Research on the Innovative Mode and Practice of Empowering Art Education Curriculum with Digital Media Technology

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ABSTRACT Against the dual background of deep educational digitization and comprehensive aesthetic education reform, traditional art education courses in primary, secondary, and higher education institutions face persistent challenges: fixed teaching scenarios, superficial aesthetic experience, limited creative practice carriers, imbalanced allocation of high-quality resources, a single evaluation system, and insufficient integration of traditional culture. These limitations make it difficult to meet the requirements of comprehensive aesthetic education for all students, throughout the whole process, and across all learning domains. Digital media technology uses VR/AR interaction, AIGC generation, 3D modeling, cloud resources, and intelligent analysis to overcome constraints of time, space, and physical materials. This study defines the theoretical support and technological adaptation logic of digital-media-enabled aesthetic education, analyzes the empowerment paths of six major technologies, and constructs an innovative teaching model integrating immersive art appreciation, digital creation, interactive training, intelligent analysis, and cultural immersion. Comparative practice is then used to examine teaching effectiveness. The results indicate that digital media technology can deepen aesthetic perception, lower the threshold of creative practice, improve the sharing of high-quality resources, and support more scientific process-based evaluation. The model provides a feasible path for art education innovation and digital cultural inheritance.

INDEX TERMS digital media technology, immersive teaching, aigc, vr/ar interaction, art education

I. INTRODUCTION

A. RESEARCH BACKGROUND

ART education is a key link in implementing the fundamental task of cultivating moral character and nurturing talents. It is the core carrier for cultivating students' aesthetic literacy, shaping humanistic spirit, activating creative thinking, and inheriting excellent traditional Chinese culture. It runs through the entire stage of basic education, vocational education, and higher education. In recent years, the country has continuously issued guiding documents such as the "Opinions on Strengthening and Improving the Art Education Work in Schools in the New Era", the "Implementation Plan for Education Digitalization Strategy Action", the "Compulsory Education Art Curriculum Standards (2022 Edition)", and the "Special Plan for the Development of Art Education in Higher Education Institutions", which clearly propose to accelerate the deep integration of information technology and art education, rely on digital technology to enrich teaching resources, innovate classroom forms, expand practical space, improve evaluation mechanisms, and build a modern art education system that covers all staff, runs through the whole process, and integrates the whole domain[1-3].

There are still prominent structural contradictions in the current development of aesthetic education teaching in China. Firstly, the traditional teaching mode is rigid, with most classrooms relying on static image displays, PPT text explanations, teacher blackboard drawings, and offline copying exercises. Classic paintings, sculpture artifacts, and ancient architectural aesthetics can only be presented through flat carriers, with distorted color reproduction, insufficient detail display, and lack of spatial perception, making it difficult for students to form a deep immersive aesthetic experience; Secondly, the distribution of high-quality aesthetic education resources is polarized. Key universities in first tier cities have professional art museums, intangible cultural heritage workshops, and full-time art teachers, while county-level and rural schools generally have a large shortage of art teachers, a lack of high-end art appreciation resources, and insufficient practical venues and materials, making it difficult to guarantee fairness in aesthetic education; Thirdly, the threshold for artistic creation practice is relatively high. Traditional painting, handmade sculpture, and intangible cultural heritage skills teaching rely on physical consum-

ables, dedicated venues, and professional tools, with high trial and error costs and single creative forms, which cannot support students' personalized creative expression; Fourthly, the evaluation system for aesthetic education lags behind, with a long-term focus on grading final works, similarity in copying, and classroom attendance as core standards, neglecting the growth of aesthetic perception, iteration of creative thinking, depth of cultural understanding, and accumulation of practical processes, resulting in a one-sided evaluation orientation; Fifthly, the implementation of traditional cultural aesthetic education is difficult, with abstract connotations of traditional Chinese painting, calligraphy, traditional patterns, intangible cultural heritage crafts, and ancient architectural culture. Static explanations are difficult to restore the creative process, technical details, and historical heritage, and the effect of cultural inheritance and education is weak[4].

B. CORE PAIN POINTS AND RESEARCH NECESSITY OF TRADITIONAL ART EDUCATION CURRICULUM

Firstly, the aesthetic experience is superficial. Static graphics and text cannot reproduce the brushstrokes and textures of paintings, the three-dimensional structure of sculptures, and the spatial layout of ancient buildings. Students can only remember the outline of the picture, making it difficult for them to understand the logic of color matching, the essence of composition aesthetics, and the cultural atmosphere of the work. Consequently, students develop only a cursory understanding of aesthetic principles.

Secondly, practical teaching is severely restricted. The cost of physical consumables is high, the site requirements are strict, and the creative tolerance rate is low. It is extremely difficult to carry out personalized creative creation, three-dimensional modeling design, and intangible cultural heritage skills training on a large scale, and students' creative ideas are difficult to implement[5].

Thirdly, the barrier to high-quality resources is prominent. National level cultural relics, original works by famous artists, skills of intangible cultural heritage masters, and top art museum resources cannot be regularly brought into campuses, making it difficult for students in remote areas to access high-end art content, exacerbating the urban-rural gap in aesthetic education[6].

Fourthly, the integration and virtualization of cultural inheritance. The classroom focuses more on copying techniques and neglects the explanation of the historical background, folk culture, and spiritual essence behind the works. Students only imitate the shapes and do not understand the cultural connotations, making it difficult to establish national cultural confidence.

Fifth, the evaluation mechanism lacks scientific rigor. Focusing on the final result over the growth process, emphasizing similarity in techniques over original creativity, cannot accurately record the improvement of students' aesthetic ability and the development of creative thinking, and the educational orientation is vague.

C. RESEARCH CONTENT, RESEARCH IDEAS, AND RESEARCH METHODS

1) Core Research Content

1. Define the core connotation, theoretical support, and technological adaptation logic of digital media technology empowering aesthetic education teaching, and consolidate the theoretical foundation of research;

2. Disassemble the specific empowerment paths of the six major technologies of VR/AR, AIGC, 3D modeling, interactive animation, cloud sharing, and intelligent analysis in various modules of aesthetic education;

3. Build an innovative aesthetic education teaching model that integrates "immersive art appreciation digital creation interactive training intelligent analysis cultural immersion", clarify the architecture, process, and implementation standards;

4. Design a multi stage and multi scenario implementation plan, conduct a one-year comparative practical research, and quantitatively analyze the teaching effectiveness;

5. Analyze the current bottlenecks in the application of digital aesthetic education, propose targeted optimization strategies and long-term guarantee mechanisms.

2) Research Approach

Taking the pain points of traditional aesthetic education as the starting point, supported by core digital media technologies, centered on innovative teaching models, supported by frontline practical verification, and focused on long-term optimization implementation, a complete research loop of "theoretical traceability - technical disassembly - model construction - practical implementation - effectiveness verification - problem analysis - strategy optimization" is formed.

3) Research Methods

1. Literature research method: Retrieve relevant literature from CNKI, EI, and Web of Science core databases in the past five years, and sort out the research context and theoretical achievements of digital art education, smart art teaching, and cultural digital inheritance;

2. Technical analysis method: Analyze the functional characteristics of various digital media technologies and their adaptation scenarios for aesthetic education teaching, clarify the core logic and application boundaries of technology empowerment;

3. Comparative experimental method: Select pilot schools to establish experimental classes (digital media innovation art education) and control classes (traditional art education), unify teaching syllabus, class hours, and faculty, and conduct long-term comparative research;

4. Questionnaire survey and interview method: Collect data on students' classroom experience, creative feedback, and cultural identity, and interview frontline art teachers on teaching difficulties and application suggestions;

5. Data statistics method: Use SPSS 26.0 software to process practical data. An Independent Samples t-test was

employed to compare the mean scores between the experimental and control groups. The results are reported using t-statistics, degrees of freedom (d_f), and p-values to quantitatively verify the effectiveness of teaching innovation and enhance the scientific nature of research.

II. THEORETICAL BASIS AND CORE TECHNOLOGICAL ARCHITECTURE OF DIGITAL MEDIA TECHNOLOGY EMPOWERING AESTHETIC EDUCATION TEACHING

A. CORE THEORETICAL SUPPORT

Constructivism advocates that learning is a process in which students actively explore, practice independently, and construct cognitive systems independently, rather than passively receiving knowledge. Digital media technology provides rich creative materials, lightweight creation tools, and unlimited trial and error space, supporting students to independently design, freely create, and repeatedly optimize based on personal aesthetics and creative ideas, actively building exclusive aesthetic cognitive frameworks and creative thinking systems, and truly realizing the transformation of student-centered aesthetic education classrooms[7]. Cloud based digital resource libraries, online virtual art museums, and remote synchronous classrooms can completely break down barriers between urban and rural areas, schools, and regions, allowing students from rural schools and weak schools to equally enjoy high-end art appreciation resources, renowned teaching courses, and creative materials, filling the gaps in grassroots aesthetic education, promoting the universal sharing of high-quality aesthetic education resources, and assisting in the fair implementation of education[8].

B. CORE DIGITAL MEDIA TECHNOLOGY SYSTEM EMPOWERING ART EDUCATION

Covering functions such as AI painting, traditional pattern generation, intelligent color matching optimization, creative material production, composition assisted design, and Chinese style illustration creation. Teachers can use AIGC to quickly generate differentiated teaching materials and create layered case studies; Zero foundation students can quickly build creative frameworks, optimize color matching, and supplement creative elements with intelligent tools; Basic students can combine traditional Chinese elements to carry out original upgraded designs, significantly reducing the entry threshold for creativity, broadening the boundaries of creative expression, and enriching the presentation forms of works.

Through professional 3D modeling software, virtual sculpture, traditional artifact replication, digital restoration of intangible cultural heritage handicrafts, and three-dimensional creative modeling design can be achieved. Without the need for physical materials such as clay, stone, wood, etc., three-dimensional art creation, structural adjustment, and shape optimization can be completed. It supports unlimited modifications and repeated trial and error, zero material loss, low practical costs, and comprehensively expands the practical teaching scenarios of three-dimensional aesthetic education, intangible cultural heritage modeling, and artifact design[9].

Build a standardized, classified, and graded global digital aesthetic education resource library, integrating high-definition art original works, digital cultural relics archives, intangible cultural heritage teaching videos, famous demonstration courses, creative case materials, and adapted curriculum courseware. Support schools to access, play online, and use offline at any time, achieve cross regional and inter school sharing of high-quality resources, and accurately fill the gaps in weak schools' aesthetic education resources[10].

C. THE CORE EDUCATIONAL ADVANTAGES OF EMPOWERING AESTHETIC EDUCATION WITH DIGITAL MEDIA TECHNOLOGY

Firstly, experience upgrade: from static plane viewing to three-dimensional immersive art appreciation, the depth of aesthetic perception is significantly enhanced;

Secondly, practical expansion: upgrading from limited physical consumables to digital free creation, expanding the space for creative expression comprehensively;

Thirdly, universal access to resources: upgrading from exclusive access to resources from prestigious universities to global cloud sharing, narrowing the gap between urban and rural aesthetic education;

Fourthly, teaching efficiency improvement: from one-way teaching and indoctrination to interactive inquiry learning, classroom participation has significantly increased;

Fifth, cultural revitalization: upgrading from static textual explanations to dynamic digital restoration, traditional cultural and aesthetic education takes root;

Sixth, scientific evaluation: upgrading from a single final grading to full process data tracking, accurately recording aesthetic growth[11,12]. Comparison Between Traditional Art Education and Digital Media Enabled Art Education As shown in Table 1:

III. DIGITAL MEDIA TECHNOLOGY EMPOWERS THE OVERALL CONSTRUCTION OF INNOVATIVE TEACHING MODELS FOR AESTHETIC EDUCATION COURSES

A. CORE PRINCIPLES FOR PATTERN CONSTRUCTION

1. Moral education cultivates people, and culture forges the soul: Adhere to the original intention of aesthetic education to educate people, strengthen the integration of excellent traditional Chinese culture, intangible cultural heritage culture, and national aesthetics, and eliminate pure technical showdowns;

2. Technology empowerment, teaching oriented: All digital tools serve classroom teaching and literacy cultivation, with technology as the carrier and aesthetic education as the core;

3. Immersive experience and equal emphasis on creativity: balancing art appreciation experience with hands-on creative practice, cultivating aesthetic perception and creative design ability simultaneously;

TABLE 1. Comparison Between Traditional Art Education and Digital Media Enabled Art Education

Comparison Dimension	Traditional Art Education Mode	Digital Media Enabled Innovative Mode	Core Improvement Effect
Aesthetic Experience	Static picture display; flat viewing; shallow perception of details	VR/AR immersive appreciation; 3D restoration; full-detail zoom and dynamic explanation	Deepen aesthetic perception; improve understanding of composition, color and connotation
Creative Practice	Limited by materials, venues and costs; high trial error cost; single creation form	AIGC + 3D digital creation; zero material consumption; free trial and diverse expression	Reduce creation threshold; expand creative boundary; improve original design ability
Teaching Resources	Uneven high-quality resources; difficult to share art museum and heritage resources	Cloud shared resource library; digital cultural relics; cross-school synchronous resource opening	Bridge urban-rural aesthetic education gap; realize equitable art education
Teaching Form	Teacher-centered explanation + blackboard demonstration + imitation training	Immersive interaction + personalized guidance + hybrid online-offline teaching	Enhance classroom participation; enrich teaching scenarios
Cultural Inheritance	Text interpretation; rigid explanation; difficult to display craft details	Digital restoration of intangible heritage; dynamic process decomposition; traditional element creative integration	Activate traditional culture; strengthen cultural identity and inheritance awareness
Evaluation System	Final work scoring; result-oriented; single evaluation dimension	AI intelligent evaluation + teacher qualitative evaluation + whole-process growth file	Realize diversified, procedural and scientific evaluation

4. Inclusive education for all, layered adaptation: adapted to primary and secondary schools, universities, urban and rural students of different stages, and students with different foundations, to achieve differentiated teaching;

5. Process cultivation and diversified evaluation: Emphasize the entire process of growth, abandon the theory of works only, and build a comprehensive and scientific literacy evaluation system;

6. Practical implementation, lightweight adaptation: in line with the actual teaching situation, reducing the difficulty of teacher operation and the threshold for school hardware investment[13,14].

Core Digital Media Technologies and Application Scenarios in Aesthetic Education Teaching As shown in Table 2:

B. OVERALL FRAMEWORK FOR INNOVATIVE "FIVE IN ONE" AESTHETIC EDUCATION TEACHING

Based on the entire teaching chain of aesthetic education, we will construct a five in one innovative model of immersive art appreciation and education module, digital creative creation module, interactive skills training module, intelligent multi-dimensional analysis module, and traditional culture activation and inheritance module, forming a fully closed-loop aesthetic education teaching system of "appreciation learning creation practice evaluation transmission", covering the entire process of pre class preview, in class teaching, post class practice, and long-term cultivation[15].

C. DETAILED DESIGN OF FIVE CORE MODULES

1) Module 1: VR/AR Immersive Art Appreciation and Education Module

Focusing on art appreciation, Chinese and foreign art history, cultural relic art education, and ancient architectural aesthetics courses, we aim to create a complete process of immersive preview, in-depth classroom appreciation, and independent review after class

Before class: Based on the cloud resource library, push high-definition digital original works, artist life animations, and background short films of works to complete basic preparation;

In class: Reproduce the original artistic scene through VR devices, break down composition, color, brush strokes, and modeling details, dynamically explain historical origins and cultural connotations, support multi angle switching, key annotations, and difficult point analysis;

After class: Open online virtual art museums and digital cultural relics exhibition halls for students to engage in self-directed immersive appreciation, write aesthetic and cultural understanding reflections, and consolidate their learning achievements[16].

2) Module 2: AIGC+Digital Creative Creation Module

Building a layered digital creation workshop for courses in creative painting, Chinese style illustration, traditional pattern design, poster creation, and digital art design:

Basic layer: relying on AI painting tools to assist zero foundation students in optimizing composition, color matching, and generating basic creative materials, reducing the difficulty of entry;

Enhancement layer: Guide students to independently integrate Chinese style elements such as auspicious clouds, window decorations, mountains and waters, and traditional patterns, and carry out personalized original design;

Advancement: Combining 3D modeling and digital animation to create three-dimensional art works, dynamic Chinese style short films, and digital replicas of intangible cultural heritage;

Display layer: Build an online digital art exhibition hall on campus, collect outstanding student works, and achieve regular display, communication, and learning reference[17].

TABLE 2. Core Digital Media Technologies and Application Scenarios in Aesthetic Education Teaching

Technology Category	Specific Technical Functions	Typical Aesthetic Education Application Scenarios	Practical Efficiency & Advantages
VR/AR Immersive Technology	3D scene restoration; detail magnification; panoramic viewing; dynamic scene reproduction	Art appreciation; ancient architecture aesthetics; cultural relics viewing; traditional craft display	Improve appreciation understanding by over 30%; realize immersive aesthetic experience
AIGC Generative Technology	AI painting; pattern generation; color matching optimization; creative material output	Creative design; traditional pattern creation; illustration design; art material production	Lower creation threshold; enrich creative elements; increase original works proportion
3D Modeling and Digital Sculpture	Virtual three-dimensional creation; digital handicraft restoration; structural optimization	Solid art teaching; intangible heritage digital restoration; three-dimensional creative design	Zero material loss; unlimited repeated modification; expand three-dimensional practice
Interactive Animation Decomposition	Step-by-step demonstration; slow playback; skill decomposition; process visualization	Calligraphy and painting skills teaching; intangible heritage craft teaching	Simplify difficult skills; improve learning efficiency of handcraft details
Cloud Resource Sharing Technology	Unified digital resource library; remote opening; cross-school sharing	Remote aesthetic education; rural school resource supplement; high-quality course popularization	Realize full coverage of high-quality art resources
AI Intelligent Evaluation Technology	Image feature recognition; composition/color analysis; creative dimension scoring	Whole-process student work evaluation; growth data recording	Realize objective quantitative evaluation + personalized teaching feedback

3) Module Three: Interactive Skill Training Module

For calligraphy, traditional Chinese painting brushwork, intangible cultural heritage weaving, carving techniques, and traditional manual training courses, interactive animation disassembly teaching is adopted: complex brushwork, carving steps, weaving processes, and coloring techniques are disassembled into step-by-step dynamic demonstrations, supporting slow playback, pause review, and partial magnification; Students will demonstrate their skills by comparing them with numbers, and engage in a two-way practice of online digital copying and offline physical operation. They will compare the details of their movements in real time, quickly standardize their techniques, and overcome teaching difficulties[18].

4) Module 4: Intelligent Multi factor Analysis Module for the Whole Process

Thoroughly breaking the single final grading model and constructing a three-dimensional comprehensive evaluation system:

The first dimension: AIGC intelligent quantitative analysis, automatically identifying the composition, color, creativity, and cultural elements of the work, generating objective scores and optimization suggestions; "Originality" is operationally defined as the degree of creative deviation from standard database templates and the unique integration of cross-domain cultural elements. Works were scored using a 10-point rubric assessing compositional novelty, color innovation, and conceptual depth.

Second dimension: qualitative evaluation of teachers, providing personalized and in-depth guidance on creative thinking, aesthetic expression, and cultural understanding;

The third dimension: whole process growth evaluation, recording all data of pre class preparation, classroom participation, creative iteration, and post class practice, and establishing a student exclusive aesthetic growth file[19].

5) Module 5: Digital Revitalization and Inheritance Module of Traditional Culture

Deeply cultivating traditional Chinese painting, calligraphy, intangible cultural heritage skills, ancient architecture, and traditional folk art education content, restoring intangible cultural heritage objects and ancient architectural structures through digital replication, explaining the origins and technical processes of folk customs through dynamic animation, guiding students to integrate traditional aesthetic elements into modern creative design through digital creation, achieving the goal of "understanding, learning, creating, and spreading" traditional culture, and strengthening students' confidence and awareness of national culture inheritance[20].

D. STANDARDIZED BLENDED CLASSROOM IMPLEMENTATION PROCESS

1. Pre class preview: cloud based digital resource push+independent online immersive preview;

2. Classroom introduction: AR dynamic scene restoration to stimulate aesthetic interest and exploration desire;

3. Core teaching: Immersive disassembly of details+in-depth interpretation of cultural connotations;

4. Practical Creation: Empowered by Digital Creative Tools+Layered Personalized Guidance;

5. Work polishing: AI intelligent error correction optimization+one-on-one precise guidance from teachers;

6. Exhibition and communication: online digital exhibition hall mutual evaluation+classroom on-site sharing and commenting;

7. Evaluation and archiving: intelligent comprehensive scoring+growth record+excellent works stored in the database;

8. After class extension: Self immersive re appreciation+personalized creative expansion practice, See Table 3 below.

TABLE 3. Practical Effect Comparison Between Experimental Class and Control Class

Evaluation Indicators	Experimental Class (Digital Media Aesthetic Education)	Control Class (Traditional Aesthetic Education)	t-value	df	Significant Difference
Aesthetic Appreciation Accuracy Rate	92.7%	65.3%	15.42	1024	$P < 0.001$
Originality Rate of Creative Works	86.2%	48.5%	18.76	1024	$P < 0.001$
Classroom Learning Participation and Concentration Score (Full Score 5)	4.68	3.12	22.14	1024	$P < 0.001$
Understanding Degree of Traditional Culture and Heritage	89.4%	57.6%	16.89	1024	$P < 0.001$
Satisfaction with Aesthetic Education Courses	93.5%	62.8%	20.35	1024	$P < 0.001$
Whole-process Growth Evaluation Comprehensive Score	88.6	61.3	19.58	1024	$P < 0.001$

IV. APPLICATION OF TEACHING PRACTICE AND EMPIRICAL EFFECT ANALYSIS

A. OVERALL DESIGN OF PRACTICAL PILOT PROJECTS

This practice selected 3 primary and secondary schools and 2 universities as pilot units, covering four stages of primary school, junior high school, high school, and undergraduate education. Parallel experimental classes and control classes were established, with a total of 1026 participating students. The practice period is a complete academic year. This study was approved by the Ethics Committee of Xinjiang Institute of Engineering, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

Experimental class: The teaching process adopted the "Five-in-One" model. Specifically, students utilized VR headsets (Pico 4 Pro) for immersive appreciation, while AIGC creative tasks were performed using the Midjourney and Stable Diffusion platforms. For 3D modeling, lightweight tools like Nomad Sculpt were deployed on school-provided tablets. To address teacher technical gaps, a 2-week intensive digital literacy workshop was conducted for the 12 participating instructors before the academic year began; Over the one-year period, 32 specific lessons were delivered, including "Virtual Reconstruction of Ancient Architecture" and "AIGC-based Traditional Pattern Design." The experimental group engaged with digital technologies (VR/AR and AIGC) for at least 90 minutes per week. For instance, in the "Ancient Architecture" module, students used VR headsets to explore 3D models of the Forbidden City. In contrast, the control group utilized traditional pedagogical methods, such as 2D slide presentations, manual sketching, and physical library research, covering the identical curriculum content and duration.

Control class: using the conventional aesthetic education teaching mode of traditional explanation, copying, and offline practical operation; Two sets of unified teaching syllabus, class schedule, and assessment standards were used. Prior to the intervention, a pre-test was conducted across all 1,026 students to establish baseline aesthetic literacy and creative skills. The results showed no significant difference between the experimental group (M=61.4, SD=5.2) and control group (M=61.1, SD=5.5) at baseline ($p > 0.05$), ensuring the groups were equivalent before the digital media implementation. Continuously collect classroom participation data, work creation data, questionnaire survey data, and teacher-student interview records during the practice period, and complete comprehensive comparative analysis. To validate the findings, two independent art experts evaluated student works. The interrater reliability was high (Cohen's Kappa = 0.84), confirming the validity of the reported originality rates.

B. QUANTITATIVE ANALYSIS OF CORE PRACTICE EFFECTIVENESS

Based on the Independent Samples t-test results shown in Table 3, the experimental class demonstrated significantly higher scores across all dimensions compared to the control class (all $P < 0.001$), with t-values ranging from 15.42 to 22.14, indicating a substantial effect size. The survey results showed that the experimental class achieved significant improvements. The calculated effect size (Cohen's $d = 1.15$) indicates a substantial practical impact of the digital model on aesthetic literacy; The digital interactive experience, immersive art appreciation, and fun creative creation have effectively activated students' interest in art learning, shifting from passive listening to lectures to active exploration and creation. Through the digital revitalization of traditional culture teaching, students in the experimental class have a clearer understanding of intangible cultural heritage techniques, Chinese aesthetics, ancient architectural culture, and traditional patterns. They are able to actively integrate traditional elements into their original works, resulting in a significant improvement in cultural understanding, national pride, and awareness of traditional cultural inheritance. Rural pilot schools rely on cloud based shared resource libraries to fill the gaps in high-end art appreciation, expert teaching, and creative materials. The gap in aesthetic education learning between urban and rural students has been effectively narrowed, and the goal of universal sharing of high-quality aesthetic education resources has been preliminarily achieved.

C. OUTSTANDING PROBLEMS IN THE PRACTICAL PROCESS

Firstly, some frontline art teachers lack the ability to operate digital technology and are unfamiliar with AIGC creation, VR classroom applications, and intelligent analysis tools, making it difficult to maximize the effectiveness of digital

teaching; Despite the benefits, potential limitations such as digital eye strain (screen fatigue), a possible decline in traditional fine-motor manual skills, and the risk of over-reliance on generative AI tools were observed. These factors necessitate a balanced pedagogical approach that blends digital tools with physical practice.

Secondly, there is a serious homogenization of existing digital resources, and there is insufficient supply of customized national style and high-quality intangible cultural heritage resources that are in line with the curriculum standards, textbooks, and school stages;

Thirdly, a few classrooms have a bias of emphasizing technology over substance, excessively pursuing immersive special effects displays, and weakening the core educational goals of aesthetic cultivation and cultural inheritance;

Fourthly, there are limitations to AI intelligent analysis algorithms, and the accuracy of identifying emotional expression, creative connotations, and deep cultural intentions in works needs to be optimized;

Fifthly, the hardware configuration of grassroots schools is uneven, and some rural schools lack VR equipment and digital creative terminals, making it difficult to achieve normalized digital aesthetic education teaching for all staff, as shown in Table 4.

V. OPTIMIZATION STRATEGY AND LONG-TERM IMPLEMENTATION GUARANTEE SYSTEM

A. CO BUILDING A HIGH-QUALITY CUSTOMIZED DIGITAL AESTHETIC EDUCATION RESOURCE LIBRARY

Collaborate with educational research institutions, art schools, intangible cultural heritage inheritance units, and technology enterprises to jointly build high-quality digital resources that are in line with curriculum standards, textbooks, learning stages, and deeply cultivate Chinese style intangible cultural heritage. These resources include immersive appreciation materials, intangible cultural heritage digital archives, AIGC teaching materials, skill decomposition animations, and original creative cases, achieving resource classification and grading, global cloud sharing, eliminating material homogenization, and strengthening resource localization and specialization.

B. BUILDING A HIERARCHICAL DIGITAL ART EDUCATION TEACHER EMPOWERMENT SYSTEM

Carry out regular special training, covering four core modules: VR classroom practical operation, AIGC creative teaching, digital creation coaching, and intelligent analysis application; Build a platform for online assistance from renowned teachers, inter school teaching and research linkage, and excellent case sharing to rapidly enhance the digital teaching ability of art teachers and create a composite teaching team that combines traditional art literacy and digital technology capabilities.

C. ADHERE TO THE ORIGINAL INTENTION OF AESTHETIC EDUCATION AND DEEPEN THE INTEGRATION OF CULTURAL CONNOTATIONS

Clarify digital technology as the teaching carrier and aesthetic education cultivation as the core goal, and eliminate flashy classrooms; All digital teaching content must integrate aesthetic interpretation, cultural explanation, and value guidance, integrating excellent traditional Chinese culture, intangible cultural heritage inheritance, and national style aesthetic education throughout the entire process of digital aesthetic education, achieving a deep unity of technological empowerment and cultural soul building.

D. ITERATIVE UPGRADE OF INTELLIGENT MULTI-DIMENSIONAL EVALUATION SYSTEM

Continuously optimizing AI art analysis algorithms to enhance the accuracy of identifying creative connotations, emotional expressions, and cultural intentions; Solidify the diversified evaluation model of "intelligent quantitative analysis+teacher qualitative evaluation+whole process growth file+student mutual evaluation and communication", so that aesthetic education evaluation comprehensively reflects students' aesthetic growth, creative improvement, and cultural understanding depth.

E. IMPLEMENTATION OF LIGHTWEIGHT AND LOW COST HARDWARE IMPLEMENTATION PLAN

Promote mobile AR, ordinary computer digital painting, and cloud based lightweight resource models for rural schools and weak schools, enabling basic digital aesthetic education teaching without the need for high-end hardware; Key universities and demonstration schools are equipped with immersive classrooms and digital creative workshops to achieve layered adaptation and gradient implementation, expanding the coverage of digital art education.

F. ESTABLISH A NORMALIZED AND LONG-TERM OPERATION GUARANTEE MECHANISM

Incorporate digital art education into the key work of school art education reform, teacher teaching and research assessment, and student comprehensive quality evaluation; Establish special funding guarantees, form professional teaching and research teams, improve daily management systems, and promote the transformation of digital media empowerment of aesthetic education from a short-term pilot to a normalized, institutionalized, and long-term education model.

VI. RESEARCH CONCLUSION AND FUTURE PROSPECTS

A. RESEARCH FINDINGS

This article systematically explores the innovation and practical implementation of digital media technology in empowering aesthetic education curriculum teaching, clarifying the four theoretical supports of immersive learning, constructivism, integration of education, and educational equity,

TABLE 4. Framework Implementation and Guarantee of Digital Aesthetic Education Innovative Mode

Module Framework	Core Teaching Functions	Implementation Measures	Long-term Support Guarantee
Immersive Appreciation Module	Realize all-scene art viewing and cultural connotation interpretation	Pre-class cloud preview; in-class VR interactive explanation; after-class digital museum independent visiting	Unified construction of high-standard immersive digital resource library
Digital Creative Creation Module	Support personalized creative design and diverse artistic expression	Popularize lightweight digital creation tools; set hierarchical creative tasks	Regular AIGC teaching training for art teachers
Interactive Skill Teaching Module	Decompose complex painting, calligraphy and intangible heritage skills	Dynamic animation demonstration; online imitation + offline practical integration	Develop standardized skill decomposition teaching courseware
Intelligent Multiple Evaluation Module	Record whole-process growth and realize scientific comprehensive evaluation	AI automatic scoring + teacher evaluation + student mutual evaluation + growth file	Continuously optimize art recognition algorithm and evaluation model
Cultural Inheritance and Activation Module	Realize digital inheritance of traditional art and intangible heritage	Digital restoration of traditional elements; creative integration of ancient style design	Build school-based intangible heritage digital aesthetic education resources

and dismantling the six core empowerment technologies of VR/AR, AIGC, 3D modeling, interactive animation, cloud sharing, and intelligent evaluation; We have developed an innovative aesthetic education teaching model that integrates immersive art appreciation, digital creation, interactive training, intelligent analysis, and cultural immersion. We have also designed a standardized classroom implementation process and a layered implementation path; Relying on multi stage and multi regional comparative practice research to verify the effectiveness. Research has confirmed that the new aesthetic education model empowered by digital media can significantly enhance students' aesthetic perception ability, creative design level, interest in art learning, and traditional cultural identity. It effectively solves the core pain points of superficial experience, limited practice, resource imbalance, lagging evaluation, and insufficient cultural integration in traditional aesthetic education, effectively narrows the gap between urban and rural schools in aesthetic education, and promotes the comprehensive improvement and upgrading of aesthetic education teaching. The teaching model constructed in this article has strong practicality and wide applicability, and can be directly applied to the digital reform of comprehensive aesthetic education in primary and secondary schools, universities, and vocational colleges.

B. FUTURE PROSPECTS

In the future, with the continuous iteration of technologies such as generative AI, digital twins, metaverse art education, and virtual digital human teacher teaching, it is possible to further build metaverse virtual art museums, intangible cultural heritage digital inheritance workshops, and cross school collaborative creative creation platforms to achieve higher dimensional immersive art appreciation and personalized creative practices; Continuously deepen the construction of digital resources for national intangible cultural heritage, and create localized and distinctive digital aesthetic education content; Continuously optimizing intelligent evaluation algorithms and constructing electronic records of students' full cycle aesthetic growth; Continuously promoting the sinking of high-quality digital aesthetic education resources, enabling every student to enjoy high-quality intelligent aesthetic education, comprehensively supporting the high-quality development of aesthetic education in the new era, and consolidating the fundamental foundation of moral education and talent cultivation.

AUTHOR CONTRIBUTIONS

Yiru Hu designed, collected and analyzed the data, and drafted the manuscript. Yiru Hu conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Yiru Hu participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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The author declares no conflict of interest.

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HUMAN RESEARCH SUBJECTS

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