The Application of Digital Music Teaching Systems in College Music Education

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Abstract. This article explores the application of digital music teaching systems in higher education music education. The system integrates key technologies such as audio digitization, music resource organization, and online interaction, and designs functional modules including music resource libraries, online classrooms, and social interaction. Through practical case analysis, the article demonstrates the application effectiveness of the system in areas such as music theory, appreciation, performance, and professional education. Research shows that digital music teaching systems can significantly improve students' learning interests and effectiveness, providing new ideas for reforming higher education music education.

Keywords: digital music teaching system, audio digitization, music resource organization, online interaction, cloud computing architecture, teaching effectiveness assessment

1 Introduction

Music is one of the indispensable subjects in higher education. Traditional music teaching methods suffer from issues such as limited teacher-student interaction and difficulty in ensuring learning effectiveness. The emergence of digital music teaching systems has injected new vitality into music education. Leveraging computer technology and network platforms, these systems realize the digitized management and sharing of music resources, providing rich teaching resources and interactive tools for teachers and students[1]. This article discusses the application of digital music teaching systems in higher education music education from aspects such as key technologies, system design, implementation evaluation, and application effectiveness, aiming to provide reference for improving the quality of music talent cultivation.

2 Key Technologies of Digital Music Teaching Systems

The key technologies of digital music teaching systems include audio digitization, music resource organization, and online interaction. Audio digitization technology

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converts analog audio signals into digital signals, enabling music editing, storage, and transmission. Common technologies include PCM and ADPCM, which need to balance between audio quality and file size according to requirements[2]. Music resource organization technology utilizes methods such as metadata annotation, content analysis, and semantic retrieval to classify, retrieve, and manage large amounts of music resources, improving their accessibility and availability,as illustrated in Table 1. Online interaction technologies such as real-time audio and video, online instruments, and collaborative editing enhance learners' participation and interactivity, thus improving learning effectiveness. By leveraging these key technologies, feature-rich, and highly interactive digital music teaching systems can be developed, injecting new vitality into music education.

Table 1. Metadata Annotation of Music Resources

Attribute	Value
Song Title	Blue and White Porcelain
Artist	Jay Chou
Album	I'm Busy
Release Date	2007/11/2
Genre	Chinese Style
Emotion	Sadness

3 System Function Module Design

3.1 Music Resource Library Module

The music resource library is the foundation of the digital music teaching system, containing a massive amount of music resources such as musical pieces, audio, video, sheet music, etc. To facilitate management and retrieval, these resources are usually categorized and annotated according to certain standards, such as genre, author, instrument, etc[3]. Taking a university's music resource library as an example, it includes over 100,000 music works covering classical, ethnic, and popular music genres. Through intelligent recommendation algorithms, the system can automatically recommend suitable learning resources based on students' learning progress, interests, etc. Meanwhile, teachers can also upload and manage music resources according to their teaching needs. The construction of the music resource library not only provides rich materials for teaching but also facilitates students' independent learning and exploration[4].

3.2 Online Classroom Module

The online classroom module is the core of the digital music teaching system, enabling remote interactive teaching between teachers and students. Through features such as video streaming, screen sharing, and online instruments, teachers can conduct demonstrations, explanations, and guidance online, while students can ask questions and interact in real-time. Taking a university's online music classroom as an example, over 20 live courses are offered weekly, covering various professional courses such as music theory, sight-singing, harmony, and musical forms. Students complete assignments through methods like playing online instruments and uploading audio, while teachers provide guidance through online grading and voice feedback[5]. The online classroom breaks the constraints of time and space, allowing high-quality teaching resources to be widely shared and providing students with more flexible and personalized learning methods.

3.3 Social Interaction Module

The social interaction module is an important supplement to the digital music teaching system, providing students with a platform for showcasing, communicating, and collaborating. Here, students can upload their music works and share and discuss them with classmates, teachers, and even music enthusiasts outside the school[6]. The system also regularly organizes online music events such as concerts and performance competitions to promote student participation and interaction. Figure 1 shows the activity data of a certain university's music community. Through social interaction, students can not only receive more learning feedback and encouragement but also find like-minded peers to enhance their learning motivation. At the same time, this also helps cultivate students' collaboration skills and innovation spirit, laying the foundation for their future career development.

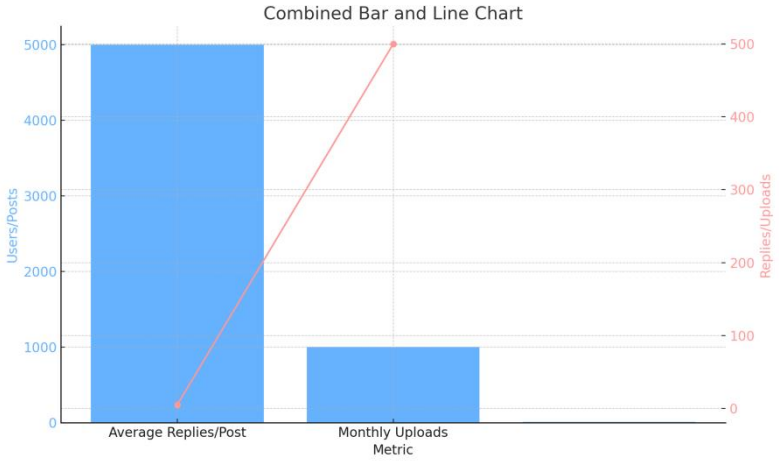

Fig. 1. Activity Data of a Certain University's Music Community

4 Implementation and Effectiveness Evaluation

4.1 System Architecture Selection and Deployment

In the implementation process of the digital music teaching system, choosing the appropriate system architecture and conducting effective deployment are crucial. Typically, adopting a B/S (Browser/Server) architecture can provide better accessibility and scalability. The frontend of the system is developed using web technologies such as HTML5, CSS3, JavaScript, while the backend utilizes languages like Java, Python, along with databases like MySQL, MongoDB. In terms of deployment, infrastructure services from cloud computing platforms (such as AWS, Alibaba Cloud) can be leveraged[7]. Through mechanisms like load balancing and auto-scaling, the system's high availability and stability are ensured. Figure 2 illustrates a typical system deployment architecture. Based on this architecture, a certain university's digital music teaching system successfully supported concurrent access from tens of thousands of users, with an average response time controlled within 2 seconds.

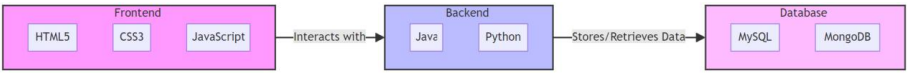

Fig. 2. Schematic Diagram of System Deployment Architecture

4.2 System Operation Monitoring and Maintenance

To guarantee the stable operation of the digital music teaching system, it is necessary to establish a comprehensive monitoring and maintenance mechanism. This includes real-time monitoring of system hardware resources (such as CPU, memory, disk), network conditions, application performance, etc., to promptly detect and resolve potential issues. Additionally, regular maintenance tasks like data backup, security audits, performance optimization, are essential[8]. In the practice of a certain university, the operations team implemented open-source monitoring tools like Prometheus, Grafana to achieve comprehensive system monitoring. Combined with automated operation platforms (such as Ansible, Puppet), the system's availability reached over 99.9%, providing solid technical support for the smooth conduct of teaching activities.

4.3 Teaching Effectiveness Evaluation

The ultimate goal of the digital music teaching system is to enhance teaching effectiveness, thus it is necessary to conduct scientific evaluations. Evaluation dimensions may include student satisfaction, academic performance, skill improvement, as well as teacher efficiency, and teaching innovation. Data can be collected through methods such as questionnaires, data analysis, practical assessments, etc., and analyzed using appropriate statistical methods. Figure 3 shows the results of a satisfaction survey among students at a certain university regarding

digital music teaching. It can be observed that the majority of students acknowledge the usability and learning effectiveness of the system. These evaluation results not only confirm the value of the system but also provide important insights for subsequent optimization and improvement.

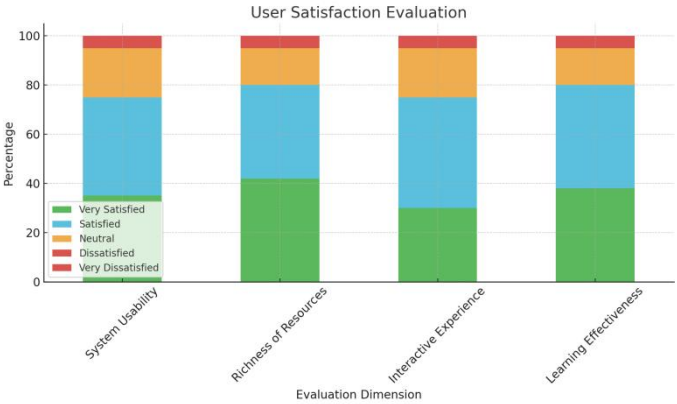

Fig. 3. Student Satisfaction Survey Results

5 System Application in Higher Education Music Education

5.1 Application in Music Theory and Appreciation Teaching

The digital music teaching system has extensive applications in music theory and appreciation courses. Taking a certain university as an example, teachers utilize the system's score editing feature to demonstrate theoretical knowledge such as chord progressions and melodic variations in real-time, making abstract concepts more tangible. Students can also practice with online instruments like virtual pianos, guitars, etc., to deepen their understanding of theory[9]. In appreciation classes, the system provides a plethora of high-quality musical works spanning different periods, styles, and regions, accompanied by detailed explanations and introductions of composers. Students can independently choose pieces of interest for listening and participate in online discussions, sharing their feelings and insights. Data shows that after using the system, students' average scores in music theory tests increased by 12%, and their music appreciation abilities also significantly improved.

5.2 Application in Vocal and Instrumental Performance Teaching

In vocal and instrumental performance courses, the digital music teaching system plays a crucial role. Taking vocal classes as an example, the system is equipped with a speech recognition module that can detect students' pitch, dynamics, breath control, etc., in real-time, providing instant feedback and suggestions. A study indicated that after using this system as a teaching aid, students' pitch accuracy improved by 8%,

and their breath control ability also significantly improved. Instrumental performance classes can also benefit from the system's instrument simulation module. Students can simulate the performance of different instruments online, mastering correct playing techniques and postures. This module also provides limb motion tracking functionality to help students correct common posture errors during performance, as demonstrated in Figure 4.A comparative experiment showed that after using the system as a teaching aid, students' sight-reading levels increased by an average of 15%.

Fig. 4. Application in Vocal and Instrumental Performance Teaching

5.3 Application in Music Education Professional Training

The digital music teaching system also plays a crucial role in the training of music education professionals[10]. Through the system, students can learn modern music teaching methods and technologies, such as multimedia courseware production, online music game design, etc., preparing them for future careers in music education. Additionally, the system provides students with a practical platform where they can organize online music activities, assist teachers in remote teaching, etc., to hone their teaching abilities. In a certain university's music college, digital music teaching has become a compulsory course for education majors. Students are required to complete a certain number of practical tasks before graduation, as shown in Table 2. Through these training tasks, students' teaching skills are comprehensively enhanced, leading to a noticeable improvement in the quality of employment after graduation.

Table 2. Practical Task Requirements for Music Education Major Students

Task Type	Quantity Required
Multimedia Courseware Production	10
Online Music Game Design	5

Organizing Online Music Activities	3
Assisting Remote Teaching	20 hours

6 Conclusion

The application of digital music teaching systems in higher education music education is increasingly widespread, covering various aspects such as music theory, appreciation, vocal and instrumental performance, as well as the training of music education professionals. By deeply integrating information technology with traditional music teaching, these systems provide teachers with rich teaching resources and tools, while creating personalized, interactive learning experiences for students, effectively enhancing teaching effectiveness. Abundant practical data shows that students' music theory literacy, performance skills, appreciation abilities, and teaching capabilities have all significantly improved. It can be foreseen that with further technological advancements, digital music teaching systems will play an increasingly important role in higher education music education, driving innovation and transformation in music education.

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