Artificial Intelligence Empowers Higher Normal Music Education: A Critical Review, Curriculum Design, and Value Implications

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Abstract. In advancing educational digitalization, artificial intelligence (AI) technology has emerged as a pivotal force in reshaping the ecosystem of higher normal education. As the core institution for cultivating music educators in basic education, the quality of music education programs in normal universities directly determines the intelligent teaching competencies and innovative capabilities of future music teachers in primary and secondary schools. This study examines the necessity and implementation requirements for developing AI courses in music education programs through an analysis of AI curriculum frameworks and practical considerations. It further elucidates the multidimensional benefits of AI technology in teacher development, student cultivation, and institutional advancement within normal universities, providing theoretical references and practical pathways for the intelligent transformation of music education programs.

Keywords: Artificial Intelligence; Higher Normal Universities; Music Education; Curriculum Construction; Intelligent Education Literacy.

1. Introduction

With the rapid development of technology, the application of artificial intelligence in education has deepened continuously, expanding its coverage and bringing profound impacts to the entire education system. The early form of "Internet + Education" broke the time and space constraints of learning, and its powerful storage function enabled teachers and learners to access relevant course resources anytime and anywhere, allowing them to study in a planned and organized manner according to their schedules. With its continuous development, the phenomenon of "knowing the world without leaving home" has long been realized. The emergence of "Artificial Intelligence + Education" has further evolved from the original breakthrough [8] of time and space in rote teaching into a new modern teaching technology that cultivates creative thinking. This makes the teaching environment more flexible and personalized, and the teaching content more abundant and diverse. "Education is the foundation of a century-long plan." "Teachers are the foundation and source of education. The key to building a high-quality education system lies in building a high-quality teaching team." China's higher education, aiming to cultivate builders and successors of socialism, undertakes the major tasks of training specialized talents, developing science, technology, and culture, and promoting modernization. What kind of people to cultivate, how to cultivate them, and for whom to cultivate them are fundamental questions that China's normal universities must answer. With the continuous advancement of "Artificial Intelligence +", the wave of AI education applications has swept through the expanding capability demands of future teachers, prompting the transformation and upgrading of normal talent cultivation models further toward "Artificial Intelligence +". Intelligent educational literacy has become a necessity for future teachers to adapt to digital-era teaching and learning. As the reserve force of the teaching team, normal students play the roles of "students" and "future teachers", and their quality and ability system need to be reshaped and updated to adapt to the changes in the new era of intelligent education.

2. The Core Connotation and Realistic Consideration of Artificial Intelligence in Music Education in Higher Normal Universities

(1) The core connotation of artificial intelligence enabling music education in normal universities

In the 1960s, artificial intelligence first entered the field of music education, presenting unprecedented possibilities. The integration of "AI + music education" has transformed the educational ecosystem while posing new challenges to talent cultivation and teacher training. In March 2012, the Ministry of Education issued key documents including the "Ten-Year [9] Development Plan for Educational Informatization (2011-2020)", proposing to deepen the integration of information technology with higher education and innovate talent development models. In June 2016, the Ministry reiterated the need to enhance the convergence of information technology with teaching practices in the "13th Five-Year Plan for Educational Informatization", marking a milestone in China's educational informatization. In July 2017, the State Council [10] released the "New Generation Artificial Intelligence Development Plan", prioritizing the application of intelligent technologies to accelerate reforms in talent cultivation models and teaching methods, aiming to build [11] a new educational system featuring smart learning and interactive learning. This initiative vigorously promotes the development of intelligent education, digital education, cloud-based education, and knowledge graph applications. In 2018, the "Notice on Piloting AI-Driven Teacher Development Initiatives" issued by the Ministry of Education emphasized deepening the integration of AI and other new technologies with teacher development, helping educators proactively adapt to technological transformations and fostering the growth of intelligent educational literacy. In October 2022, the report from the 20th National Congress of the Communist Party of China further proposed requirements to "advance educational digitalization and build a lifelong learning society and a learning-oriented nation for all citizens". The "Compulsory Education Art Curriculum Standards (2022 Edition)" emphasizes the need to "utilize modern information technology to expand channels and methods for music learning." In January 2025, the Central Committee of the Communist Party of China and the State Council issued the "Outline for Building a Strong Education Nation (2024-2035)," which explicitly proposed the key task of "opening new development tracks and shaping new advantages through educational digitalization." These policy documents collectively highlight the pivotal role of AI-powered digital education in cultivating music teachers who meet the demands of the new era. With the rapid advancement of artificial intelligence and its growing applications in daily life and education, intelligent music teaching platforms, smart music assessment tools, and virtual reality technologies continue to emerge, further propelling music education into a new era of intelligent and personalized learning.

With the continuous advancement of science and technology, artificial intelligence has evolved from a distant concept in science fiction to become an integral part of our daily lives. Breakthroughs in fields like intelligent voice recognition, computer vision, and data mining have driven transformative changes across industries, generating innovative outcomes that are gradually replacing human roles in sectors such as automotive manufacturing, translation services, and healthcare. Even the realm of artistic creation is being reshaped by AI, impacting positions in composition, vocal performance, and instrumental playing. AI-powered music composition software now allows users to input specific styles and themes, automatically generating original musical pieces. While robotic performers can execute various instruments with precision, their performances still lack the nuanced expressiveness of human musicians. However, with ongoing technological progress, these AI instruments are becoming increasingly sophisticated. The integration of AI into music creation, performance, and education is opening new opportunities while bringing transformative changes to the industry. This shift poses unprecedented challenges for traditional music educators. Are today's music teachers facing the looming threat of being "replaced"?

(2) Realistic reflection on the application of artificial intelligence in practical music teaching

In the age of artificial intelligence, music educators must proactively transform their roles and continuously enhance their professional competencies to meet the demands of modern music

education. AI technology now permeates music classrooms and open teaching sessions, indicating that some teachers have recognized its importance and begun integrating it into instruction. However, practical implementation still faces two major challenges: superficial application of technology and homogenized teaching outcomes. Many educators remain trapped in basic AI usage, employing low-level tools that lack depth and innovation. For instance, virtual avatars often mechanically recite biographies like "Hello everyone, I'm Nie Er" or mechanically repeat lyrics without incorporating musical elements such as melody, rhythm, or emotional nuance. Similarly, while some use AI to create music videos, these often reduce content to mere text-image combinations, failing to engage students with the essence of musical works. While these tools replace traditional lecturing, they maintain the essence of spoon-feeding knowledge. Though they may briefly capture students' attention, the temporary appeal stems from the "humorous" or "weird" delivery of digital avatars rather than genuine musical understanding. With the empowerment of AI technology, teachers should consider whether students have gained a deeper understanding of the connections between musical elements like melody, rhythm, and harmonic forms in works; whether it enhances students 'abilities in singing, appreciation, and composition; and whether it effectively addresses key teaching challenges, stimulates learning interest, and resolves students' questions.

Furthermore, "low-level" AI teaching methods not only fail to sustain students' learning interest but also risk causing aesthetic fatigue through prolonged use, ultimately triggering resentment and resistance. Some music majors in teacher training colleges observe that "current AI applications in classrooms remain superficial, offering minimal assistance in enhancing musical learning capabilities." In actual classes, students even cover their eyes with hands upon encountering digital avatars, exclaiming "Why is it AI again?" This phenomenon primarily stems from educators treating AI merely as a generic teaching aid without effectively integrating it with their unique pedagogical approaches to better serve music education. Consequently, AI has become perceived as a "handcuff" and an "additional burden" rather than a valuable tool.

Therefore, the establishment of artificial intelligence courses is an inevitable requirement in response to the national education digitalization strategy, with human-machine collaboration becoming the mainstream paradigm of future learning. Within the context of music education in teacher training institutions, AI courses are not merely technical training programs. Instead, they form an interdisciplinary curriculum system that integrates AI principles, musical discipline characteristics, and pedagogical laws, guided by the needs of music education. The core objective is to cultivate teacher trainees' mindset for actively applying new technologies in daily learning and life, as well as their practical ability to leverage AI technology to solve real-world challenges in music education and drive innovative teaching models. This transforms AI technology from a simple auxiliary tool in music education into a crucial instrument [12] for addressing fundamental questions about how teacher trainees should "develop," "teach," and "educate." It guides students to evolve their understanding of AI tools from "low-order cognitive levels" to "higher-order cognitive goals" through questioning, exploration, and expansion.

3. Practical Needs and Developmental Goals for AI Course Implementation in Music Education at Teacher Training Colleges

As the wave of intelligence sweeps across the globe and technological applications reach unprecedented levels, traditional industries are undergoing fundamental transformations in their core logic. Production models, service formats, and competitive landscapes are being redefined. Only by proactively embracing technological innovation and accelerating upgrades can industries avoid being left behind and seize opportunities in emerging fields. The introduction of AI courses in music education programs at teacher-training universities isn't merely following technological trends. It represents a strategic choice driven by the current realities of music education in teacher-training institutions, evolving demands for music educators in basic education, and the inherent logic of

professional development. The core value lies in establishing a virtuous cycle system that fosters "teacher development and student growth."

(1) The practical need to solve the shortcomings of music teachers' intelligent education literacy in normal universities

Currently, music faculty in higher education institutions generally lack sufficient AI teaching competencies. Some teachers in normal universities still adhere to traditional teaching models, focusing solely on subject-specific knowledge. The absence of systematic IT education background directly prevents teachers from effectively teaching AI application methods in classrooms, creating a vicious cycle where "teachers hesitate to use AI, students [13] naturally struggle to learn it." Research indicates that approximately 70% of music teachers harbor unspoken eagerness to master AI technology, while 20%-30% have only superficial understanding but face practical barriers like passive acceptance. Therefore, AI course implementation serves dual purposes: enhancing teachers' professional capabilities while enabling students to better comprehend relevant technologies to meet modern demands. Through this teaching-learning synergy, educators deepen their own understanding of AI applications while instructing students, effectively breaking the "double-edged sword" dilemma caused by insufficient AI teaching competencies among teachers and inadequate AI learning abilities among students.

(2) It is an inevitable requirement to cultivate music teachers who can meet the digital needs of basic education

With the ongoing digitalization of basic education, primary and secondary schools are placing higher demands on music teachers' digital literacy. Currently, most schools have equipped themselves with smart music classrooms and AI-powered teaching software, yet these intelligent devices often remain underutilized due to a shortage of music teachers proficient in AI applications. Moreover, many schools now require AI application skills as a mandatory qualification for music teacher recruitment. However, graduates from music education programs at teacher training colleges often lack specialized AI knowledge, creating a persistent mismatch between job seekers and employers. To bridge this gap, AI system courses tailored for music education majors are being developed. Centered on the core objective of "music education in basic education," these courses aim to equip teacher trainees with practical AI technologies to address real-world teaching challenges. Through systematic learning, students not only develop solid music expertise but also gain knowledge of AI applications in music instruction. This approach cultivates versatile professionals with "music specialization + digital literacy," enabling them to swiftly adapt to the digital demands of music education and transition smoothly from "students" to "educators."

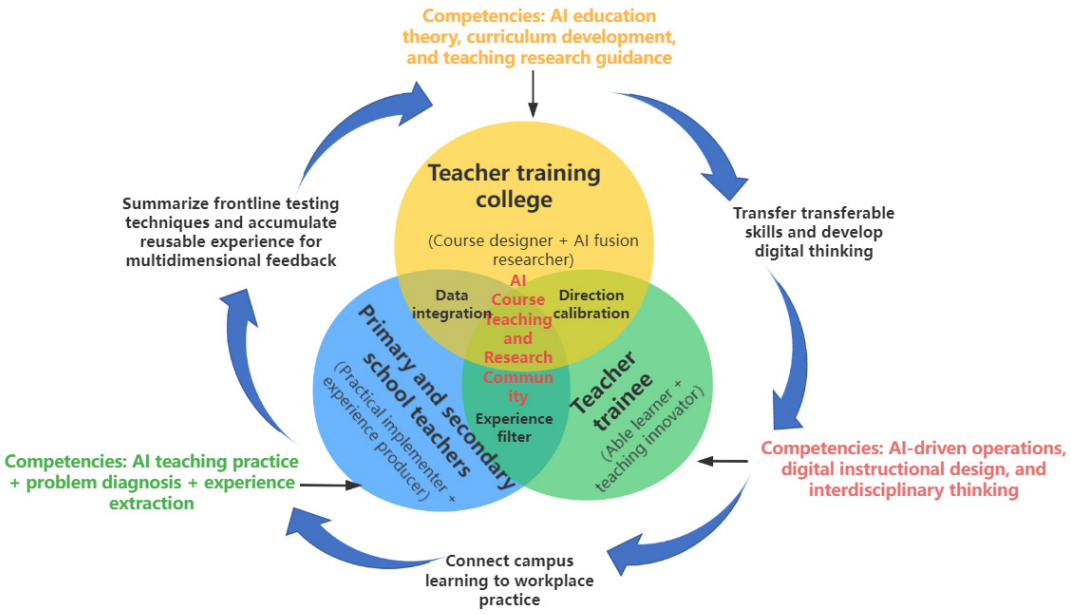

Figure 1. AI Course Teaching and Research Community's Circular Development Framework

(3) A critical approach to drive the sustainable development of AI curriculum research communities that foster mutual growth between teaching and learning

The core mission of music education in teacher training universities is to cultivate future music educators, which requires a curriculum system with sustainable development. Offering AI courses in higher education institutions can establish a professional development cycle spanning "teacher educators – teacher trainees – primary/secondary school teachers". On one hand, teacher educators enhance their expertise by teaching AI courses and guiding student learning processes, thereby continuously improving their professional competence. On the other hand, teacher trainees should develop interdisciplinary thinking integrating "AI + subject-specific expertise" during their studies, applying these capabilities to teaching practices. Meanwhile, through internships, teaching research activities, and feedback from AI education experiences in basic education to universities, this creates a cyclical development model that drives the sustainable growth and refinement of music education in higher institutions.

4. AI-empowered Development of Music Education Curriculum and System Refinement in Higher Normal Universities

The impact of intelligentization on education and teaching extends from the intelligent iteration of teaching tools to the transformation of teaching models, from the digital upgrade of evaluation systems to the comprehensive transformation of educational objectives. This requires teacher training institutions to take proactive actions under the guidance of new educational technologies represented by intelligentization, translating leading concepts into practical implementation while conducting educational work with scientific rigor and innovative approaches. The content of artificial intelligence courses in music education at teacher training colleges should revolve around the principle of "technology as the foundation, music as the application, and education as the soul" in curriculum system construction, faculty team development, practical platform establishment, and evaluation mechanism improvement. Through systematic design and strategic planning, a structured practical pathway should be created to ensure AI technology truly serves the essential goals of music education in teacher training institutions.

(1) Curriculum Enhancement: Developing tiered AI compulsory courses

The core of AI courses is to adapt to the needs of music education. It is necessary to avoid the tendency of "emphasizing technology and neglecting teaching", and to deeply integrate the concept of intelligent education into the talent training program. It is necessary to build a hierarchical and progressive curriculum framework that is deeply integrated with practice, which can be divided into two levels.

1. Basic cognition layer

By offering compulsory courses in AI education applications and data-driven teaching methodologies, educators and students can systematically explore the technical principles and practical implementations behind cutting-edge technologies. Starting with the fundamental connection between AI technology and music education, this program equips students with essential AI knowledge, fosters an understanding of intelligent education, and helps overcome initial apprehension about AI. The curriculum covers core AI fundamentals, generative AI concepts, AI-powered music creation tools, AI-assisted practice systems, AI music data analysis software, and specific requirements for information technology applications outlined in digital music education policy documents.

2. Practical Operation Layer

This module focuses on hands-on training in AI tools for music education, enabling students to master AI tools tailored for music teaching scenarios. It guides learners in selecting appropriate AI software and technologies based on practical teaching needs, avoiding the pitfall of excessive technical accumulation. The course structure is organized by music teaching modules, featuring targeted practical sessions. Since music teachers are unlikely to independently develop required AI

teaching software, identifying suitable tools in the market becomes crucial. The program emphasizes discovering multi-sensory interactive AI tools that foster students' independent exploration of music fundamentals, thereby enhancing classroom instruction and embodying the principle of technology serving students. Examples include AI tools for music resource creation (e.g., Jianying, Doubao, Heygen+Al Script Generator), AI platforms for music skill training (e.g., Rhythm Trainer, Vocalive), AI tools for music analysis and evaluation (e.g., Mubert Music Analysis Platform), and AI platforms for music teaching management (e.g., Chaoxing Learning Hub, Yu Classroom).

(2) Human-Machine Collaboration: Building an AI Faculty Development Team with Dual-Led Mentorship

As the primary implementers of AI curriculum implementation, music teachers in teacher-training universities should fully leverage their educational expertise and utilize both internal talent cultivation and external recruitment. Building on this foundation, they should actively promote multi-stakeholder collaborative education through school-enterprise co-research and teaching collaboration, guiding teachers to effectively integrate advanced AI technologies into classroom instruction. This will cultivate a dual-qualified music faculty group with both professional musical competence and AI education capabilities. Simultaneously, partnerships with AI education enterprises and IT-focused universities should be strengthened. Based on current AI teaching platform technologies and individual teacher characteristics, tiered AI course development and application training should be implemented. Entry-level training covering "AI fundamentals + music teaching tool operation" should be provided for less experienced teachers, while intermediate-level programs focusing on "AI instructional design + data analysis" cater to those with foundational knowledge. Senior faculty members should receive advanced training in "AI teaching innovation + project development," ensuring all educators can adapt to AI-driven teaching demands. Through organizing teaching practices and establishing AI music pedagogy research groups, regular seminars should be conducted to address AI curriculum design, teaching method selection, and technical challenges. Furthermore, teachers should be encouraged to apply AI technologies in daily instruction. Public demonstration classes and "AI+music teaching" workshops should be organized to enhance practical skills. Teachers are required to design teaching plans for specific course modules, conduct trial lectures, and continuously refine classroom processes through peer evaluations, student feedback, and expert guidance. Schools may also invite industry experts, AI education technology specialists, developers of intelligent teaching platforms, and outstanding AI music teachers from primary and secondary schools to deliver specialized lectures for their faculty and students. This initiative helps students gain insights into the cutting-edge applications of AI technology and practical teaching experiences from frontline educators.

(3) Intelligent Support: Building a cross-school AI teaching practice platform

Teaching practice forms the core objective of AI education. We should establish a cross-institutional AI teaching platform that integrates virtual and physical environments, enabling students to engage in authentic AI-based learning experiences. This involves creating specialized labs such as AI music composition workstations, VR virtual concert halls, and smart music teaching terminals (including AI-powered pianos and practice companions) to provide immersive learning environments. Beyond hardware, implementing learning analytics systems and AI evaluation tools will help students trace the origins of their instructional data and outcomes. Furthermore, we should consolidate high-quality AI music educational resources from both domestic and international sources to build a comprehensive AI music teaching resource library. This repository should include AI teaching tools, case studies, virtual simulation scenarios, and music education datasets for K-12 schools, supporting students' practical training. Additionally, establishing AI music teaching practice bases in collaboration with primary and secondary schools will facilitate student internships, teaching observations, and volunteer teaching activities tailored to educational needs. Through these initiatives, students will proactively apply intelligent tools to solve problems during simulated teaching and practical training, cultivating essential competencies and practical skills required for the future

intelligent education ecosystem. This approach will solidify the talent foundation for the intelligent transformation of the music education industry.

(4) Tripartite collaboration: Establishing a multi-dimensional AI course evaluation mechanism

A scientific evaluation mechanism can ensure the quality of AI courses by transcending the limitations of traditional "paper-and-pencil tests". A diversified evaluation system integrating written exams, online assessments, and practical internships should be established to assess students 'theoretical knowledge mastery and the implementation of digital education. Additionally, a collaborative evaluation framework involving school teachers, students, and primary/secondary school educators should be implemented. Teacher evaluations should take center stage, with music teachers assessing students' daily assignments, project proposals, and classroom practice completion. Student self-assessment combined with peer evaluation should include self-evaluation of learning progress and skill development, as well as group evaluations focusing on individual contributions and teamwork during collaborative projects. Teachers from practice bases should comprehensively evaluate students' classroom effectiveness, interactive abilities, and problem-solving skills in real teaching scenarios. By combining formative and summative assessments through a "evaluate-improve-evaluate" cycle, feedback should be continuously updated and provided to students. Based on these evaluations, AI course content and teaching methods should be refined iteratively until meeting quality standards, ultimately improving student performance and elevating teaching standards.

5. The Multi-Dimensional Value and Contemporary Significance of Artificial Intelligence Enabling Music Education in Higher Normal Universities

The promoting effect of AI technology on music education in normal universities is not a single-dimensional technology empowerment, but a comprehensive transformation covering "teacher development, student training and school construction", which can promote the goal of quality improvement of music education in normal universities.

(1) Teacher Development: From "Traditional Teaching Craftsman" to "Intelligent Instructional Designer"

AI technology can drive dual transformations in the professional roles and teaching capabilities of music educators in teacher training institutions. On one hand, AI replaces teachers in handling repetitive, mechanical, and labor-intensive tasks, allowing educators to focus more on teaching innovation and student development – evolving from mere knowledge dispensers to true guides in students' growth. On the other hand, AI visualization in music theory instruction transforms abstract harmonic progressions and form structures into dynamic diagrams, enabling teachers to explain complex concepts more intuitively. This addresses the traditional issue of overly detailed explanations that hinder student comprehension. Moreover, when AI-focused courses are integrated into teaching, they continuously motivate educators to deepen their understanding of interdisciplinary integration between music education and AI technology, while learning digital design principles and practical applications. This approach facilitates better implementation of digital teaching methods in actual instruction, equipping students with dual competencies in both music pedagogy and digital technology. With the rapid evolution of AI, music teachers must break free from their comfort zones, actively embrace new technologies, and explore innovative teaching methods. Through persistent exploration in AI course instruction, they can cultivate themselves into "dual-qualified" educators who proactively adapt to the demands of educational digitalization.

(2) Student development: evolving from passive knowledge recipients to active practitioners of smart literacy

As the core reserve force for future music teachers in basic education, the development of teacher candidates 'competency system directly determines the quality of digital music education in primary and secondary schools. AI technology enhances teacher candidates' comprehensive qualities through

three dimensions: learning ability, practical ability, and innovation ability. In terms of learning ability, AI technology provides personalized guidance to overcome academic challenges, improve learning efficiency, and help students break free from passive reliance on teachers to solve problems, enabling them to independently plan and resolve issues. Meanwhile, AI's visualization capabilities transform abstract knowledge into more concrete forms, further assisting students in understanding and mastering concepts. Regarding practical ability, AI technology offers simulated teaching platforms that allow students to accumulate substantial teaching experience before graduation, thereby enhancing their employability. On the innovation front, AI tools like music editing software help students create and better express innovative works. It also inspires students' thinking through new perspectives and methods to understand digital teaching approaches, driving innovative teaching designs and developing more creative teaching models, ultimately cultivating future innovative music educators. As a "learning by doing" approach, AI learning provides extensive hands-on experience in intelligent teaching, promoting the integration of artificial intelligence with pedagogy while enabling continuous learning of AI foundational theories and practical application skills before graduation, thus facilitating professional development.

(3) School development: From "traditional teacher education" to "intelligent education ecosystem"

Artificial intelligence can drive the connotative development of music education programs in teacher training colleges and enhance their competitiveness. By retaining core music education courses while introducing "AI technology + music specialization" modules, the curriculum system is optimized. Building on this enhanced structure, the AI-powered teaching resource library enables shared access to premium materials, eliminating redundant development efforts among faculty. Furthermore, AI virtual laboratories and instrument studios break geographical constraints, allowing students to practice performances and choral conducting without physical space limitations. This innovation effectively alleviates resource shortages in teacher training institutions.

The core mission of music education in teacher training institutions is to serve basic education, with AI technology creating new synergies between these two domains. By establishing an AI-powered collaborative platform connecting teacher training colleges and primary/secondary schools, these institutions can transform real-world teaching needs into AI-driven course materials, making curriculum content more practice-oriented. For teacher trainees, this enables them to apply acquired knowledge in authentic teaching scenarios during AI-based internships. Simultaneously, teacher training colleges can utilize AI data analytics to track the effectiveness of student internships in primary/secondary schools and optimize their AI curriculum systems accordingly. This creates a closed-loop system where basic education demands drive curriculum reforms in teacher training, which in turn enhances teaching capabilities for student teachers and feeds back into basic education, achieving coordinated development between music education in teacher training and foundational education. Additionally, AI technology facilitates collaborations between music education programs in teacher training colleges, primary/secondary schools, and enterprises, fostering a "industry-education integration and school-enterprise partnership" model. This elevates the social service capabilities of professional programs and advances the development of intelligent education ecosystems.

6. Conclusion

In the era of educational digitalization, artificial intelligence has become a pivotal force reshaping development patterns across industries. AI technology now serves as the core engine driving profound transformations in music education at teacher training institutions, making its integration with such programs not an optional choice but an imperative. The introduction of AI system courses in music education majors at teacher training institutions not only fulfills national educational digitalization strategies and innovation-driven development requirements, but also addresses the critical shortage of qualified teachers for music education digital transformation in basic education. It represents a

crucial measure to meet the urgent demand for innovative music educators in modern primary and secondary schools, while serving as the sole pathway for music education majors to break through traditional development bottlenecks, enhance core competitiveness, and cultivate high-quality music teachers with digital literacy and innovative capabilities. As the historic opportunities of accelerated information society evolution rapidly diminish, music education majors at teacher training institutions must abandon passive attitudes, break free from path dependence, and seize the digital race with a sense of urgency. By deepening AI integration research in music education, optimizing AI curriculum systems, and comprehensively improving the digital literacy of teachers and students, we can accelerate the construction of a new music education ecosystem characterized by "technology empowerment, music-based education, and educational innovation." This will solidify the foundation of qualified teachers for China's digital transformation in basic education music education. The research on this topic is not only vital for the survival and development of music education at teacher training institutions, but also directly impacts the future direction of China's music education sector. Its necessity and urgency have become increasingly evident and cannot be delayed.

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