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Research on the Teaching Value and Promotion of Virtual Simulation Platform for Digital Human Vocal Music Education

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Abstracts

With the rapid development of information technology, the application of digital human technology in the field of education is becoming more and more extensive, especially in the teaching of vocal music shows unique advantages. This paper focuses on the virtual simulation platform of digital human vocal music education, and systematically discusses its application value and promotion strategy in teaching. By analysing the platform's architectural design, teaching functions, practical application effects and market promotion paths, the study finds that the platform integrates cutting-edge technologies such as speech recognition and virtual reality, provides an immersive and interactive learning environment, and significantly improves students' learning efficiency and teaching quality. Empirical studies have shown that students' pitch and rhythm accuracy increased by an average of 15 per cent and the time taken to complete practice tasks was shortened by an average of 20 per cent after using the platform, with more than 80 per cent of the students indicating that they were satisfied with the experience of using the platform. However, the platform still has certain deficiencies in terms of technical stability, teaching content richness and user interaction experience. For this reason, this paper puts forward corresponding improvement suggestions, including strengthening technical research and development, enriching teaching resources, and optimising user experience. In summary, the virtual simulation platform for digital human vocal education is of great significance in enhancing the quality of vocal education, promoting educational fairness and facilitating educational innovation, and in the future, the platform functions should be further improved and the scope of application should be expanded in order to realise a wider range of educational values.

1. Introduction

1.1. Background and significance of the study

In today's era of rapid development of information technology, digital education has become a key trend in global education reform. However, in the field of music education, especially vocal music teaching, the traditional mode faces many difficulties, such as the shortage of teachers, unbalanced distribution of teaching resources, and a single teaching method, etc., which seriously constrain the improvement of the quality of education and the realisation of

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education equity. With the booming development of digital technology, vocal education has brought unprecedented opportunities, and is expected to break the limitations of the traditional education model. With the help of the digital human voice education virtual simulation platform, students can carry out vocal training in a virtual environment in an immersive manner, and can get accurate feedback in a timely manner, thus significantly improving the learning efficiency. This innovative teaching mode can not only effectively alleviate the pressure on teachers, but also provide students with a personalised learning experience, its application value and promotion significance in the field of teaching is self-evident, and has a far-reaching impact on promoting the modernisation process of vocal education[1].

1.2. Research objectives and questions

The core purpose of this study is to explore in depth the application value of the virtual simulation platform for digital human voice education in teaching practice, comprehensively analyse its application effect in actual teaching scenarios, and propose practical promotion strategies based on it. Specifically, this study focuses on the following key issues:

1.What are the unique advantages of the Digital Human Vocal Education Virtual Simulation Platform in the teaching process?

2.How effective is the platform in practical teaching applications?

3.What are the challenges that might be faced in promoting the platform and what strategies should be adopted to address them?

2. Relevant theoretical and technical foundations

2.1. Overview of digital human technology

Digital Human (DH) is a virtual character with human appearance and behavioural characteristics constructed through computer graphics, artificial intelligence, speech synthesis and other technologies. In the field of education, digital humans are widely used in the roles of virtual teachers and teaching assistants to provide personalised teaching services. For example, Tencent Music's "Tianqin" project uses AI technology to create a virtual human performance system to achieve automation and personalisation of music performance[2].

The application of digital human technology in vocal education is mainly reflected in the following aspects:

1.Speech Synthesis and Recognition: Through deep learning models, it achieves high-quality synthesis and recognition of the human voice, and assists students in vocal practice and pitch correction. For example, voice analysis software and sensor technology are used to provide real-time feedback and analysis for students in the process of singing, helping them to more accurately understand their pitch, timbre, resonance and other issues, and make timely adjustments and improvements.

2. Virtual Reality (VR) and Augmented Reality (AR): build an immersive learning environment to enhance students' interest and participation in learning. Through virtual simulation technology, students can conduct vocal training in a virtual environment, obtaining an experience similar to the real scene, and enhancing the fun and practicality of learning.

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3.Motion Capture and Expression Recognition: Captures students' facial expressions and body movements, providing real-time feedback to help students correct their singing posture and expression management. For example, in vocal music teaching, through motion capture technology, students can see in real time whether their singing posture is correct or not, and make adjustments based on the feedback.

2.2. Digitalisation trends in vocal education

Traditional vocal music teaching mainly relies on face-to-face teacher-student interaction, and there are problems such as uneven distribution of teaching resources and single teaching method. With the development of information technology, vocal music education is gradually transforming towards digitalisation and intelligence. The digital vocal music teaching platform realises the diversification of teaching content and the personalisation of teaching methods by integrating a variety of technical means.

For example, the lecture on "The Application and Future Development of Artificial Intelligence in Music Education" held by Jiangsu Second Teachers College pointed out that the application of AI technology can achieve the customisation of teaching content, meet the personalised needs of each student, and assist in the learning of music theory and music creation. In addition, the application of virtual simulation technology in music education has become increasingly widespread, providing students with a more intuitive and interactive learning experience[3].

The main advantages of digital vocal education include:

1.Sharing and popularisation of teaching resources: Breaking down geographical constraints to achieve wide dissemination of quality teaching resources. For example, through the digital platform, students can access excellent vocal music teaching resources from all over the world to broaden their learning horizons.

2.Flexibility of learning modes: Students can choose the time and progress of learning according to their own situation to enhance the efficiency of learning. For example, students can study independently after class through online courses and teaching videos to consolidate what they have learnt in class.

3. Diversity of teaching content: Through multimedia technology, teaching content is enriched to enhance the fun and practicality of learning. For example, using virtual reality technology, students can immerse themselves in different styles of vocal performances to enhance their interest in learning.

4.The application of digital technology in vocal education not only improves the teaching effect, but also brings more opportunities for the innovation and development of vocal education. In the future, with the continuous progress of technology, vocal education will be more intelligent, personalised and efficient.

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3. Design and Functions of Virtual Simulation Platform for Digital Human Vocal Music Education

3.1. Platform architecture and technical implementation

The virtual simulation platform for digital human voice education integrates a number of advanced technologies to build a comprehensive system integrating teaching, practice and evaluation. Its architecture mainly includes the following core modules:

1.User Interaction Interface: Provide an intuitive interface that supports real-time interaction between students and virtual teachers. The interface design focuses on user experience, ensuring easy operation and full functionality.

2.Virtual Teacher Module: A digital human image based on artificial intelligence with speech recognition, speech synthesis, expression management and other functions, capable of simulating the teaching behaviour of real teachers. Through high-precision modelling and motion capture technology, the virtual teacher can achieve natural and smooth movements and expressions to enhance the realism of teaching.

3.Teaching Content Management System: Integrates diversified teaching resources, including vocal illustrations, song audios, teaching videos, etc., and supports personalised learning path planning. The system can intelligently recommend relevant learning resources according to students' learning progress and points of interest.

4.Evaluation and Feedback System: Analyses students' singing performance in real time and provides targeted feedback and improvement suggestions. Through voice recognition and analysis technology, the system is able to accurately assess students' pitch, rhythm, timbre and other parameters.

The technical realisation of the platform relies on cutting-edge technologies such as virtual reality (VR), augmented reality (AR) and artificial intelligence (AI). For example, VR technology is used to build an immersive learning environment and enhance students' sense of participation; AI algorithms are used to realise voice recognition and synthesis to improve the intelligence of teaching. In addition, the platform also adopts dot-matrix technology to accurately simulate facial expressions, and works with positioning tracking technology to refine the gestures of virtual characters, further optimising the learning experience[4].

3.2. Teaching Functions and User Experience

The platform's pedagogical functions are designed to enhance students' learning and experience in the following ways:

1.Personalised teaching: Dynamically adjusting the content and difficulty of teaching according to students' learning progress and ability level to achieve tailor-made teaching. The system provides students with personalised learning solutions by intelligently analysing their learning behaviour and performance data.

2. Real-time feedback mechanism: During the students' singing process, the platform is able to capture parameters such as pitch, rhythm and timbre in real time and provide instant corrective suggestions to help students improve in time. This real-time feedback mechanism not only improves learning efficiency, but also enhances students' self-confidence.

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3.Interactive learning: Through the interaction between the virtual teacher and students, it enhances the fun and initiative of learning and stimulates students' interest in learning. Students can communicate with the virtual teacher through voice, text or body movements to get a more vivid learning experience.

4.Visual learning resources: Provide three-dimensional models of vocal organs, video demonstrations of singing techniques, etc. to help students understand and master vocal knowledge more intuitively. These visual resources not only enrich the teaching content, but also increase students' interest in learning.

In addition, the platform also supports multi-terminal access so that students can study anytime and anywhere through computers, tablets, mobile phones and other devices, which greatly enhances the flexibility and convenience of learning. This design of multi-terminal support allows students to make full use of fragmented time for learning without the limitation of time and space.

5.The way forward

With the continuous advancement of technology, the virtual simulation platform for digital human voice education will develop in the direction of greater intelligence, personalisation and efficiency. In the future, the platform will further optimise the interaction capabilities of virtual teachers, enhance the efficiency and quality of teaching content generation, and explore the deep integration with other emerging technologies, such as big data and the Internet of Things, in order to provide a more comprehensive and in-depth learning experience.

4. Analysis of the value of teaching

4.1. Assessment of teaching effectiveness

The virtual simulation platform for digital human vocal education provides students with an immersive and interactive learning environment by integrating speech recognition, audio analysis, virtual reality and other technologies. In teaching practice, the platform shows the following significant advantages:

1. Enhancement of learning effectiveness:

Students can practice anytime and anywhere, breaking the constraints of time and space and significantly improving the flexibility and efficiency of learning. For example, after the introduction of the platform in a university, students' average grades increased by 15% and classroom participation by 20%, showing the significant role of the platform in enhancing teaching effectiveness. Through virtual simulation technology, students can conduct vocal training in a virtual environment, obtaining an experience similar to the real scene, and enhancing the fun and practicality of learning[5].

2. Enhancement of motivation to learn:

The interactive learning approach stimulates students' interest in learning and enhances their initiative and motivation. Through real-time interaction between virtual teachers and students, students become more confident and efficient in the learning process. As a teaching assistant, the virtual digital person, with its vivid image and real interactive experience, makes students feel as if they are in a real vocal music teaching scene, which greatly stimulates their learning interest and participation.

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3. Improving the quality of teaching:

The platform provides instant feedback and personalised guidance to help students correct their mistakes in time and consolidate their learning achievements. For example, in vocal music teaching, the platform is able to capture students' pitch, rhythm, timbre and other parameters in real time and provide instant corrective suggestions. By intelligently analysing students' learning behaviours and performance data, the system can recommend personalised learning resources and extended reading materials for students, helping them to learn in a targeted manner according to their interests and needs[6].

4. Sharing and universal access to teaching resources:

Break the geographical limitation and realise the wide dissemination of quality teaching resources. Through the digital platform, students can access excellent vocal teaching resources from all over the world to broaden their learning horizons. As a teaching assistant, the virtual digital person can simulate real teaching scenes and provide students with a more vivid, intuitive and personalised learning experience.

5. Flexibility in learning modalities:

Students can choose the study time and progress according to their own situation to enhance learning efficiency. With multi-terminal access, students can study anytime, anywhere using computers, tablets, mobile phones and other devices, which greatly enhances the flexibility and convenience of learning.

4.2. Feedback from teachers and students

In the practical application, teachers and students gave positive comments on the virtual simulation platform of digital human vocal education:

1. Teacher feedback:

Teachers believe that the platform effectively assists teaching and reduces the burden of teaching, while providing rich teaching resources and improving the quality of teaching. As a teaching assistant, the virtual digital person can simulate real teaching scenarios, provide students with a more vivid, intuitive and personalised learning experience, and help teachers focus more on the optimisation of teaching strategies and the guidance of students' personalised development.

2. Student feedback:

Students reported that the personalised learning path and instant feedback mechanism provided by the platform made them more confident and efficient in the learning process. Students generally reflected that they were able to better master their vocal skills and improve their actual singing ability through the exercises on the platform. For example, 94.32% of the students believed that the digital human technology could better help them master new knowledge, and 92.67% of the students believed that the digital human technology could assist them in model design and production, and quickly master skills and methods[7].

4.3. Future Directions

With the continuous advancement of technology, the virtual simulation platform for digital human voice education will develop in the direction of greater intelligence, personalisation and efficiency. In the future, the platform will further optimise the interaction capabilities of virtual teachers, enhance the efficiency and quality of teaching content generation, and

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explore the deep integration with other emerging technologies, such as big data and the Internet of Things, in order to provide a more comprehensive and in-depth learning experience.

To sum up, the virtual simulation platform for digital human vocal education has significant advantages in enhancing teaching effect, strengthening learning motivation and improving teaching quality, and has been widely recognised by teachers and students. In the future, with the continuous progress of technology, the platform will bring more innovations and breakthroughs for vocal education[8].

5. Promotion Strategy Study

5.1. Analysis of market demand and potential users

With the advancement of digitalisation in education, there is a growing demand for innovative teaching tools in the field of vocal education. With its interactive and personalised features, the Digital Human Vocal Education Virtual Simulation Platform has attracted widespread attention. Potential users mainly include:

1. Higher education institutions specialising in music:

Requirement: Seeking tools to improve teaching quality and students' practical ability. Through the virtual simulation platform, students can conduct vocal training in a virtual environment, get instant feedback and improve learning efficiency. Application Scenario: In vocal courses, virtual teachers can simulate real teaching scenarios, provide personalised guidance and feedback, and help students better master vocal skills[9].

2. Music education in primary and secondary schools:

Requirement: We hope to stimulate students' interest and enrich the form of teaching through technology. The virtual digital person can be used as a virtual learning companion or virtual teacher to increase the interest and interactivity of the classroom. Application Scenario: In the music classroom, the virtual digital person can interact with students, explain music knowledge, demonstrate singing skills, and stimulate students' interest in learning.

3. Artistic training institutions:

Demand: Pursuing differentiated teaching and enhancing competitiveness. Through the introduction of the Digital People Vocal Education Virtual Simulation Platform, personalised teaching services are provided to meet the needs of different students. Application Scenario: In the vocal training course, the platform can dynamically adjust the teaching content and difficulty according to the students' learning progress and ability level, so as to realise tailor-made teaching[10].

4. Individual learners:

Needs: looking for a flexible, personalised approach to learning. With multi-terminal access, students can learn anytime, anywhere and use fragmented time to improve vocal skills. Application Scenario: Individual learners can access the platform via mobile phones, tablets or computers for self-directed learning, personalised learning paths and instant feedback.

In addition, with the popularisation of distance education, the potential of the platform's application in remote areas should not be overlooked. Through virtual simulation technology, students in remote areas can access high-quality vocal education resources and narrow the education gap between urban and rural areas.

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5.2. Promotion Channels and Co-operation Models

In order to effectively promote the virtual simulation platform for digital human voice education, the following strategies can be adopted:

1. Cooperation with educational institutions:

Strategy: Establish partnerships with universities, primary and secondary schools and carry out pilot projects to demonstrate the effectiveness of the platform. Demonstrate the advantages of the platform in enhancing teaching effectiveness and students' interest in learning through practical application cases. Case: After the introduction of the platform in a university, students' average grades increased by 15 per cent and classroom participation increased by 20 per cent, showing the significant effect of the platform in enhancing teaching effectiveness[11].

2. Participation in educational exhibitions and forums:

Strategy: Showcase the platform at various educational technology exhibitions and seminars to expand its reach. Attract the attention of educators and institutions through live demonstrations and interactive experiences. Case: At educational technology exhibitions, the interactive and personalised features of the platform attracted the interest of many visitors and received wide acclaim.

3. Online promotion:

Strategy: Publish teaching cases and user feedback through social media, education platforms and other channels to attract attention. Utilise short video platforms and online education communities to demonstrate the actual application effect of the platform.

Case: The teaching case videos released through social media have gained a high number of clicks and user interactions, effectively raising the visibility of the platform.

4. Provide training and support:

Strategy: Provide training for teachers and students on the use of the platform to ensure its effective application. Through online training courses and offline workshops, help users to quickly master the use of the platform.

Case in point: Through online training courses, teachers and students were able to quickly master the operation of the platform and improve its efficiency.

5. Establishment of user communities:

Strategy: Establish a user community to collect feedback and continuously optimise the platform functions. Through the user community, users can share their experience of using the platform, put forward suggestions for improvement, and promote the continuous optimisation of the platform. Case: The establishment of user communities not only improves user satisfaction, but also provides valuable feedback for platform optimisation[12].

5.3. Policy Support and Market Trends

1. Policy support:

Background: In recent years, the state has introduced a series of policies to support the digital transformation of education and promote the development of education informatisation. These policies provide a strong policy guarantee for the promotion of the virtual simulation platform for digital human voice education.

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Specific policies: For example, the Ministry of Education promotes the construction of a national smart education platform and encourages schools at all levels to embed the platform's resources and services into education and teaching.

2. Market trends:

Market size: the size of the education digitisation market is growing steadily, and the market size will be about 600 billion yuan in the next three years. Digital human voice education virtual simulation platform as an important part of education digitisation, has a broad space for development.

Technology trends: with the continuous maturation of artificial intelligence, big data, virtual reality and other technologies, the virtual simulation platform for digital human vocal education will develop in the direction of more intelligent, personalised and efficient[13].

In summary, the Digital Human Vocal Education Virtual Simulation Platform has significant advantages in enhancing teaching effectiveness, strengthening learning motivation and improving teaching quality. Through strategies such as cooperation with educational institutions, participation in educational exhibitions, online promotion, provision of training and support, and establishment of user communities, the platform can be effectively promoted to meet the needs of different users and promote the digital transformation of vocal education.

6. Case studies and empirical analyses

6.1. Presentation of specific application cases

In the practical application of the Virtual Simulation Platform for Digital Human Vocal Education, a pilot project was carried out by a university music school, aiming at exploring the practical effects of the platform in vocal music teaching. The project mainly includes the following aspects:

1.Integration of teaching content: Combine the content of traditional vocal music courses with the functions of the platform to design course modules suitable for virtual teaching. Through virtual reality technology, it creates an immersive vocal music teaching scene, making students feel as if they were in a real vocal music classroom. The platform provides rich teaching resources, including vocal organ illustrations, song audio, teaching videos, etc., and supports personalised learning path planning.

2.Student participation: Students of different grades were selected to participate in the pilot, covering beginners and those with some basic knowledge, in order to assess the adaptability of the platform to students of different levels. The interaction between virtual teachers and students will enhance the fun and initiative of learning.

3.Teacher training: Teachers involved in the project are trained in the use of the platform to ensure the smooth running of the teaching process. Teachers use the feedback data provided by the platform to provide personalised guidance and help students correct their mistakes in a timely manner.

During the implementation of the project, students learn and practice independently through the platform, while teachers provide personalised guidance through the feedback data provided by the platform. For example, the virtual teacher can capture the student's pitch, rhythm, timbre and other parameters in real time and provide instant corrective suggestions.

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6.2. Analysis of empirical data

In order to assess the pedagogical effectiveness of the platform, the project team quantitatively analysed the learning outcomes of the participating students, including the following indicators[14]:

1.Intonation and rhythmic accuracy: through the platform's audio analysis function, the intonation and rhythmic accuracy of students during practice is recorded. The results of the data analysis show that students' pitch and rhythm accuracy increased by an average of 15 per cent after using the platform.

2.Learning efficiency: The time taken by students to complete specific practice tasks was counted to assess the improvement in learning efficiency. The results showed that the time taken by students to complete practice tasks was reduced by 20 per cent on average.

4.Student satisfaction: Feedback from students on their experience of using the platform was collected through a questionnaire survey, including aspects such as interface friendliness and practicality of functions. More than 80 per cent of the students indicated that they were satisfied with the experience of using the platform and believed that it helped to improve their vocal skills.

6.3. Case Analysis and Discussion

1. Case background:

The pilot project was carried out in the School of Music of a university, aiming to explore the effectiveness of the application of the Digital Human Vocal Education Virtual Simulation Platform in vocal music teaching. Students of different grades were selected to participate in the project, covering both beginners and students with a certain foundation.

2. Application effects:

Teaching Content Integration: By combining the content of traditional vocal music courses with the platform's functionality, course modules suitable for virtual teaching are designed. The platform provides rich teaching resources and supports personalised learning path planning. Student participation: Students learn and practice independently through the platform, while teachers provide personalised guidance through the feedback data provided by the platform. Virtual teachers can capture students' pitch, rhythm, timbre and other parameters in real time and provide instant corrective suggestions. Teacher training: Teachers involved in the project are trained in the use of the platform to ensure the smooth running of the teaching process. Teachers provide personalised guidance through the feedback data provided by the platform to help students correct their mistakes in a timely manner[15].

3. Empirical data:

Intonation and rhythmic accuracy: Students improved their intonation and rhythmic accuracy by an average of 15 per cent after using the platform. Learning Efficiency: Students' time to complete practice tasks was reduced by an average of 20%. Student satisfaction: More than 80% of students reported that they were satisfied with their experience of using the platform and that it helped improve their vocal skills.

6.4. Conclusion and outlook

These empirical data show that the Digital Human Vocal Education Virtual Simulation Platform has significant effects in enhancing students' vocal skills, improving learning

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efficiency and enhancing the learning experience. In the future, with the continuous progress of technology, the platform will develop in the direction of more intelligent, personalised and efficient. For example, the virtual digital man will have stronger interactive capabilities, which can better simulate the real teaching scene and provide a more personalised learning experience.

In addition, as the digital transformation of education advances, new technologies such as big data and artificial intelligence continue to be recognised by the education community, and virtual digital people, as a new thing, is the first step across the application of the education meta-universe, so let's wait and see[16].

7. Problems and suggestions for improvement

7.1. Limitations of the current platform

Although the virtual simulation platform for digital human voice education shows many advantages in teaching, there are still some problems and challenges in the process of practical application:

Technical stability and compatibility:

Problem: Some platforms may have compatibility issues when running on different devices and operating systems, affecting user experience. For example, certain functions do not work properly on specific devices, or data loss or display anomalies occur when switching between different operating systems.

Case: In a pilot project at a university, some students reported that when using tablet devices, certain interactive features of the platform did not work properly, resulting in a poor learning experience.

Depth and breadth of content taught:

Problems: The teaching resources of the current platform may not fully cover all aspects of vocal music teaching, especially in terms of advanced techniques and personalised training. For example, the resources for explaining and practising some advanced vocal techniques are rather limited and cannot meet the needs of senior students.

Case in point: In a study of an arts training organisation, it was found that the resources provided by the platform were not sufficient to support the learning needs of some of the students when they were learning advanced vocal techniques, resulting in unsatisfactory learning outcomes.

User interaction experience:

Problems: The interaction design of some platforms is not yet user-friendly enough and lacks sufficient interactivity, which may affect students' motivation to learn. For example, the virtual teacher image of some platforms is not vivid enough, and the interaction method is relatively single, which cannot effectively attract students' attention[17].

Case: In a pilot project in a primary and secondary school, some students reflected that the interactive interface of the platform was not user-friendly enough and the operation was complicated, which led to a decline in learning interest.

Data security and privacy protection:

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Problem: In the process of collecting and analysing students' learning data, how to ensure the security of the data and the protection of users' privacy is a pressing issue. For example, students' learning data and personal information may be at risk of leakage, affecting users' trust in the platform.

Case in point: In a pilot project at a university, some teachers and students expressed concerns about the platform's data security measures, fearing improper use or leakage of personal data.

7.2. Future Directions

In order to improve the teaching effect and user satisfaction of the virtual simulation platform for digital human voice education, it is suggested to make improvements in the following aspects:

Technology optimisation and upgrading:

Measures: Strengthen the technical research and development of the platform to enhance the stability and compatibility of the system and ensure smooth operation under a variety of devices and environments. For example, optimise the code architecture of the platform to reduce compatibility problems; increase testing on different operating systems and devices to ensure the stability and reliability of the platform[18].

Case: Through cooperation with a technology provider, a platform successfully solved compatibility issues on different devices after updating its version, significantly improving user experience.

Enrichment of teaching resources:

Measures: Expanding the teaching content to cover basic to advanced vocal techniques and providing diversified practice and assessment tools to meet the learning needs of students at different levels. For example, video demonstrations and practice modules for advanced vocal techniques are added to provide personalised learning path planning.

Case in point: after a university music school added a module on advanced vocal techniques to the platform, the learning effect of the students improved significantly, especially in the feedback from senior students, the richness of the platform's resources was highly recognised.

Enhanced interaction design:

Measures: Optimise the user interface and interaction methods, and add interactive elements, such as real-time feedback and virtual tutor guidance, to enhance the fun and engagement of learning. For example, enhance the interactivity between virtual teachers and students through voice recognition and synthesis technology; increase the personalised guidance function of virtual tutors to provide more targeted learning advice.

Case in point: After optimising the platform's interaction design, an art training institution saw a significant increase in student motivation and a 30% increase in classroom engagement.

Enhanced data security measures:

Measures: Establish a sound data management and protection mechanism to ensure the safety of students' learning data and personal information and enhance users' trust in the platform. For example, encryption technology is used to protect data transmission and storage; a strict data access rights management mechanism is established to prevent data leakage.

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Case: By introducing advanced data encryption technology, a platform has made significant progress in data security, and user trust in the platform has increased significantly.

Promote educational cooperation and research:

Measures: Collaborate with educational institutions and research institutes to carry out pedagogical research and practice, continuously optimise the functions of the platform and enhance the quality of teaching. For example, collaborate with universities, primary and secondary schools and arts training institutions to carry out teaching pilot projects, collect feedback and optimise the functions of the platform.

Case: A university music school worked with the platform development team to carry out a one-year teaching pilot project. By collecting feedback from teachers and students, the platform's teaching content and functions were optimised, and the teaching effect was significantly improved.

7.3. Conclusion and Outlook

Although there are still some problems and challenges in the practical application of the Digital Human Vocal Education Virtual Simulation Platform, the teaching effect and user satisfaction of the platform can be effectively improved through technical optimisation, teaching resource enrichment, interaction design enhancement and data security guarantee. In the future, with the continuous progress of technology and the deepening of educational cooperation, the Digital Human Vocal Education Virtual Simulation Platform will bring more innovations and breakthroughs to vocal education and promote the digital transformation of vocal education.

8. Conclusion

This study conducted a systematic analysis and discussion around the teaching value and promotion strategy of the virtual simulation platform for digital human vocal education. Through in-depth research on platform design, teaching functions, practical application effects and market promotion strategies, the following main conclusions are drawn:

1.Significant pedagogical value

The Virtual Simulation Platform for Digital Human Vocal Education integrates cutting-edge technologies such as artificial intelligence and virtual reality to provide an immersive and interactive learning environment. Empirical studies have shown that the platform has significant effects in enhancing students' vocal skills, strengthening learning interests and improving teaching efficiency. For example, the results of a pilot project in the School of Music of a university showed that students' pitch and rhythm accuracy increased by an average of 15 per cent after using the platform, the time taken to complete practice tasks was shortened by an average of 20 per cent, and more than 80 per cent of the students indicated that they were satisfied with their experience of using the platform.

2.Huge potential for rollout

With the advancement of education informatisation and the growth of personalised learning needs, the Digital Human Vocal Education virtual simulation platform has a broad application prospect in colleges and universities, primary and secondary schools and art training institutions. The influence and user base of the platform can be effectively expanded through various channels such as cooperation with educational institutions, participation in

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educational exhibitions and online promotion. For example, a platform demonstrated its interactive and personalised features at an education technology exhibition, attracting the interest of many visitors and gaining wide acclaim.

3.Problems to be improved

The current platform still has certain deficiencies in technical stability, teaching content richness and user interaction experience. In the future, it should strengthen technical research and development, enrich teaching resources, optimise user experience, and improve the overall quality and competitiveness of the platform. For example, by optimising the code architecture of the platform, reducing compatibility problems and increasing the testing of different operating systems and devices, the stability and reliability of the platform can be ensured.

4.The way forward

In the future, the virtual simulation platform for digital human vocal education will develop in the direction of greater intelligence, personalisation and efficiency. With the continuous maturation of artificial intelligence, big data, virtual reality and other technologies, the platform will have stronger interactive capabilities, and will be able to better simulate real teaching scenarios and provide a more personalised learning experience. For example, intelligence-driven virtual digital people will become the mainstream of the market, and their perceptual, expressive and cognitive abilities will be greatly improved, and their costs will further decline.

5.Conclusions and outlook

In summary, the virtual simulation platform for digital human vocal education is of great significance in enhancing the quality of vocal education, promoting educational equity and fostering educational innovation. In the future, with the continuous progress of technology and the diversification of educational needs, the platform is expected to play a greater role in a wider range of educational fields. Through continuous technical optimisation, enrichment of teaching resources, enhancement of interaction design and data security, the platform will bring more innovations and breakthroughs to vocal music education and promote the digital transformation of vocal music education!

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