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Research on the status and development pathways of artificial intelligence technology in dance education

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Abstract: This paper primarily explores the current status and development pathways of artificial intelligence (AI) technology in dance education. The research methodology is based on literature analysis. The study suggests that AI has great potential in areas such as dance movement analysis, choreography, and dance education equipment. The paper proposes three areas for reform and innovation in the future integration of AI with dance education: first, optimizing and upgrading dance teaching software and equipment; second, utilizing AI to promote students' autonomous learning; and third, integrating AI into dance teaching evaluation. Additionally, the integration of AI technology will help uncover valuable dance teaching resources, laying the foundation for innovation in dance education.

Key words: artificial intelligence; dance education; status; development pathways

1 Introduction

Artificial intelligence (AI) has recently become a major focus in dance education, playing a critical role in personalized learning, often achieved through adaptive games or training programs controlled by various software [1]. The demand for AI and machine learning among choreographers and dancers is growing, as working with these tools fosters greater creativity [2][3]. Dance education focuses on inspiring and guiding students' imagination and creative improvisation, while cultivating physical, cognitive, and emotional skills such as precision, musicality, expression, timing, and spatial awareness. As dance and technology continue to merge and influence each other, AI technology has the potential to transform traditional dance teaching methods, although the integration is still in its exploratory phase. This paper, based on a literature review, analyzes the application of AI technology in dance teaching and training, and proposes future development pathways for AI in dance education.

2 The status quo of artificial intelligence technology in dance education

2.1 Artificial intelligence technology and dance movements

Currently, AI technology can recognize and analyze dancers' movements to assess the accuracy and quality of their actions. This helps performers identify issues in their movements and make targeted adjustments in their training [4]. Some systems also provide real-time feedback and guidance, enabling dancers to improve immediately. Additionally, AI leverages deep learning models and pose estimation algorithms to recognize dancers' movements and skeletal key points. With precise pose recognition, AI can analyze a dancer's body lines, angles, and positioning, offering feedback for

optimizing performance. By comparing a dancer's movements with those of professional performers, AI can evaluate movement quality. Using machine learning algorithms and predefined criteria, AI systems can assess movement accuracy, coordination, and fluidity, and provide specific improvement suggestions.

In terms of movement timing analysis, AI employs motion sequence models and time-series algorithms to evaluate transitions, speed variations, and coordination between dance movements, offering deeper insights for improvement. Furthermore, AI can analyze dance style and emotions by recognizing visual features and emotional expressions in dance videos. By considering dancers' facial expressions, movement speed, and synchronization with music, AI can identify various dance styles and emotional characteristics, providing guidance for choreography and performance.

2.2 Artificial intelligence technology and dance creation

Artificial intelligence (AI) can provide inspiration and suggestions for dance creation and choreography based on dance rules and styles. By learning and analyzing a vast number of dance works, AI systems can generate new movement combinations, music-rhythm pairings, and spatial layouts, offering strong creative support to choreographers [3]. Current literature indicates that AI's main applications in dance choreography and creation include:

(1) Music rhythm and synchronization: AI can analyze musical features and rhythms, providing choreographers with suggestions for movement design and spatial layout that harmonize dance and music.

(2) Movement innovation and inspiration: AI, by learning from numerous dance works, can generate novel movement combinations and offer creative insights from different perspectives.

(3) Performance and emotional expression: AI can analyze dancers' emotions and performance, offering feedback on emotional expression in dance to help choreographers better convey the emotional content of their work.

(4) Interactive performance and virtual reality: By integrating virtual reality (VR) and augmented reality (AR), AI can create virtual scenes and props that interact with dancers, delivering an immersive stage experience for the audience [5][6].

Overall, AI's applications in dance encompass music synchronization, movement innovation, emotional expression, spatial layout, and interactive performance. These capabilities help enhance the artistic quality and visual appeal of dance, providing choreographers and dancers with richer creative and expressive tools.

2.3 Artificial intelligence technology and dance installation

The integration of artificial intelligence (AI) technology with virtual reality (VR) and augmented reality (AR) has opened up new possibilities for stage design and performance. By creating virtual scenes, characters, and props that interact with dancers, audiences can experience a more immersive and creative stage environment. In terms of intelligent stage layout and lighting control, AI can intelligently design stage settings and lighting effects based on the emotional needs and characteristics of the dance piece. By analyzing dance rhythms, musical expression, and dancers' movements, AI automatically adjusts the color, brightness, and angles of lighting to achieve optimal visual effects, enhancing the overall presentation of the performance.

Regarding the synchronization of stage imagery and performance, AI technology enables real-time interaction between projected imagery and dancers' movements. Through computer vision and image processing, AI captures dancers' motions instantly and projects corresponding visual effects onto the stage. This interactive performance not only enhances the visual impact but also introduces more artistic expression into the dance.

Additionally, AI has made breakthroughs in intelligent interaction between dance and music. By using sensors or wearable devices, AI systems can monitor dancers' movements and rhythms in real time and automatically adjust the music's tempo, volume, and sound effects accordingly, creating a seamless integration between dance and music. In VR and AR applications, audiences can wear VR headsets or use AR devices to enter a virtual dance space, interact with

virtual dancers, and even participate in the performance, significantly enhancing their engagement and immersive experience.

In summary, the application of artificial intelligence in intelligent stage design and interactive performance encompasses smart stage layouts and lighting control, interaction between stage imagery and performance, intelligent integration of dance and music, VR and AR experience, as well as emotional guidance and feedback. These applications not only enrich stage design and performance formats but also significantly enhance audience engagement and viewing experience, driving innovation and development in the art of dance.

3 Development path of artificial intelligence technology in dance education

3.1 Optimize and upgrade dance teaching software and equipment

The software and equipment used in current dance education are critical factors in promoting its high-quality development, but they also face several key challenges, including:

(1) High costs and equipment requirements: Advanced dance teaching software and equipment often require significant financial investment, such as computers, cameras, and virtual reality devices. This creates barriers for schools or educational institutions with limited resources, restricting the broad application and promotion of these technologies.

(2) Technological updates and adaptability: With the rapid advancement of technology, new dance teaching software constantly emerges, while older versions may struggle to keep up with the latest technical demands. Teachers and students need to continuously learn new technologies and update software to maintain their technical advantages and teaching effectiveness.

(3) Data security and privacy concerns: Dance teaching software typically requires the collection and storage of students' personal data and performance records. Ensuring the security of this data and preventing privacy breaches are key issues.

These problems hinder the digitalization of dance education to some extent. To promote the high-quality development of dance education, there is an urgent need to optimize software functionality, reduce costs, enhance technical support, and improve data security. Optimizing and upgrading software and equipment is a key aspect of integrating AI technology into dance education. In light of the existing software and hardware challenges, the following pathways are recommended for improvement:

(1) Technological upgrades and compatibility enhancements: Effectively utilize the latest technologies to upgrade and improve software, ensuring it can adapt to changing hardware environments and operating systems. The software should also be compatible with other tools and devices, providing stable performance and data interaction support.

(2) Providing training and technical support: Offer training and technical support to teachers and students to help them master the software's functions and techniques. This can include creating workshops, online tutorials, and video guides to answer questions that arise during use.

(3) Cost reduction and widespread adoption: Efforts should be made to lower the purchase and usage costs of dance teaching software and equipment, increasing its accessibility and feasibility. Collaborations with vendors to explore reasonable pricing strategies and promotion plans will better serve the practical needs of educators and students.

(4) Data security and privacy protection: Strengthen data security management to ensure that users' personal information and sensitive data are adequately protected. Establish secure storage and transmission mechanisms, encrypt and back up data, and mitigate risks of data leaks and misuse.

By implementing these measures, the functionality, ease of use, and safety of dance teaching software and equipment can be continuously improved, providing better resources for teachers and students, and advancing the development and

innovation of dance education.

3.2 The application of artificial intelligence technology to promote students' independent inquiry learning

In dance practice teaching, instructors should leverage artificial intelligence (AI) technology to innovate teaching methods. For instance, dance teachers can use advanced AI devices to identify human skeletal key points and analyze standard movements and extensive materials in foundational dance training through segmented learning. AI can generate training videos of students using visual capture technology and scientifically assess these videos to pinpoint the irregularities in students' movements.

In the context of dance teaching reform, schools can install AI-equipped mirror displays in dance studios to provide real-time corrections of students' dance movements and offer standard demonstrations. Additionally, AI voice technology can be introduced into the classroom, allowing students to wear one earphone to receive personalized error correction prompts from AI, while the other ear listens to the teacher's explanations. This approach enables real-time correction of movements while promoting independent learning.

AI technology in dance education aids teachers in obtaining accurate information about students' dance performance and offers real-time, personalized guidance. This technology supports student self-directed learning and helps teachers implement personalized instruction, thereby enhancing each student's basic dance skills. With the application of AI motion analysis technology, systems can scientifically analyze students' training data and generate detailed learning reports, highlighting areas for improvement and providing targeted coaching to address training challenges and blind spots, ultimately improving teaching effectiveness.

Furthermore, dance teachers can use AI technology to generate extensive data on students' dance training, optimizing teaching plans based on this data, and adjusting classroom content and teaching methods to better meet the personalized dance learning needs of contemporary students.

3.3 Integration of artificial intelligence technology and dance teaching evaluation

In school dance practice teaching, teachers should not rely solely on intuitive experience to evaluate students' dance training, as this approach may overlook learning blind spots. Therefore, dance teachers should effectively use big data technology to create a robust environment for analyzing teaching data, systematically collecting and organizing dance training data from both inside and outside the classroom. By conducting in-depth analysis of this vast amount of data, teachers can optimize teaching plans and strategies based on the results, thereby continually improving the overall quality of dance education [7].

When analyzing students' dance training data, teachers can use specialized artificial intelligence software for statistical analysis, gaining clear insights into students' understanding of dance theory and techniques. Based on this data, teachers can tailor personalized training programs for each student, helping them address learning blind spots and further enhancing the efficiency and quality of dance teaching. Additionally, after analyzing students' daily dance training data, teachers can use AI software to generate visualized training data reports. These reports can visually display each student's training outcomes, movement deviations, and skill development, aiding teachers in providing more objective evaluations. Students can also use this data to summarize and reflect on their learning status, enhancing their awareness of self-directed learning and self-assessment. This not only helps students improve their dance knowledge structure but also promotes their overall development in dance.

4 Conclusion

This paper explores the current status and development pathways of artificial intelligence (AI) technology in dance education. The study finds that while the integration of AI technology into dance education is significant, the application

scenarios are still relatively sparse, and a deep integration between the two has not yet been achieved. Based on this, the paper proposes three pathways to enhance the development of AI technology in dance education. As AI technology continues to advance, the development models and educational philosophies of dance education must also be innovated. By leveraging AI technology to uncover more valuable dance teaching resources, a foundation for innovation in dance education can be established.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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