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Research on the Challenges and Pathways of AI-Driven Digital Transformation in University Aesthetic Education

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Abstract: While artificial intelligence (AI) presents new opportunities for the digital transformation of aesthetic education in higher education, it also introduces significant challenges. These include an imbalance between instrumental and value rationality, a mismatch between technological capabilities and the needs of aesthetic education, inefficient resource development and sharing, outdated teaching models, and insufficient digital literacy, as well as gaps in evaluation systems. To address these issues, this study proposes a strategic framework for transformation: guiding technology use with the principle of "aesthetic cultivation", developing a supportive and adaptive technological infrastructure, fostering a high-quality, shared digital resource ecosystem, redesigning human-AI collaborative teaching models, and establishing a multidimensional evaluation system that integrates technical and artistic criteria. These recommendations aim to facilitate the digital evolution of aesthetic education in the AI era, ultimately nurturing a new generation with refined aesthetic sensibilities and creative capabilities.

Keywords: AI; University aesthetic education; Digital transformation; Challenges and pathways

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1. Introduction

Aesthetic education plays a pivotal role in higher education by cultivating students' aesthetic appreciation and humanistic literacy. With the implementation of relevant policies, university aesthetic education has entered a period of unprecedented development. Concurrently, artificial intelligence (AI) is profoundly reshaping the educational landscape. Generative AI, VR/AR, and other emerging technologies provide robust support for content creation, scenario simulation, interactive experiences, and personalized learning in aesthetic education.

The integration of aesthetic education and AI represents both an inevitable trend in technological empowerment and a crucial solution to longstanding challenges such as uneven resource distribution, rigid teaching models, and simplistic evaluation methods. However, this integration faces inherent tensions between

technological rationality and artistic sensibility, between efficiency-driven approaches and the fundamental purpose of education, and between instrumental applications and value-oriented guidance.

Given these challenges, a thorough analysis of transformation obstacles and the exploration of strategic pathways are essential for achieving high-quality digital aesthetic education. This study aims to address these critical issues and propose actionable solutions.

2. Challenges in AI-driven digital transformation of aesthetic education in higher education

2.1. Imbalance between instrumental and value rationality

Max Weber distinguished between value rationality (focusing on the intrinsic worth of actions) and instrumental rationality (emphasizing means to achieve ends) [1]. In university aesthetic education, these should complement each other — value rationality establishes the direction of "cultivating people through beauty", and instrumental rationality provides technical support. However, the digital transformation process has witnessed an imbalance where instrumental rationality expands while value rationality diminishes.

Under instrumental rationality dominance, aesthetic education faces the predicament of "means replacing ends." Excessive emphasis on quantifiable metrics like AI adoption rates, digital resource quantities, and platform engagement reduces aesthetic evaluation to algorithmically measurable parameters (color schemes, compositions, etc.), while neglecting whether these technologies genuinely cultivate students' aesthetic literacy. This approach severs essential value dimensions like emotional resonance and cultural understanding, gradually diverting aesthetic education from its core purpose and reducing it to a mere technological appendage.

The weakening of value rationality exacerbates the loss of fundamental educational values. The ultimate goal of "aesthetic cultivation", cultivating people through beauty, aims to holistically develop students' aesthetic sensibility, nurture character, enrich spiritual life, and stimulate creative vitality — all value-rational objectives that resist quantitative measurement [2–3]. When technological applications dominate teaching, the humanistic essence of aesthetic education becomes marginalized: emotional experiences yield to virtual interaction convenience, and personalized creation gives way to standardized templates. This rational imbalance constitutes the profound theoretical foundation of value cognition dilemmas in the digital transformation of university aesthetic education.

2.2. Structural mismatch between AI technical characteristics and aesthetic education needs

The application of artificial intelligence technology in university aesthetic education teaching faces significant structural compatibility challenges, stemming from inherent tensions between AI's technical characteristics and the fundamental requirements of aesthetic education. At its core, aesthetic education aims to enhance human aesthetic experience and perception, pursuing spiritual connections, emotional resonance, and meaningful engagement [4]. In contrast, AI technology operates on principles of standardized data processing, algorithmic logic, and quantifiable outputs — creating a fundamental divergence in operational mechanisms.

Most current AI tools are developed for general purposes without deep customization for aesthetic education pedagogy, leading to a disconnect between technical application and teaching needs. For example, AI painting tools can quickly generate images but often fail to accurately capture the emotional expression and cultural connotations in student creations; intelligent evaluation systems can analyze the formal elements

of works but cannot fully interpret their humanistic value. This "mismatch" greatly diminishes the potential benefits of AI integration.

Furthermore, a contradiction exists between the rapid evolution of AI technology and the stability requirements of higher education systems. While AI algorithms and tools undergo constant innovation, university curricula and teaching plans require rigorous evaluation and pilot testing before implementation — creating an inherent pace discrepancy in adoption.

Moreover, inadequate hardware and software infrastructure remain a significant challenge in technology adoption. Due to budget constraints and limited equipment, many universities lack the necessary smart devices, computing resources, and network capabilities to fully support digital art education. As a result, technological integration remains superficial, failing to meaningfully enhance core teaching and learning processes

2.3. Dual obstacles of extensive resource construction and the sharing mechanism

The quality problem of digital aesthetic education resources is a prominent shortcoming in the transformation process. At present, there is a tendency towards a quantity-over-quality approach in digital resource creation. A large number of resources lack systematic issues, including fragmented content and excessive homogenization. Many resources merely digitize traditional materials without AI-enhanced innovation, and cannot fully convey the emphasis on emotion, experience, and perception in aesthetics [5]. At the same time, overemphasis on technical presentation may lead to the weakening of the educational function of resources, including emotional, experiential, and perceptual dimensions of aesthetics.

The imperfect resource-sharing mechanism restricts the exertion of resource efficiency. Barriers exist in sharing digital art education resources between universities and between academic institutions and social organizations, compounded by the lack of uniform standards and a centralized sharing platform. While AI technology offers the potential to facilitate resource exchange, the absence of supporting institutional frameworks and benefit-sharing mechanisms prevents high-quality resources from being equitably distributed across regions and institutions.

2.4. Synergistic shortcomings of teaching model inertia and digital literacy

The path dependence of traditional aesthetic education teaching models forms a strong resistance to digital transformation. For a long time, traditional aesthetic education teaching has been teacher-centered, with students passively accepting knowledge, making it difficult to stimulate their aesthetic subjectivity [6]. Some teachers have insufficient understanding of digital transformation, lack the awareness of active reform, and are still accustomed to traditional teaching processes, resulting in AI technology being difficult to integrate into the entire teaching process.

The insufficient digital literacy of teachers is also a key bottleneck restricting transformation. Currently, most art education instructors in higher education lack adequate digital competencies, with systemic training programs remaining underdeveloped. Some teachers have a fear of AI technology and find it difficult to effectively apply it to teaching design, resource development, and teaching evaluation. At the same time, excessively relying on AI tools for teaching decision-making may lead to an imbalance in pedagogical priorities, where technical efficiency overshadows the essential humanistic dimensions of art education. These also result in the "dehumanization" of the teaching process and deviating from the educational essence of aesthetic education.

Differences in students' digital learning abilities also exacerbate teaching challenges. There are significant differences in students' acceptance and mastery of AI tools. Some students can quickly adapt to the digital teaching environment, while others, especially those with weak technical foundations, may affect their learning effects due to unfamiliarity with tool operations and even generate learning anxiety. This difference may lead to a "digital divide" in aesthetic education teaching, affecting educational equity.

2.5. Gap between technical quantification and aesthetic experience in teaching evaluation

The conventional evaluation framework for aesthetic education struggles to meet the demands of digital transformation. Current systems predominantly rely on quantitative metrics, such as scores and grades, which fail to adequately assess the humanistic dimensions central to aesthetic learning in an AI-enhanced environment. Key qualities like depth of aesthetic experience, emotional resonance, creativity, and critical thinking remain underrepresented in these assessments.

While AI technologies offer new possibilities for evaluation—such as automated analysis of visual compositions through image recognition and data processing—their current applications are limited. Most AI-driven tools focus on formal attributes of artwork (e.g., technique, color, or composition) but cannot effectively evaluate subjective dimensions such as emotional depth, cultural significance, or innovative intent. This technological constraint hinders the potential for more nuanced, holistic assessment in aesthetic education.

Furthermore, the application of AI technology to evaluate complex artistic processes, such as improvisation, collaborative creation, and critical appreciation, lacks established standards and reliable assessment tools. Moreover, the transparency and interpretability of AI evaluation models are insufficient, which may imply cultural and style biases brought by training data, and the fairness and educational nature of evaluation results are easily questioned.

3. Pathway reconstruction for AI-driven digital transformation in university aesthetic education

3.1. Cultivating people through beauty, reconstructing the logic of aesthetic education value, and leading technology

The key to solving the imbalance between instrumental and value rationality lies in reconstructing the logical relationship of "value leading technology" to realize their complementary coexistence.

First, establish a correct concept of artificial intelligence use, clarify the core position of the ultimate goal of "cultivating people through beauty" in digital transformation, and take the improvement of students' aesthetic literacy as the fundamental evaluation standard for transformation. In the links of teaching goal design, technical application planning, and resource development, priority is given to whether it serves the deepening of aesthetic experience and the cultivation of humanistic spirit, rather than simply pursuing technical coverage or efficiency indicators.

Second, standardize the application boundary of instrumental rationality and establish a "technical adaptability evaluation mechanism" to screen the application scenarios of AI technology in aesthetic education teaching to avoid technical abuse. For example, in aesthetic evaluation, algorithms can assist in analyzing the formal characteristics of works (color, composition, etc.), but must combine teachers' subjective interpretation of emotional connotation and cultural value. At the same time, build a "value-tool" collaborative evaluation system, break through the limitations of a single quantitative indicator, and design a multi-dimensional

evaluation framework covering "technical efficiency" and "educational value." Pay attention to both the instrumental rationality dimensions, such as the application efficiency of AI tools and the accessibility of resources, and more importantly, the value rationality dimensions, such as the depth of students' aesthetic perception, the independence of aesthetic judgment, and the improvement of humanistic literacy, to avoid the transformation falling into the misunderstanding of "technology-only theory."

3.2. Demand-oriented development of a techno-pedagogical support system for aesthetic education

Promoting the deep integration of technology and aesthetic education based on demand is the core path to breaking through the adaptability dilemma. Universities should collaborate with technology developers to create specialized AI tools and platforms that precisely align technical capabilities with the emotional and creative requirements of aesthetic pedagogy, particularly focusing on intelligent systems that support personalized learning, immersive experiences, and creative expression, such as emotion-aware interactive teaching platforms and culturally-sensitive creative assistance tools.

Strengthening the technical support system is essential for ensuring a successful transformation. Universities should increase investment in digital infrastructure for aesthetic education, including smart devices, high-speed networks, and computing centers. Crucially, they must establish coordination mechanisms between technological upgrades and teaching adjustments to balance innovation with system stability.

Collaboration with industry partners is essential to deploy dedicated technical support teams. These teams can test new algorithms and tools in real teaching environments, identify the most compatible solutions, and provide ongoing training and guidance to faculty, reducing the burden of technology adoption.

3.3. Building a high-quality shared digital resources ecosystem for aesthetic education

Establishing a standard system for high-quality digital resources is the prerequisite for improving resource quality. Universities should cooperate with aesthetic education experts and educational technology experts to formulate construction standards for digital aesthetic education resources. In terms of technical dimension, combined with AI interactivity and immersive characteristics, develop innovative forms such as virtual art exhibition halls and interactive creative tools; in terms of humanistic dimension, strengthen the cultural connotation and educational value of resources, ensure that the content covers aesthetic thoughts, art history context and cultural spirit, and avoid the disconnection between technical presentation and humanistic core.

A robust quality assurance system requires the formation of interdisciplinary review panels consisting of aesthetic education experts, technical specialists, and practicing educators. These panels should conduct thorough evaluations based on three key criteria: educational effectiveness, artistic merit, and technical implementation.

To optimize resource utilization, a three-tier sharing platform (national-regional-institutional) should be established with standardized formats, metadata protocols, and access specifications to facilitate cross-institutional collaboration. Sustainable participation can be encouraged through equitable incentive mechanisms, including intellectual property protection and revenue-sharing models, thereby motivating universities, museums, and galleries to contribute high-quality resources.

Blockchain technology offers an effective solution for digital rights management, particularly in establishing clear attribution for both traditional and AI-generated content. This technological approach

addresses copyright challenges while simultaneously stimulating ongoing innovation in resource development. Together, these measures create an integrated framework that balances technological advancement with educational integrity in digital aesthetic education.

3.4. People-oriented, reshaping the human-machine collaborative teaching model for aesthetic education

The rapid development of artificial intelligence has promoted significant changes in the talent training model in the field of higher education, transforming the teaching model from a "teacher-student" binary structure to a "teacher-machine-student" ternary structure [7]. In this context, college teachers should integrate AI technology into the entire process of teaching design and build a new "human-machine collaborative, student-centered" teaching model. In theoretical teaching, use VR/AR technology to create immersive art scenes, combine with AI voice interaction to achieve in-depth interaction with virtual art scenes, and enhance students' aesthetic experience; in practical teaching, carry out "technology-assisted creation" teaching with the help of AI creative tools, guide students to regard AI as a tool for realizing creativity rather than a substitute, such as using AI to generate first drafts and then deepen emotional and cultural expression through independent modification and secondary creation, cultivating the composite ability of "technical application + humanistic thinking."

In this process, improving the digital literacy of teachers and students is crucial. Colleges should incorporate digital literacy into the core competency requirements of aesthetic education teachers, formulate systematic training plans covering AI technology foundation, teaching application strategies, data analysis methods, and ethical norms.

At the same time, pay attention to the differentiated cultivation of students' digital learning abilities. Offer general courses on "AI and Aesthetic Education" to help students master basic AI tool usage methods and digital learning strategies, and improve their adaptability to technical applications. Establish learning support systems, provide one-on-one tutoring and resource push for students with weak technical foundations, and alleviate learning anxiety through peer mutual assistance and online Q&A to ensure that all students participate in the digital teaching process equally.

3.5. Constructing a multidimensional teaching evaluation paradigm integrating skills and artistry for aesthetic education

The reform of teaching evaluation in the intelligent era needs to pay attention to both the accuracy and efficiency of technology and the aesthetic and humanistic nature of art [8]. Building a "technology + art" diversified evaluation system is the core to breaking through the evaluation dilemma. Colleges should break the limitations of traditional evaluation systems, establish multi-dimensional evaluation indicators covering knowledge mastery, skill application, emotional experience, cultural perception, and innovation ability, and incorporate value rational dimensions into core indicators.

In terms of evaluation subjects, form a human-machine collaborative evaluation model of "AI tools, teachers, students, social experts." AI tools are responsible for the objective analysis of formal elements of works and learning behavior data, teachers focus on the subjective evaluation of emotional connotation and cultural value, students develop reflective ability through self-evaluation and mutual evaluation, and social experts participate in the evaluation of the innovation and social value of works, ensuring the comprehensiveness and objectivity of evaluation and realizing the complementarity of "machine objective

empowerment" and "humanistic guidance." It should be emphasized that technical teams should be united to develop AI evaluation tools integrating humanistic semantic understanding to avoid the mechanization of evaluation, clarify the application boundary of AI evaluation, and position it as an "auxiliary tool" rather than a "decision-maker."

Strengthen the feedback and application of evaluation results. Use AI technology to build a visual analysis platform for evaluation results, provide teachers with accurate suggestions for teaching improvement, generate personalized learning diagnosis reports for students, clarify advantages and disadvantages, and guide self-improvement.

4. Conclusion

The digital transformation of college aesthetic education needs to balance technical tools and humanistic values, and realize the return from technical application to the essence of education through systematic reconstruction. The key lies in establishing a value-led technical application logic, developing highly adaptable intelligent tools, building a resource-sharing ecosystem, innovating teaching models and improving evaluation systems, and finally achieving the organic unity of "technical empowerment" and "cultivating people through beauty."

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Disclosure statement

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