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Digitalization-Enabled Red Culture Education: The University-Museum Collaboration Model

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Abstract

Red culture stands as a core resource for cultivating new-generation talents, while university-museum collaboration constitutes a critical pathway for red culture inheritance. Against the backdrop of digital transformation, this study, rooted in collaborative governance theory and digital governance theory, systematically analyzes the resource foundations, digital transformation potential, core managerial dilemmas, and intrinsic operational mechanisms of red culture-oriented university-museum collaboration in Nanchang, and proposes targeted optimization pathways. Taking universities and red-culture museums in Nanchang as research objects, this study employs policy interpretation, case analysis, and logical deduction to provide management-based solutions for red culture university-museum collaboration in the digital age. All analyses are strictly based on authentic academic literature and official policy documents, emphasizing managerial logic, organizational mechanisms, and practical orientation while excluding economic jargon.

Keywords: Digitalization; Red Culture; University-Museum Collaboration; Collaborative Education Model; Management Mechanism

1. Introduction

Red Culture embodies the spiritual lineage of the Communist Party of China and serves as a vital carrier for advancing ideal and conviction education and fostering core socialist values. The 14th Five-Year Plan for Cultural Development explicitly advocates “digital preservation and inheritance of red cultural resources” and “deepening university-local and university-museum cooperation to construct a red-culture-focused education system” (Qiu et al., 2025). As the site of

the August 1st Nanchang Uprising, Nanchang is endowed with abundant red cultural resources, including the Memorial Hall of the August 1st Nanchang Uprising, Jiangxi Revolutionary Martyrs Memorial Hall, and the Exhibition Hall of the Former Site of the New Fourth Army Headquarters in Nanchang. As a national hub for red tourism and red cultural education, Nanchang provides a natural foundation for university-museum collaborative education.

From a practical demand perspective, Nanchang is home to more than 20 universities and colleges, including Nanchang University, Jiangxi Normal University, and Jiangxi University of Finance and Economics, with over one million students enrolled, creating an urgent need for red culture education.Nevertheless, the traditional university-museum collaborative model is plagued by problems such as fragmented resources, inadequate coordination, monotonous experiences, and insufficient educational effectiveness, which can hardly adapt to the cognitive habits and educational needs of young students in the digital era.The rapid development of digital technology provides new tools and pathways for the revitalization of red culture resources, the optimization of university-museum collaborative mechanisms, and the innovation of education models.The digital transformation of red culture resources, the digital reconstruction of university-museum collaboration processes, and the digital empowerment of the education process have become critical to addressing the dilemmas of traditional education models (Zhou & Fan, 2018; Guo, 2025; Hu, 2025). Therefore, constructing an optimized path for university-museum collaborative education of red culture in Nanchang under the digital context will not only improve the effectiveness and coverage of red culture inheritance but also offer a replicable practical paradigm for red culture education in similar regions.

Although existing studies have laid a certain theoretical foundation for this research, notable research gaps remain. Studies on university-museum collaborative education in red culture are largely concentrated in education and cultural studies, focusing on educational content and pedagogical approaches, while systematic analyses from a management perspective remain insufficient (Han & Zou, 2025). Although some research addresses digital transformation, it tends to emphasize technical applications and lacks in-depth investigation into the integration of digitalization with core elements of university-museum collaborative governance, including governance mechanisms, organizational structures, and resource allocation (Ji & Wang, 2025). Furthermore, empirical research tailored to the red cultural context of Nanchang is particularly scarce. Existing work fails to sufficiently incorporate the managerial characteristics and digital transformation potential of Nanchang's red resources to propose targeted governance solutions (Liu & Guo, 2025). Accordingly, this study takes Nanchang as its geographic setting and university-museum collaborative education in red culture as its core subject, and addresses three central questions: What are the key managerial dilemmas facing digital-enabled university-museum collaborative education in red culture in Nanchang? What are the underlying operational mechanisms? How can systematic optimization pathways be designed to enhance the effectiveness of digital collaborative education?

This paper makes three primary theoretical contributions. First, it transcends the unidimensional limitations of prior research by grounding its framework in collaborative governance and digital governance, thereby developing a systematic optimization pathway and

enriching the management-oriented research system of university-museum collaborative education in red culture. Second, it focuses on the deep integration of digitalization and governance mechanisms, addressing the shortage of studies examining the synergy between technology and governance, and further refining the theoretical landscape of red culture collaborative education. Third, taking Nanchang as a distinctive case, it identifies key pain points and actionable solutions in the digital transformation of regional university-museum collaborative education for red culture. This provides empirical support for the regionalized and differentiated governance of red culture education, filling a critical perspective gap in management research on digital-enabled university-museum collaborative education in the red culture domain.

2. Theoretical Foundations

2.1. Collaborative Governance Theory

Collaborative governance theory, systematically elaborated by Yu (2014), centers on the coordinated interaction among multiple actors—including government, universities, cultural venues, and communities—to break down organizational barriers and resource fragmentation, thereby achieving efficient governance of public affairs. This theory emphasizes the division of responsibilities and rights, interest-sharing, and process coordination among multiple stakeholders, with the core objective of overcoming governance dilemmas such as fragmentation and isolated governance, and improving the efficiency of public resource allocation and governance effectiveness (Liu & Zheng, 2025). In the context of university-museum collaborative education for red culture, universities undertake the core function of talent cultivation, venues possess distinctive advantages in red cultural resources, and governments are responsible for policy guidance and resource coordination. Collaboration among these three actors requires cross-departmental integration across education, culture, finance, and other sectors, involving interest coordination and process alignment among diverse stakeholders (Wang & Zhang, 2025). Collaborative governance theory provides a key analytical framework for addressing managerial challenges in university-museum collaboration, including organizational silos, scattered resources, and ambiguous responsibilities. Its logic of multi-stakeholder coordination and process optimization can be directly applied to the restructuring of governance structures and the design of mechanisms for university-museum collaborative education in the digital era, offering theoretical support for the efficient interaction of multiple actors.

2.2. Digital Governance Theory

Digital governance theory originates from research on digital transformation in public administration and was systematically developed by Dunleavy et al. (2006). Its core rationale lies in employing digital technologies to restructure governance processes, optimize resource allocation, and enhance governance effectiveness, encompassing such key components as digital platform development, data-sharing mechanisms, digital service provision, and technology-enabled management. Within the context of university-museum collaborative education for red culture, digital technology serves as a critical bridge connecting the educational demands of universities and the resource supply of cultural venues. Digital governance theory provides a

theoretical foundation for constructing digital collaboration platforms, facilitating data resource sharing, optimizing educational processes, and delivering targeted services in university-museum collaboration (Cui et al., 2025). Its insights into the deep integration of digital technology and governance mechanisms can guide Nanchang in establishing a digital system for university-museum collaborative education. By enabling technology-driven coordination, this theory helps break down collaboration barriers, improve resource utilization efficiency, and refine educational service experiences, thereby facilitating the transformation of red culture education from a unidirectional offline model to an integrated online-offline and interactive precision-oriented model. In this way, digital governance theory offers core theoretical support for the practical implementation of university-museum collaborative education in the digital era.

3. Management Foundations and Digitalization Potential of University-Museum Collaborative Education in Red Culture in Nanchang

First, university-museum collaborative education in red culture in Nanchang is underpinned by solid management foundations and substantial potential for digital transformation. In terms of the managerial attributes of red cultural resources, Nanchang boasts more than 50 revolutionary heritage sites, including 6 national-level protected cultural relics and 10 provincial-level protected cultural relics. These resources cover revolutionary history, martyr deeds, and red spirits, featuring high resource density and outstanding educational value, thus providing a rich content foundation for university-museum collaborative education. Major revolutionary venues are highly concentrated in urban Nanchang: the Memorial Hall of the August 1st Uprising in Xihu District, the Jiangxi Revolutionary Martyrs Memorial Hall in Donghu District, and the Exhibition Hall of the New Fourth Army Headquarters Site in Xihu District. Such geographic concentration facilitates field study activities organized by universities and reduces the spatial coordination costs between universities and venues. Furthermore, as core bases for patriotism education and Party history learning, these revolutionary venues are functionally aligned with universities' fundamental mission of fostering virtue through education. Their clear educational orientation provides a natural value foundation for collaborative education between universities and cultural institutions.

Second, policies at both national and local levels provide strong institutional support for university-museum collaborative education in red culture in Nanchang.The Guidelines for the Implementation of the Revolutionary Cultural Relics Protection and Utilization Project (2023–2027) explicitly encourages revolutionary cultural relics protection institutions to establish cooperative mechanisms with universities and primary/secondary schools to develop school-based curricula and study-tour programs.Jiangxi Province has released the Construction Plan for the Red Culture Inheritance and Innovation Demonstration Zone of Jiangxi Province, which emphasizes deepening university-museum partnerships and building digital education platforms for red culture.Nanchang has promulgated the Regulations on the Protection and Utilization of Red Cultural Resources in Nanchang, which encourages universities, research institutes, and red cultural venues to jointly conduct research, education, and communication on

red culture.Collectively, these policies form a comprehensive policy support system covering national, provincial, and municipal levels, offering clear policy foundations and strategic guidance for the digital transformation of university- museum collaborative education.

Third, in terms of digital transformation foundations and potential, Nanchang has already established a preliminary digital infrastructure. The Memorial Hall of the August 1st Uprising in Nanchang has developed a digital exhibition hall and VR-based red experience projects, while the Jiangxi Revolutionary Martyrs Memorial Hall has launched an online memorial platform and a digital cultural relics database. Additionally, several universities have developed online courses on red culture, laying a preliminary groundwork for digital collaboration. The widespread application of technologies such as 5G, VR/AR, big data, and artificial intelligence in Nanchang provides robust technical support for the immersive transformation of red cultural resources, real-time sharing of inter-institutional data, and precision management of the educational process. These technological enablers facilitate the transition from "one-way offline communication" to "online-offline interaction" and "personalized precision education." Furthermore, as digital natives, young students demonstrate a strong demand for interactive, immersive, and personalized educational approaches. Digital transformation effectively enhances the appeal and effectiveness of red culture education, aligning with the demand-oriented paradigm of talent cultivation in the new era and providing powerful demand-driven momentum for the advancement of digital collaborative education

4. Core Management Dilemmas of University- Museum Collaborative Education in Nanchang's Red Culture Under Digitalization

4.1. Governance Level: Insufficient Digitalization of Collaborative Governance Mechanisms

Barriers to multi- stakeholder collaboration remain unaddressed. Universities, revolutionary cultural venues, and government departments lack a unified digital collaboration platform. Communication and coordination still rely heavily on offline meetings and ad hoc interactions, leading to cumbersome procedures and delayed responses. For example, organizing study tours requires repeated offline communication and reservation between universities and venues, and policy communication from government is transmitted hierarchically, making it difficult to establish a normalized collaborative mechanism (Wu & Sun, 2025). Responsibility allocation and benefit- sharing arrangements remain ambiguous. There are no clear institutional rules governing responsibilities for digital collaboration construction, permissions for resource sharing, or assessment of educational effectiveness. Universities lack enthusiasm due to concerns about high costs of digital resource integration, while venues limit openness in the absence of a clear benefit compensation mechanism for resource provision, thus weakening collaborative motivation (Zhou & Tuerdi, 2025). Policy support and resource assurance are inadequate. Government investment, technical support, and policy guidance for digitalized university- museum collaboration remain limited, with few dedicated supporting policies and overall coordination mechanisms. The development of digital platforms and digitization of cultural resources require substantial financial and technical inputs (Zeng, 2025), yet existing fiscal support is fragmented and

insufficient, restricting the large- scale advancement of digital collaboration.

4.2. Resource Dimension: Lagging Digital Transformation and Management

The digitalization of resources remains comparatively low. Most revolutionary cultural resources remain at the traditional exhibition stage, with severely insufficient supply of digital resources. Existing digital resources are largely limited to superficial forms such as images and texts, lacking in-depth products including VR/AR immersive content and interactive curricula, which fails to satisfy students' demand for in-depth experiences of revolutionary culture (Xu, 2025). Digital resource integration is fragmented. Digital resources held by universities and cultural venues operate in isolation: universities focus on the digital presentation of revolutionary cultural theories, while venues prioritize the digital display of cultural relics and historical scenes. The absence of a unified resource database and sharing platform results in the coexistence of redundant development and supply-demand mismatch. For instance, digital resources of revolutionary historical scenes needed by universities are underdeveloped by venues, while existing digital relic resources from venues are underutilized by universities, impeding the formation of a systematic digital educational resource system (Zhang, 2025). Digital resource standards are inconsistent across institutions. Digital resources from different venues vary in formats, technical specifications, and metadata standards. For example, digital resources from the Nanchang August 1st Uprising Memorial Hall adopt specialized VR formats, whereas online resources from the Jiangxi Revolutionary Martyrs Memorial Hall are predominantly video-based. Incompatible data interfaces between universities and venues increase barriers to resource sharing and integration, substantially weakening the efficiency of collaborative education.

4.3. Organizational Dimension: Weak Digital Operation Capabilities

The organizational structure lacks digital adaptability. Neither universities nor cultural venues have established dedicated departments for digital university-venue collaborative education. In universities, revolutionary culture education is mostly assigned part-time to schools of ideological and political education or student affairs offices; in venues, digital initiatives are often implemented sporadically by technical units. The existing organizational structure centers on traditional education administration and venue operation, making it difficult to coordinate systematic tasks such as digital resource development, collaborative process optimization, and educational program design (Zhang, 2026). A severe shortage of interdisciplinary talent persists. There is a critical lack of professionals who combine solid knowledge of revolutionary culture, educational administration competence, and digital technology application skills. University instructors excel in revolutionary culture teaching yet lack capabilities in digital instructional tools and online course design; venue staff are familiar with revolutionary cultural resources but are weak in digital resource development and online service operation. Such mismatches fail to support the full-cycle demands of digital collaborative education (Zhu, 2025). The performance management system is misaligned. Performance evaluation of university-venue collaboration still relies heavily on traditional indicators such as participant numbers and activity frequency, while core indicators including digital resource utilization rate, educational precision, and student satisfaction are largely excluded. Consequently, universities and venues prioritize formal collaborative activities over substantive effects of digital transformation, leading organizational

operations to deviate from the core goals of digital education.

4.4. Educational Dimension: Insufficient Digital Services and Experiences

The supply of digital educational products is homogeneous. Existing digital education products mainly take the form of one-way output such as online visits and online courses, lacking in-depth products including personalized recommendation, interactive experience, and immersive study tours. They can hardly meet students' diverse and personalized learning needs. Students of different majors and grades have differentiated demands for Red Culture learning, yet current digital products are uniform and fail to realize targeted supply (Wang, 2025). The digitalization of the education process is low. Full-process digital coverage from resource inquiry, appointment and registration, study tour implementation to effectiveness evaluation is insufficient. Students need to learn about study tour information through university official websites, make appointments via venue telephone, and fill in paper feedback forms after offline participation. The process is cumbersome and inefficient, imposing heavy management burdens on universities, and the convenience and experience of the education process need to be improved (Hu, 2025). The digital evaluation of educational effectiveness is absent. There is a lack of a big data-based tracking and evaluation system for educational effectiveness, making it difficult to accurately grasp students' learning trajectories, cognitive changes, and value identification. Data such as students' online learning duration and interaction frequency fail to be effectively collected, and the mastery of Red Culture knowledge and the internalization of Red Spirit are hard to quantify. Consequently, the optimization and adjustment of education programs lack scientific data support, making it challenging to continuously improve educational effectiveness (Zhao, 2025).

5. Mechanisms Underpinning University-Museum Collaborative Education on Red Culture in Nanchang Under Digitalization

5.1. Collaborative Governance Mechanism

The collaborative governance mechanism serves as the institutional guarantee for the effective implementation of digital university-museum collaborative education. Its core logic lies in using digital technologies to break down multi-stakeholder collaboration barriers and form a collaborative structure featuring government guidance, university-museum leadership, and technological support (Peng & Zhang, 2024). At the government level, a digital collaborative coordination mechanism is established to integrate resources across education, culture, and finance sectors, provide policy and financial support, and clarify the division of responsibilities and benefit-sharing rules among multiple stakeholders. At the university-museum level, a digital collaboration platform enables resource sharing, process docking, and information exchange, streamlining collaboration procedures and improving response efficiency. For instance, universities can directly reserve digital resources and study venues through the platform, while venues can obtain educational demands from universities and optimize resource supply. At the multi-stakeholder level, clear institutional provisions and benefit-sharing mechanisms stimulate collaborative motivation among universities and museums, forming a closed-loop collaborative governance system of policy guidance – platform support – clear rights and responsibilities –

benefit sharing, which provides a stable institutional environment for digital collaborative education.

5.2. Digital Empowerment Mechanism

The digital empowerment mechanism serves as the core value realization path of University-Museum Collaborative Education on Red Culture under the Digital Context. Its core logic lies in empowering resource transformation, process optimization, and service upgrading through digital technologies, thereby achieving targeted supply and high efficiency in Red Culture education (Li et al., 2023). In terms of resource transformation, technologies such as VR/AR and big data facilitate the digital collection, immersive conversion, and innovative development of Red Culture resources, transforming static cultural relics and historical scenes into dynamic digital resources and enriching the supply of digital resources. In terms of process optimization, the Digital Collaborative Platform reconstructs the collaborative processes of resource inquiry, reservation, study tours, and effectiveness evaluation between universities and museums, realizing full-process onlineization management and improving collaborative efficiency. In terms of service upgrading, data mining and precise matching are adopted to analyze students' learning preferences and demands, enabling personalized recommendation of digital resources and targeted supply of educational services. Accordingly, a digital empowerment closed loop of resource digitalization – process onlineization – targeted service supply is formed, providing core support for digital University-Museum Collaborative Education.

5.3. Organizational Adaptation Mechanism

The organizational adaptation mechanism acts as the core support for the sustainable advancement of digital university-museum collaborative education on Red Culture. Its core logic is to enhance the digital operation capacity of university-museum collaboration through systematic optimization of organizational structure, talent development, and performance management (Li, 2021). In terms of organizational structure, the establishment of dedicated administrative departments for digital collaborative education breaks down traditional organizational barriers and enables professional coordination of digital resource development, collaborative project management, and educational services. In terms of talent development, interdisciplinary talents with integrated Red Culture literacy, educational administration competence, and digital technology application capabilities are cultivated through university-venue cooperation, on-the-job training, and talent introduction to fill talent shortages. In terms of performance management, a comprehensive performance evaluation system is constructed that integrates digital resource utilization rate, educational precision, student satisfaction, and the effectiveness of Red Spirit inheritance. This system steers organizational operation back to the core goals of digital education. Accordingly, a closed loop of organizational adaptation featuring structure optimization – talent support – performance guidance is formed, providing sustained capability support for digital collaborative education.

5.4. Effectiveness Improvement Mechanism

The effectiveness improvement mechanism represents the ultimate goal-achieving path of digital university-museum collaborative education on Red Culture. Its core logic is to empower

the whole process of education through digital technologies, driving the transformation of Red Culture education from formal participation to value identification (Wang & Mu, 2021). At the demand identification stage, big data analytics are applied to examine students' learning preferences, cognitive levels and interests, so as to accurately capture educational demands. At the process engagement stage, digital products such as VR/AR immersive experiences, interactive courses and personalized study tours enhance student participation and emotional resonance. At the effectiveness evaluation stage, a digital evaluation system tracks students' learning trajectories, quantifies their cognitive changes and value identification, and dynamically optimizes educational programs based on evaluation results. Accordingly, a closed loop for effectiveness improvement is formed: demand identification – in-depth engagement – quantitative evaluation – iterative optimization, which ensures the continuous enhancement of Red Culture education effectiveness.

6. Conclusion and Future Directions

6.1. Research Findings

First, under the Digital Context, University-Museum Collaborative Education on Red Culture in Nanchang faces systematic management dilemmas across four dimensions—governance, resources, organization, and education—with these challenges intertwining to form a vicious cycle. Insufficient digitalization of Collaborative Mechanisms at the governance level leads to inefficient multi-stakeholder linkage and weak motivation. Lagging digital transformation and management of resources result in inadequate supply and barriers to sharing of Digital Resources. Weak digital operation capabilities at the organizational level hinder the implementation of digital transformation. Meanwhile, insufficient digital services and experiences in education undermine educational effectiveness, which in turn further reduces multi-stakeholder enthusiasm for collaboration. This forms a vicious cycle of inadequate governance collaboration → delayed resource digitalization → weak organizational capabilities → poor educational effectiveness → declining collaborative motivation, becoming the core obstacle restricting the digital transformation of University-Museum Collaborative Education on Red Culture in Nanchang. The essence of these dilemmas lies in the ineffective integration of digital technologies with the management mechanisms of university-museum collaborative education, as traditional collaborative models and management systems struggle to adapt to the demands of the digital era.

Second, collaborative governance theory and digital governance theory serve as the core theoretical pillars of University-Museum Collaborative Education on Red Culture in Nanchang under the Digital Context, forming a complementary theoretical system. Collaborative governance theory offers a methodological framework for addressing multi-stakeholder and cross-organizational collaboration challenges. Its inherent logic—emphasizing multi-actor synergy, division of responsibilities, and benefit-sharing—aligns with the organizational attributes of university-museum collaborative education, providing a theoretical rationale for dismantling collaboration barriers. Digital governance theory, by contrast, underpins digital transformation, with its focus on digital platform development, data sharing, and technological empowerment

offering theoretical guidance for resource digital conversion, process optimization, and service enhancement. The organic integration of these two theories transcends the limitations of a single theoretical lens, laying a robust foundation for systematically resolving management dilemmas and formulating optimization pathways.

Third, the effective advancement of University-Museum Collaborative Education on Red Culture in Nanchang under the Digital Context necessitates constructing a systematic optimization framework across five dimensions—governance, resources, organization, education, and technology—grounded in collaborative governance and digital governance theories, and directly targeting the four core management dilemmas. Specifically, it requires improving the digital collaborative governance system to break multi-stakeholder collaboration impasses; advancing the digital transformation of Red Culture resources to enrich content provision; strengthening organizational digital empowerment to boost operational capacities; optimizing digital educational services to enhance educational outcomes; and reinforcing technical support and security safeguards to consolidate the foundation for transformation. These five interrelated pathways, when synergistically implemented, can break the vicious cycle, driving the transition of University-Museum Collaborative Education on Red Culture in Nanchang from traditional offline collaboration to in-depth digital collaboration, and ultimately achieving the dual dividends of Red Culture inheritance and talent development.

6.2. Optimization Pathways

6.2.1. Improve the Digital Collaborative Governance System

Led by the Nanchang Municipal Bureau of Education and the Bureau of Culture, Radio, Television, Tourism and Sports, and in conjunction with departments such as the Finance Bureau and Science and Technology Bureau, an interagency leading group for the digital advancement of University-Museum Collaborative Education on Red Culture in Nanchang should be established. This group will convene regular collaborative meetings to coordinate policy formulation, resource allocation, project implementation, and dispute resolution, thereby dismantling inter-departmental silos and barriers between universities and museums. A dedicated digital platform for University-Museum Collaborative Education on Red Culture in Nanchang should be developed, integrating functions including resource display, reservation and docking, project application, data sharing, and effectiveness evaluation. This platform will enable precise online matching between universities and museums, streamline collaborative processes, and enhance response efficiency. Additionally, the Implementation Measures for the Digital Construction of University-Museum Collaborative Education on Red Culture in Nanchang should be formulated to clarify the rights, responsibilities, and obligations of universities and museums in areas such as digital resource development, open sharing, talent cultivation, and performance evaluation. A special support fund should also be established to provide financial subsidies and technical assistance for digital collaborative projects, thereby stimulating the collaborative motivation of all stakeholders.

6.2.2. Promote the Digital Transformation of Red Culture Resources

A comprehensive digital census of Nanchang’s Red Culture resources should be conducted to

collect basic data including texts, images, audio, and video materials. A unified digital resource database for Red Culture will be established, clarifying the educational attributes, applicable academic stages, and digital transformation directions of each resource. Priority should be given to developing VR/AR immersive experience projects, such as the restoration of the Nanchang August 1st Uprising scenes and interactive exhibitions of revolutionary martyrs' deeds. Digital interactive courses will be created to integrate Red Culture into ideological and political education and history curricula. Diversified products including digital study tour handbooks and Red Culture story animations will be produced to enrich the supply of digital resources.

Furthermore, unified digital standards and specifications for Nanchang's Red Culture resources should be formulated, standardizing resource formats, technical parameters, metadata specifications, and data interfaces. Relying on the digital collaborative platform, an open and shared digital resource repository will be constructed to realize interconnection and on-demand access of resources between universities and museums, thereby avoiding redundant development.

6.2.3. Strengthen Organizational Digital Empowerment

First, optimize organizational structure design. Universities should establish a "Digital Red Culture Education Center" to coordinate digital resource docking, study tour project design, and educational effectiveness evaluation. Revolutionary venues should set up a "University-Museum Collaborative Digital Service Department" responsible for digital resource opening, collaborative project connection, and online service provision, thereby realizing professional management.

Second, implement a talent-driven management initiative. Collaborate with universities such as Nanchang University and Jiangxi Normal University to launch training programs related to digital Red Culture education, enhancing university teachers' digital teaching capabilities and venue staff's digital service capacities. Introduce interdisciplinary talents with integrated Red Culture literacy, educational management experience, and digital technology backgrounds to enrich the university-museum collaborative education team. Establish a digital education talent pool to achieve talent resource sharing.

Third, digitize the entire collaborative process, including resource inquiry, registration, study tour organization, and feedback collection, to realize full-process digital management and improve efficiency and convenience. Construct a comprehensive performance evaluation system that incorporates indicators such as digital resource utilization rate, student satisfaction, educational precision, and Red Spirit inheritance effectiveness. Recognize and reward universities and venues with outstanding performance to guide the direction of organizational operations.

6.2.4. Enhance Digital Educational Effectiveness

A personalized education system should be constructed by leveraging student data from the Digital Collaborative Platform—the core infrastructure for University-Museum Collaborative Education on Red Culture. Through analyzing students' learning preferences, cognitive levels, and interest points, individual student profiles are established to deliver tailored digital resource recommendations, study tour program designs, and learning path planning, thereby realizing "person-specific" targeted education that aligns with diverse learning needs. Cutting-edge technologies including 5G, VR/AR, and the metaverse are harnessed to develop immersive Red

Culture learning scenarios, such as virtual tours of the Nanchang August 1st Uprising Memorial Hall and participation in revolutionary history situational simulations. Blended online-offline study tour activities are implemented: pre-learning and theoretical acquisition are completed via the Digital Collaborative Platform, while offline sessions involve on-site study tours and practical experiences. This integrated model strengthens student engagement and emotional resonance with Red Culture, addressing the inadequacy of one-way educational delivery. A digital evaluation index system for Red Culture educational effectiveness is developed, encompassing dimensions of knowledge mastery, emotional identification, and behavioral transformation. Students' cognitive changes and value recognition are quantified through multi-method assessment, including online questionnaires, learning trajectory analysis, and practical performance evaluation. A feedback loop for evaluation results is established to dynamically optimize digital resources and educational programs, forming a continuous improvement mechanism that ensures the sustained enhancement of digital collaborative education outcomes.

6.2.5. Strengthen Technical Support and Security Assurance

Universities and museums should be supported in upgrading digital infrastructure, enhancing network bandwidth, storage capacity, and computing power to provide technical underpinnings for digital resource development and University-Museum Collaborative Education on Red Culture. Advanced technologies including artificial intelligence (AI), big data, and blockchain are introduced to improve the intelligence level of the Digital Collaborative Platform and reinforce data security capabilities, addressing technical bottlenecks in large-scale resource sharing and real-time collaborative interaction. A security management framework for digital Red Culture resources should be formulated, clarifying security requirements across the entire data lifecycle—including collection, storage, transmission, and utilization. A data backup and emergency response mechanism is established to mitigate risks such as data leakage and loss. Special emphasis is placed on protecting students' personal information, with strict compliance with data security laws and regulations to ensure the safety and legitimacy of the digital education process.

6.3. Research Prospects

First, deepen the empirical evaluation research on the performance of digital collaborative education. The optimization pathways proposed in this study provide theoretical and practical guidance for University-Museum Collaborative Education on Red Culture in Nanchang, but quantitative empirical verification remains absent. Future research could construct a scientific performance evaluation index system, select representative universities and revolutionary venues in Nanchang as research samples, and conduct empirical analysis on the effectiveness of the proposed pathways through methods such as questionnaires, in-depth interviews, and data statistics. This would quantify the impact of each optimization measure on educational effectiveness, providing data support for the further refinement of the pathways. Simultaneously, longitudinal tracking surveys could be implemented to analyze the dynamic evolution laws of the digital collaborative education model, offering a basis for the continuous optimization of management strategies.

Second, expand research on digital collaborative education for different types of Red Culture resources. Nanchang's Red Culture resources cover diverse categories including revolutionary history, martyrs' deeds, and Red Spirit, with significant differences in digital transformation difficulty, educational methods, and collaborative needs among these resource types. While the optimization pathways proposed in this study address general issues, they lack sufficient attention to differentiated challenges. Future research could conduct specialized studies on different types of Red Culture resources, analyzing their unique digital transformation pathways and collaborative education strategies—such as immersive digital education approaches for revolutionary historical sites and story-driven digital communication strategies for martyrs' deeds. This would provide more targeted solutions for the precise advancement of University-Museum Collaborative Education on Red Culture in Nanchang.

Third, explore the innovative application of emerging digital technologies in collaborative education. With the rapid development of emerging digital technologies such as artificial intelligence (AI), the metaverse, and blockchain, the scenarios and models of University-Museum Collaborative Education on Red Culture are undergoing profound transformations. Although this study proposes technical support pathways, it lacks in-depth discussion on the integration of emerging technologies with management mechanisms. Future research could focus on the innovative application of emerging digital technologies, such as AI-based personalized education recommendation systems, metaverse-enabled virtual study communities for Red Culture, and blockchain-based copyright protection and sharing mechanisms for Red Culture resources. This would explore new paradigms of University-Museum Collaborative Education on Red Culture in the context of emerging technologies, promote the advancement of optimization pathways with the times, and inject new momentum into the high-quality development of Red Culture education in Nanchang.

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