities, satisfaction with achievement, and attempting to assess the significance of music and its place in their lives. Two models were developed from the standpoint of positive psychology, one of them including variable gratitude (Baratè et al. 2019). The first suggests that an effort will be made, while the second suggests that gratitude will be expressed. Theories in the realm of music education underscore the significance of cognition, motivation, and the connection between exertion and appreciation (Turchet et al. 2018). According to New Zealand research (Pierard and Lines 2022), DAW systems are convenient for self-usage cause the only thing students need to create music is computer equipment. No musical instruments or additional equipment—everything is organised in DAW systems. The study found that students were highly enthusiastic about their success with the software and embraced self-study at home to improve skills and learn additional theoretical information. Remarkably, 95% of students consider DAW systems to be highly effective.

Chinese scholars Zhang and Zhang (2021) anticipated that using modern technology in music education would result in innovative educational scenarios. The new method of teaching art that involves 'integrating diverse technologies for experiential



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learning' is ideal for the advancement of music education and promotes students' rapid learning. Once implemented, the investigated 5G methodology has increased children's enjoyment of music education in general. Incorporating DAW systems into 'Academic Singing' learning classes creates a similar situation. The range of what students can understand has expanded, and they now enjoy learning about a broader range of subjects and investing more time in self-studies. The algorithm for these actions will result in more effective learning, notably improved academic achievement.

## 5 | Conclusions

College, university, and conservatory music instructors are gradually adapting their pedagogical practices to reflect the new pedagogical philosophy and digital music software of the twenty-first century, replacing the textbook as the primary instructional tool and increasing the use of ICT in the classroom. Teacher-student communication is no longer sufficient in today's knowledge flow. To acquire quality and, most importantly, effective knowledge, the student must implement newly acquired information as frequently as possible.

It was nearly impossible to do this without a teacher in the 'Academic Singing' discipline without sacrificing quality. However, with the BandLab DAW recording system, students could have additional practice in the classroom and outside of class time. Notably, 95% of the students reported the software's understandable and user-friendly design. For 67% of the students, the option to study using a tablet or mobile phone was highly convenient. Remarkably, two-thirds of the students began regularly practising at home, with 25% practising every day and the rest once every 2–3 days. Evidently, 84% of students' interest and engagement, according to teachers, increased.

The findings have practical implications because they have the potential to lead to further reforms in music education not only in China but also in other countries around the world, broadening the range of disciplines in which digital learning should take place. Furthermore, based on this research, the use of DAW technology in participatory disciplines such as Choral Singing can be investigated. The use of DAW technology for conducting music workshops to study choral singing, play musical instruments, and study the musical composition basics are inspired by this research and could be further investigated.

### Ethics Statement

The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. The study was approved at the meeting of the Ethics Committee of Harbin Normal University (Protocol No. 15 dated April 10, 2022).

### Consent

Informed consent was received from all participants.

### Conflicts of Interest

The author declares no conflicts of interest.

### Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### References


Abdallah, A. K., and A. F. Farhan. 2023. "Breaking Barriers and Empowering Women Leaders to Drive School Improvement." In *Restructuring Leadership for School Improvement and Reform*, 399–419. Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-6684-781-9.ch020.

Anderson, A., and M. Northcote. 2018. "Australian Studies of Video Conference and Video-Assisted Instrumental Music Teaching: What Have We Learned?" *Australian Journal of Music Education* 52, no. 1: 3–18.

Baratè, A., G. Haus, L. A. Ludovico, E. Pagani, and N. Scarabottolo. 2019. "5G Technology and Its Applications to Music Education." In *MCCSIS 2019-Proceedings of the International Conference on e-Learning*, 65–72. Lisbon, Portugal: International Association for Development of the Information Society.

Bell, A. 2018. *Dawn of a DAW: The Studio as Musical Instrument*. England: Oxford Press.

Bernabé-Valero, G., J. S. Blasco-Magraner, and C. Moret-Tatay. 2019. "Testing Motivational Theories in Music Education: The Role of Effort and Gratitude." *Frontiers in Behavioral Neuroscience* 13: 172. https://doi.org/10.3389/fnbeh.2019.00172.

Carey, G., L. Coutts, C. Grant, S. Harrison, and R. Dwyer. 2018. "Enhancing Learning and Teaching in the Tertiary Music Studio Through Reflection and Collaboration." *Music Education Research* 20, no. 4: 399–411. https://doi.org/10.1080/14613808.2017.1409204.

Cox, M. N. 2021. "A Comparative Study of Classical and Contemporary Commercial Vocal Pedagogies." Thesis, University of the Witwatersrand.

Fernández, A., B. Gómez, K. Binjaku, and E. K. Meçe. 2023. "Digital Transformation Initiatives in Higher Education Institutions: A Multivocal Literature Review." *Education and Information Technologies* 28, no. 10: 12351–12382. https://doi.org/10.1007/s10639-022-11544-0.

Forrester, S. H. 2018. "Music Teacher Knowledge: An Examination of the Intersections Between Instrumental Music Teaching and Conducting." *Journal of Research in Music Education* 65, no. 4: 461–482. https://doi.org/10.1177/0022429417742124.

Gouzouasis, P., and D. Bakan. 2011. "The Future of Music Making and Music Education in a Transformative Digital World." *University of Melbourne Refereed E-Journal* 2, no. 2: 127–154.

Grajewski, D., and A. Hamrol. 2023. "Low-Cost VR System for Interactive Education of Manual Assembly Procedure." *Interactive Learning Environments* 31, no. 1: 68–86. https://doi.org/10.1080/10494820.2020.1761836.

Gudmundsdottir, H. R., C. Beynon, and K. M. Ludke. 2020. "Introduction: Singing and Education: Learning to Sing and Singing to Learn." In *The Routledge Companion to Interdisciplinary Studies in Singing, Volume II: Education*, edited by H. R. Gudmundsdottir, C. Beynon, K. Ludke, and A. J. Cohen, 1–12. London: Routledge.

Holochwost, S. J., C. B. Propper, D. P. Wolf, et al. 2017. "Music Education, Academic Achievement, and Executive Functions." *Psychology of Aesthetics, Creativity, and the Arts* 11, no. 2: 147–166. https://doi.org/10.1037/aca0000112.

Li, L. 2021. "On the Relationship Between Humanistic Quality and Music Education in Colleges and Universities." In *2021 2nd Asia-Pacific Conference on Image Processing, Electronics and Computers*, edited by J. He, 117–120. New York: ACM. https://doi.org/10.1145/3452446.3452476.

Liu, C. W. 2021. "Navigating Music Teaching in Uncertain Times." *General Music Today* 34, no. 2: 39–41. https://doi.org/10.1177/1048371320961384.




14653435, 2025, 1, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ejed.12901 by Luxembourg Institute Of Health, Wiley Online Library on [06/10/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Liu, X., and X. Shao. 2024. "Modern Mobile Learning Technologies in Online Piano Education: Online Educational Course Design and Impact on Learning." *Interactive Learning Environments* 32, no. 4: 1279–1290. https://doi.org/10.1080/10494820.2022.2118787.

Ma, R., and R. Ma. 2023. "Piano Education Online: Challenges and Solutions." *Education and Information Technologies* 28: 1359–1372. https://doi.org/10.1007/s10639-022-11242-x.

Martín-Lucas, J., and Á. García del Dujo. 2023. "Knowledge-Building in an Environment Mediated by Digital Technology: A Case Study in Higher Education." *Education and Information Technologies* 28, no. 3: 3267–3287. https://doi.org/10.1007/s10639-022-11304-0.

McPherson, G. E., P. Miksza, and P. Evans. 2017. "Self-Regulated Learning in Music Practice and Performance." In *Handbook of Self-Regulation of Learning and Performance*, edited by D. H. Schunk and J. A. Greene, 181–193. London: Routledge.

Millican, J. S., and S. H. Forrester. 2018. "Core Practices in Music Teaching: A Delphi Expert Panel Survey." *Journal of Music Teacher Education* 27, no. 3: 51–64. https://doi.org/10.1177/1057083717736243.

Nart, S. 2016. "Music Software in Technology Integrated Music Education." *Turkish Online Journal of Educational Technology* 15, no. 2: 78–84.

Partti, H. 2017. "Pedagogical Fundamentalism Versus Radical Pedagogy in Music." In *Oxford Handbook of Technology & Music Education*, edited by R. Mantie and A. Ruthmann, 257–276. England: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199372133.013.25.

Peng, F. 2021. "Optimisation of Music Teaching in Colleges and Universities Based on Multimedia Technology." *Advances in Educational Technology and Psychology* 5, no. 5: 47–57. https://doi.org/10.23977/aetp.2021.55009.

Pierard, T., and D. Lines. 2022. "A Constructivist Approach to Music Education With DAWS." *Teachers and Curriculum* 22, no. 2: 135–145. https://doi.org/10.15663/tandc.v22i2.406.

Rivas, J., R. Sparey, J. Davies, et al. 2021. "Voices From Southwark: Reflections on a Collaborative Music Teaching Project in London in the Age of COVID-19." *International Journal of Community Music* 14, no. 2–3: 169–189. https://doi.org/10.1386/ijcm_00043_1.

Ruthmann, A., and R. Mantie. 2017. *Oxford Handbook of Technology and Music Education*. England: Oxford University Press.

Sarmento, R. P., and V. Costa. 2019. "An Overview of Statistical Data Analysis." arXiv preprint arXiv:1908.07390. https://doi.org/10.48550/arXiv.1908.07390.

Shi, J., and Q. Ning. 2022. "Research on the Innovation of Music Teaching in Universities Based on Artificial Intelligence Technology." *Security and Communication Networks* 2022: 3140370. https://doi.org/10.1155/2022/3140370.

Sielska-Badurek, E. M., M. Sobol, K. Olszowska, and K. Niemczyk. 2018. "Contemporary Commercial Music Singing Students—Voice Quality and Vocal Function at the Beginning of Singing Training." *Journal of Voice* 32, no. 6: 668–672. https://doi.org/10.1016/j.jvoice.2017.08.027.

Stapp, A., and M. B. Hall. 2020. "Examining the Impact of Music and Movement Interventions on Transitions and Behavioural Engagement in a First-Grade Classroom. Journal of Education & Social." *Policy* 7, no. 1: 118–129. https://doi.org/10.30845/jesp.v7n1p14.

Strachan, R. 2017. *Sonic Technologies: Popular Music, Digital Culture and the Creative Process*. New York, NY: Bloomsbury Academic.

Tang, M. M. 2022. "College Vocal Music Teaching Design Based on Internet Platform." *Wireless Communications and Mobile Computing* 2022: 3590597. https://doi.org/10.1155/2022/3590597.

Tounsi, O. 2021. "Effects of Music Background on Engagement of Students With Mild Intellectual Disability." *Journal of Advances in Sports and Physical Education* 4, no. 8: 186–192. https://doi.org/10.36348/jaspe.2021.v04i08.003.

Turchet, L., C. Fischione, G. Essl, D. Keller, and M. Barthet. 2018. "Internet of Musical Things: Vision and Challenges." *IEEE Access* 6: 61994–62017. https://doi.org/10.1109/ACCESS.2018.2872625.

Walzer, D. 2020. "Blurred Lines: Practical and Theoretical Implications of a DAW-Based Pedagogy." *Journal of Music Technology & Education* 13, no. 1: 79–94. https://doi.org/10.1386/jmte_00017_1.

Zhang, H. L., and P. J. Yu. 2021. "Design of Multimedia Vocal Music Education Data Integration System Based on Adaptive Genetic Algorithm." *Security and Communication Networks* 2021: 3897696. https://doi.org/10.1155/2021/3897696.

Zhang, M., and H. Zhang. 2021. "Construction of Music Teaching Effect Evaluation Model Based on 5G Technology." In *2020 International Conference on Data Processing Techniques and Applications for Cyber-Physical Systems: DPTA 2020*, edited by C. Huang, Y.-W. Chan, and N. Yen, 493–500. New York: Springer. https://doi.org/10.1007/978-981-16-1726-3_60.

Zhang, Y., and D. Yi. 2021. "A New Music Teaching Mode Based on Computer Automatic Matching Technology." *International Journal of Emerging Technologies in Learning* 16, no. 16: 117–130. https://doi.org/10.3991/ijet.v16i16.24895.



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