

# Intangible Cultural Heritage Education Through a Digital Lens: A Study on Cross-Platform Teaching and Dissemination Models for Guangxi's Tianqin Culture

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## Abstract

This study employs a mixed-methods approach to examine the influencing factors of digital-era art education and cross-platform dissemination of the Zhuang Tianqin in Guangxi. Quantitative findings reveal that cross-platform interactivity ( $\beta=0.370$ ) is the primary determinant of dissemination effectiveness, followed by cultural identity ( $\beta=0.336$ ), usage motivation ( $\beta=0.198$ ), and technological acceptance characteristics ( $\beta=0.198$ ). The model collectively explains 77.9% of the variance in dissemination effectiveness ( $R^2=0.779$ ,  $F=322.65$ ,  $p<0.001$ ). Qualitative analysis revealed the underlying logic of these influencing mechanisms: cross-platform interaction operates through three primary channels—content complementarity, interactive design, and community connectivity; Cultivating cultural identity progresses through three sequential stages: cognitive, affective, and behavioural; Satisfying usage motivation requires addressing four-dimensional needs: informational, entertainment, social, and identity-related; Technology adoption faces dual challenges of empowerment and constraints. This study uncovers key factors and operational mechanisms in digital intangible cultural heritage education and dissemination. Findings provide theoretical foundations, practical guidance, and insights for the digital preservation and transmission of musical intangible cultural heritage.

**Keywords:** guangxi zhuang tianqin art, cross-platform interaction, musical intangible cultural heritage, digital dissemination

## 1. Introduction

The art of the Zhuang Tianqin in Guangxi constitutes a comprehensive musical cultural form centred upon the Tianqin instrument and associated rituals. It embodies the historical memory, religious beliefs, and ethnic characteristics of the Zhuang people, and was inscribed in 2021 upon the Fifth Batch of the National ICH Representative Projects List (II-186). However, shifts in the socio-cultural environment have progressively eroded the rural spaces where this art thrives, confronting it with severe challenges including transmission gaps, shrinking learning communities, and diminished functional spaces. In recent years, the Guangxi Zhuang Autonomous Region and local governments have implemented measures to revitalise the social influence of this cultural heritage within contemporary contexts. Nevertheless, systematic transmission pathways within the broader education system require further development.

Within the globalised context where cultural transmission and digital transformation proceed in parallel, the preservation of ICH and its educational transmission have become critical issues. The advancement of digital technology has opened new pathways for the educational development and innovative transmission of traditional ICH. Against this backdrop, this study focuses on the educational transmission of the Guangxi Zhuang Tianqin art from a digital perspective. It aims to explore the construction of cross-platform educational pathways and teaching models, thereby providing theoretical underpinnings and practical references for the innovative development of ICH education.

### 1.1 Research Objectives

1) Conduct an in-depth analysis of the dissemination and learning status and challenges of digital resources for Guangxi Zhuang Tianqin art within the current educational system and digital media environment. Examine the applicability and feasibility of cross-platform educational models across diverse educational settings. Explore the influencing factors and evaluation mechanisms for integrating digital technology into the teaching content of Guangxi Zhuang Tianqin art.

2) Employing an interdisciplinary perspective and multi-platform collaborative mechanisms, investigate innovative transmission mechanisms for Guangxi Zhuang Tianqin art within the modern educational system. Develop pedagogical pathways tailored to both digital technologies and the distinctive characteristics of Guangxi Zhuang Tianqin art, clarifying the functional positioning and collaborative mechanisms of cross-platform approaches within the teaching continuum.

### 1.2 Research Questions

Based on the aforementioned research objectives, this study proposes to systematically explore the following questions:

1) Under the combined influence of the digital wave and regional cultural policies, what dissemination and learning landscape emerges for Guangxi Zhuang Tianqin art within educational training contexts? What shortcomings exist in current practices regarding content selection, teaching organisation, and platform utilisation?

2) From a learner development perspective, how does the cross-platform educational system for Guangxi Zhuang Tianqin art achieve content continuity across knowledge acquisition, skill experience, and cultural identity? Specifically, how are transmission methods, learning motivations, and cultural identity conveyed for learners at different educational stages within digital platforms?

3) In the current multi-platform environment, how can an educational community be established that integrates teachers, ICH practitioners, platform operators, and local cultural management departments? What are the key factors and operational mechanisms that influence the overall enhancement of engagement and interactivity among different audiences within cross-platform teaching models?

### 1.3 Research Framework

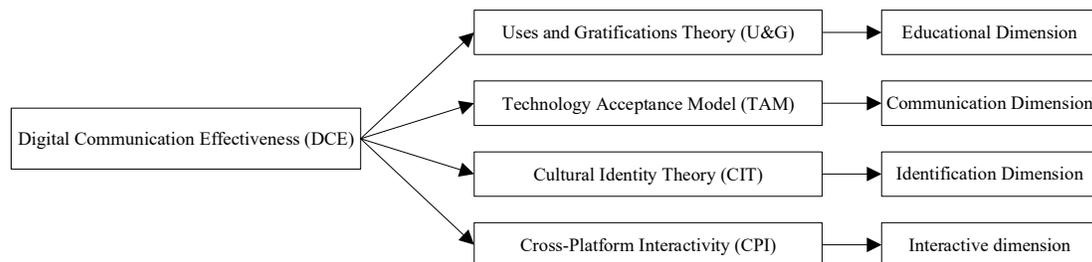


Figure 1. Research Framework

### 1.4 Significance of the Research

This study takes the art of the Zhuang Tianqin from Guangxi as its point of entry, focusing on music-based ICH education from the perspectives of digital education and cross-platform dissemination. Its innovation lies in:

**Theoretical Level:** Breaking away from single-perspective approaches in music-based ICH education research, this work positions digital technology as an innovative element in cultural transmission rather than a mere tool. It constructs an integrated theoretical framework of ‘culture-technology-education’, blending digital humanities with educational technology to offer new insights for collaborative, interdisciplinary teaching models in music-based ICH.

**Practical Dimension:** Focusing on cross-platform pathways and digital transformation in Guangxi Zhuang Tianqin art education, it counters the homogenisation tendency in existing music-based ICH educational practices. This facilitates the transition of music-based ICH education from abstract concepts to concrete implementation.

Concurrently, the findings offer reference points for digital education in other ICH projects, holding positive implications for advancing music-based ICH education development in China.

## 2. Literature Review

### 2.1 Theoretical and Practical Research on Music-Related Intangible Cultural Heritage Education

#### 2.1.1 Core Essence and Cultural Value of Music-Related Intangible Cultural Heritage

The *Convention for the Safeguarding of the Intangible Cultural Heritage* defines music-related ICH as a system of practices conveyed through sound and performance, created and transmitted by specific communities. Its essential characteristics manifest across three dimensions: processuality, contextuality, and collectivity (Lazaro Ortiz & Jimenez de Madariaga, 2022). Such intangible heritage encompasses not only quantifiable elements like pitch and rhythm, but is more profoundly embedded within cultural fields comprising ritual structures, belief systems, and bodily skills, forming a composite existence as integrated cultural events. This characteristic necessitates research perspectives that transcend static textual analysis, shifting towards dynamic deconstruction of how musical practices organise social action, maintain cultural boundaries, and construct emotional communities.

Musical ICH exhibits threefold value characteristics: 1) As a cultural gene bank, it carries historical memory and cosmologies through festive rituals and life-cycle ceremonies, serving as a key code for decoding local social structures; 2) As a resource for identity construction, it reinforces cultural belonging within ethnic groups while functioning as a symbol of cultural diversity within national narratives; 3) as educational vehicles, they cultivate collaborative awareness and ethical cognition through collective musical practice, organically integrating aesthetic education with moral development objectives (Howard, 2022). Research indicates that learners participating in intangible musical heritage practices must internalise tacit knowledge through bodily perception. This process deepens cultural identity while simultaneously fostering critical thinking abilities.

#### 2.1.2 Paradigmatic Characteristics of Intangible Cultural Heritage Education in Music

The practice of intangible cultural heritage education in music has long been constrained by the dual tensions of traditional educational models and modern educational systems. Early traditional ICH education relied on apprenticeship systems and familial transmission, emphasising the imparting of skills and deep embedding within cultural contexts, with educational objectives focused on preventing loss (De-Miguel-Molina et al., 2021). whereas the modern education system tends to incorporate intangible cultural heritage within standardised frameworks. Centred on knowledge classification and skill training, it advocates achieving contemporary cultural expression through understanding, interpretation, and re-creation, thereby shifting the educational paradigm from unidirectional skill transmission towards a process of cultural co-creation (Gui et al., 2024).

ICH in music has been integrated into primary, secondary, tertiary and social education systems. Practical challenges manifest as fragmented educational content, monotonous teaching methodologies and weakened cultural contextualisation. Research indicates that classrooms, cultural spaces, public cultural facilities, and digital platforms form a multi-contextual interactive framework. Information technology interventions have propelled the development of blended teaching models (Qiang, 2025), with audio-visual resources, online collaboration, and learning analytics supporting personalised learning. This approach maintains the core of face-to-face instruction while expanding feedback channels. However, traditional educational models exhibit significant limitations in addressing the cultural consumption habits and dissemination demands of the digital era: linear transmission methods struggle to meet the needs of diverse learning scenarios (Baxter et al., 2024), hindering learners' emotional connection to and value recognition of ICH.

### 2.2 Innovative Pathways for Digital Technology-Empowered Music-Related Intangible Cultural Heritage Education

#### 2.2.1 Mechanisms for the Digital Transformation of Intangible Cultural Heritage Education

The core mechanisms of digital transformation in ICH education manifest through three pathways: resource reconstruction, scenario re-engineering, and stakeholder empowerment. Digital technologies enable the perceptible and interactive representation of musical intangible cultural heritage forms through high-precision data capture, three-dimensional modelling, and virtual reality (Kang, 2022). This creates immersive, personalised, and collaborative learning environments integrating multimodal resources, transcending the temporal and spatial constraints of traditional ritual settings. Furthermore, national-level systems and policies establish the foundation for digital standardisation, while the educational sector's positioning of digital ICH within curricula directly influences pedagogical integration. Standardised data cataloguing and resource acquisition processes have yielded searchable, shareable databases. However, despite enhancing students' cognitive understanding of intangible cultural heritage, digital courses face challenges including divergent participation levels and insufficient depth of experiential engagement (Cozzani et al., 2017). This transformation drives the continuous refinement of ICH education, whose effectiveness hinges upon a dynamic equilibrium between preserving cultural authenticity and upholding

technological ethics.

### 2.2.2 Teaching Scenarios for Musical Intangible Cultural Heritage in the Digital Context

Within formal educational settings, online courses, blended learning environments, and smart classrooms constitute novel pedagogical platforms. These integrate audio-visual resources, online assessment tools, and discussion modules to form progressive, closed-loop systems. Digital technology in this context serves dual functions as both pedagogical support and management tools, manifesting in the digital recreation of ICH rituals within virtual environments, multi-platform collaborative construction of teaching chains (Innocente et al., 2024), and the extension of learning scenarios into everyday life and gamified contexts. Within informal educational settings, social media and short-video platforms are reshaping the learning ecosystem for ICH. Learners engage in its reproduction through content consumption, imitation, and creative adaptation. However, research indicates that platform algorithms tend to compress cultural content into fragmented audiovisual snippets, resulting in contextual loss and dilution of meaning (Wang et al., 2025).

### 2.3 Collaborative Educational Models for Cross-Platform Dissemination

#### 2.3.1 Foundational Architecture for Cross-Platform Dissemination of Musical Intangible Cultural Heritage

The foundational architecture for cross-platform dissemination of ICH in music comprises three technical pillars: multimodal resource integration, dynamic content adaptation, and collaborative governance. Multimodal resource integration necessitates overcoming platform silos to establish a resource network spanning online courses, social media, and virtual reality environments (Tang, 2024). Dynamic content adaptation emphasises learner profiling systems based on big data analytics, matching learning objectives at different stages through real-time optimisation and personalised recommendations; collaborative governance among stakeholders necessitates establishing cooperative mechanisms between educators, inheritors, technology developers, and cultural administrators to achieve copyright protection and benefit distribution, while community operation platforms facilitate learner interaction and feedback (Zuo et al., 2025). The essence of cross-platform dissemination infrastructure lies in a dynamic equilibrium between technological conditions, educational objectives, and cultural ethics. This architecture provides the technical framework and organisational logic for cross-platform educational pathways in Guangxi Zhuang Tianqin art, constituting the key to achieving the digital transformation of musical ICH education.

#### 2.3.2 Task-Driven Cross-Platform Dissemination Pathways for Musical Intangible Cultural Heritage

The construction of a task-driven cross-platform dissemination pathway for musical ICH involves the structured integration of multi-platform resources and learning processes. Within AI-era musical ICH education, a progressive task framework effectively reduces cognitive load arising from platform switching (Ott et al., 2015), enabling learners to proactively select appropriate platforms and resources based on clear objectives. This facilitates a closed-loop process encompassing information gathering, skill training, outcome presentation, and reflective summarisation. Blended learning research confirms that when tasks present a stepwise progression in difficulty and content relates to learners' lived experiences, sustained cross-platform engagement significantly increases. Within music-based ICH contexts, task chains progressively unfold around rhythmic pattern analysis, melodic structure cognition, performance technique acquisition, and cultural context interpretation (Wang & Yang, 2025), with each stage corresponding to distinct platform functional strengths.

### 2.4 Current Status and Shortcomings in the Education of Guangxi Zhuang Tianqin Art

#### 2.4.1 Current State of Education and Dissemination of Guangxi Zhuang Tianqin Art

As a nationally recognised ICH, the education and dissemination of the Zhuang Tianqin art in Guangxi have developed a multi-dimensional interactive framework, though its systematic construction requires further refinement. Research indicates that this art form has evolved from a comprehensive expression blending religious rituals and folk narratives towards a transformation into stage performances and cultural symbols, now serving a dual function of ethnic identity marker and cultural image display (Wang et al., 2025). Regarding transmission mechanisms, its social foundation exhibits regional decline due to urbanisation and generational shifts (Yi et al., 2023). Regarding educational practice, Guangxi Zhuang Tianqin art has been integrated into the curricula of some institutions through specialised courses, elective modules, and practical activities, linking it with music appreciation, aesthetic education, and ethnic cultural education. At the dissemination level, cultural festivals, artistic performances, and symposiums enhance the public visibility of Guangxi Zhuang Tianqin art. Such events not only strengthen local cultural identity but also provide performance and teaching opportunities for practitioners.

### 2.4.2 Shortcomings and Challenges in the Guangxi Zhuang Tianqin Art Education Model

The educational model for the Zhuang Tianqin art in Guangxi exhibits structural contradictions. Existing educational practices suffer from ambiguous positioning, with most programmes emphasising the stimulation of cultural interest and emotional identification without integrating these into a systematic learning framework. This results in a lack of organic connection between knowledge construction, skill acquisition, and cultural understanding, making it difficult for learners to establish a stable cognitive structure (Guang et al., 2024). Curriculum structural deficiencies are equally pronounced, including shortages of specialised teaching staff, reliance on externally hired inheritors or short-term training programmes, lagging development of teaching resources, and difficulties integrating theoretical exposition with cultural value transmission (Deng, 2025). Moreover, digitalisation and cross-platform applications lag considerably. Despite policy advocacy for digital technology empowerment, digital resources remain insufficient in quantity, lack standardisation, and suffer from platform fragmentation. Furthermore, these resources predominantly consist of performance excerpts or promotional footage, lacking modular, learning-goal-designed materials and interactive elements (Figure 2). Meanwhile, data silos across platforms compel educators to undertake repetitive resource integration. This state of inadequate technological empowerment constrains the development of cross-platform educational models (Wang & Yang, 2025).



**Figure 2.** Teaching Scenes of the Zhuang Tianqin Art in Guangxi

## 3. Research Methodology

### 3.1 Research Design

This study employs an Explanatory Sequential Design (Creswell & Plano Clark, 2023) to comprehensively examine the key factors influencing the digital educational dissemination of the Zhuang Tianqin art in Guangxi. The rationale for selecting a mixed-methods approach lies in the following: quantitative research identifies influencing factors and their relative significance, providing statistical evidence and generalisable conclusions; qualitative research enables deeper understanding of the mechanisms and contextual characteristics at play, revealing processes and meanings. The integration of both methodologies endows the research with both the breadth of statistical inference and the depth of interpretative understanding.

The study unfolds in two sequential phases. The first phase comprises quantitative research, employing a large-scale questionnaire survey to identify key influencing factors and their relative significance. The second phase involves qualitative research, utilising semi-structured in-depth interviews to elucidate the operational mechanisms and contextual characteristics of these factors. The quantitative phase employs a cross-sectional survey design, grounded in an integrated theoretical framework drawing upon the Technology Acceptance Model (TAM), the Uses and Gratifications Theory (U&G), Cultural Identity Theory, and Media Convergence Theory. The qualitative phase utilises purposive sampling and thematic analysis to explore the lived experiences of cultural communication stakeholders. Data integration occurs during the interpretative phase, where qualitative findings inform the interpretation and contextualisation of quantitative results.

### 3.2 Scope of the Research Site

The research site encompasses the Guangxi Zhuang Autonomous Region as the core field, where the art of the Zhuang Tianqin harp thrives. It focuses on educational institutions such as local higher education establishments in Guangxi that offer relevant courses, while also incorporating short-video platforms and online education platforms into the research framework to construct a cross-regional digital dissemination network.

### 3.3 Data Collection and Sample Selection

#### 3.3.1 Population and Sample

**Quantitative research sample:** The quantitative study employed a combination of quota sampling and snowball sampling, ultimately yielding 365 valid responses. Questionnaires were distributed via both online channels (Wenjuanxing platform and social media) and offline channels (universities, cultural centres, and ICH training events) over a period of 4–5 weeks. A total of 400 questionnaires were distributed, with 385 returned (response rate: 96.3%). After excluding 20 invalid responses, the effective response rate stood at 91.25%.

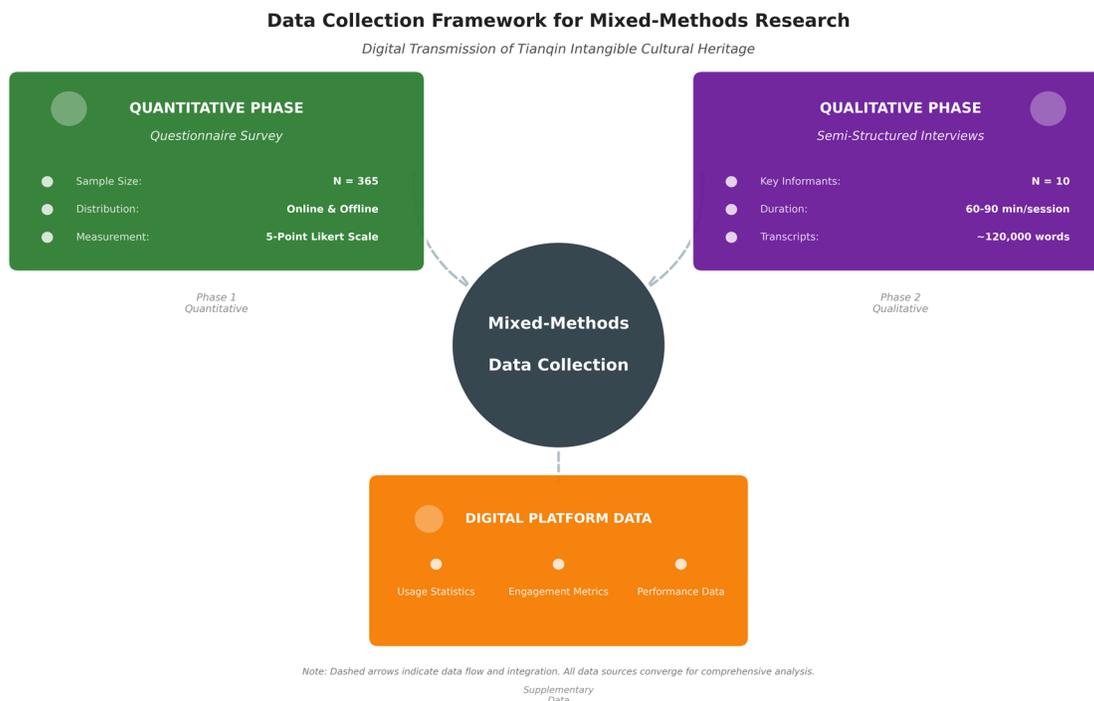
**Qualitative Research Sample:** Following preliminary quantitative analysis, purposeful sampling was employed to select ten key informants for semi-structured in-depth interviews. Selection criteria prioritised diversity in stakeholder roles, platform usage experience, and levels of cultural identification. Participants included: three Tianqin cultural inheritors (one national-level, two regional-level); two university lecturers (one professor from a music academy, one associate professor from an ethnic studies faculty); 2 cultural practitioners (1 cultural centre director, 1 ICH protection centre director), 2 new media professionals (1 short-video content creator, 1 online education platform operations manager), and 1 deep learner who had studied Guangxi Zhuang Tianqin art via digital platforms for over 18 months and attained performance proficiency.

This sampling strategy ensured representation across content creators (heritage bearers, educators, cultural practitioners), content consumers (learners), and dissemination intermediaries (platform operators). Interviewees spanned ages from 24 to 68, providing a generational perspective.

#### 3.3.2 Quantitative Research Data Collection

A structured questionnaire was developed based on an integrated theoretical framework. The questionnaire comprised two sections: demographic information (8 items) and core measurements (34 items). The core measurements employed a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), covering five dimensions: Technology Acceptance Characteristics (6 items, measuring perceived usefulness and ease of use), Usage Motivation (6 items, assessing informational, entertainment, social, and identity needs), Cultural Identity (6 items, evaluating cognitive, affective, and behavioural dimensions), Cross-Platform Interactivity (6 items, measuring platform integration and interactive design), and Digital Communication Effectiveness (8 items, assessing learning outcomes and cultural engagement).

The questionnaire demonstrated excellent reliability and validity, with Cronbach's  $\alpha$  coefficients for each dimension ranging from 0.964 to 0.984. The overall scale reliability coefficient  $\alpha = 0.976$ . The KMO measure of sampling adequacy was 0.976, and Bartlett's sphericity test was significant ( $\chi^2 = 15979.28$ ,  $df = 496$ ,  $p < 0.001$ ). The data proved suitable for factor analysis. Exploratory factor analysis extracted five factors, cumulatively explaining 86.46% of variance, thereby validating the theoretical construct (Figure 3).



**Figure 3.** Data Collection Methods

### 3.3.3 Qualitative Data Collection

Semi-structured in-depth interviews were conducted with ten participants, each lasting 60–90 minutes and recorded following informed consent.

The interview guide was organised around four thematic domains corresponding to the quantitative study's variables: technology acceptance, usage motivation, cultural identity formation, and cross-platform interactivity. Each domain comprised 3–4 open-ended questions, with flexibility to adapt based on emerging themes. Sample interview questions included: ‘*What do you consider the greatest strengths and weaknesses of the current Guangxi Zhuang Tianqin Art Digital Platform?*’ (Technology Acceptance); ‘*What are your primary motivations for creating/participating in Guangxi Zhuang Tianqin Art digital content, and how do different platforms meet varying needs?*’ (Usage Motivation); ‘*How do digital platforms facilitate or impede learners' cultural identity development?*’ (Cultural Identity); ‘*How do you perceive the necessity of multi-platform collaborative dissemination, and which strategies have proven effective?*’ (Cross-platform interactivity).

All interviews were transcribed within 24 hours, yielding approximately 120,000 words of transcript text. Field notes and reflective journals were maintained throughout the data collection process, documenting contextual observations and emerging analytical insights.

### 3.4 Data Analysis Methods

#### 3.4.1 Quantitative Data Analysis

Quantitative data underwent systematic analysis using SPSS 26.0, comprising five stages:

- 1) Characterising sample characteristics and variable distribution patterns through descriptive statistics;
- 2) Assessing internal consistency reliability of measurement instruments using Cronbach's  $\alpha$  coefficient;
- 3) Verifying the construct validity of the scales through exploratory factor analysis employing the KMO measure of sampling adequacy, Bartlett's test of sphericity, and an orthogonal rotation maximising variance.
- 4) Examining bivariate relationships between variables via Pearson correlation analysis.
- 5) Conducting multiple linear regression analysis using forced entry (Enter) methodology, with digital communication effectiveness as the dependent variable and the four theoretical constructs as independent variables. Within the regression analysis, multiple collinearity was diagnosed using variance inflation factor (VIF) and tolerance statistics, with model assumptions validated through residual analysis.

### 3.4.2 Qualitative Data Analysis

Qualitative data underwent Thematic Analysis, strictly adhering to Braun and Clarke's (2006) six-stage framework.

Stage One: Familiarisation with the data through repeated reading of interview transcripts and the drafting of preliminary notes.

Stage Two: Systematic coding of meaningful data segments.

Stage Three: Consolidation and categorisation of initial codes into candidate themes.

Stage Four: Review and refinement of candidate themes to ensure homogeneity within themes and heterogeneity between them.

Stage Five: Clear definition and naming of refined themes.

Stage 6: Drafting analytical reports and selecting exemplary quotations for support.

To ensure the rigour and credibility of qualitative analysis, this study employed four quality control strategies.

- 1) Researcher triangulation: An independent qualitative research expert coded 10% of interview transcripts, achieving 85% inter-coder reliability, indicating robust coding scheme validity.
- 2) Member validation: Preliminary findings were shared with three key informants to verify interpretative accuracy.
- 3) Thick description: Rich contextual details were provided in the report to enhance the transferability of findings.
- 3) Reflective practice: Researchers maintained reflective journals documenting theoretical assumptions, potential biases, and analytical decision-making processes to improve transparency and auditability.

### 3.4.3 Data Integration

The integration of quantitative and qualitative data follows the logic of an explanatory sequential design, achieving complementary fusion during the interpretative phase.

Quantitative analysis identified key factors influencing the effectiveness of digital dissemination for the Zhuang Tianqin art in Guangxi, revealing the relative importance of each factor and their statistical correlation patterns. This addressed the questions of 'what factors' and 'to what extent they influence'. Qualitative analysis delves into the underlying mechanisms behind these statistical patterns, elucidating how factors operate, the processes through which they exert influence, and the contexts where their effects are most pronounced, addressing the questions of 'how' and 'why'.

Through this integration, quantitative data provides breadth and universality to the research, while qualitative data offers depth of understanding and contextual richness. This enables the study to present a more complete and profound picture of the digital dissemination of Tianqin culture.

## 4. Results

This chapter presents findings from a mixed-methods study encompassing both quantitative patterns of key influencing factors and qualitative insights into the mechanisms at play. The research outcomes are organised into two complementary sections: first, quantitative findings establishing the relative importance of critical factors; second, qualitative themes elucidating the processes and contexts underlying these statistical relationships.

### 4.1 Quantitative Research Findings

#### 4.1.1 Sample Characteristics Analysis

This study distributed 400 questionnaires through a combination of online and offline methods, and collected 385 questionnaires. After removing 20 invalid questionnaires, 365 valid questionnaires were obtained, resulting in a valid response rate of 91.25%. The sample showed good representativeness and diversity in dimensions such as gender, age, education level, identity/role, geographical distribution, cultural understanding, and platform usage experience (Table 1).

**Table 1.** Distribution of Sample Demographic Characteristics ( $N=365$ )

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	165	45.2
	Female	200	54.8
Age	18-25 years	128	35.1
	26-35 years	133	36.4
	36-45 years	64	17.5
	46-55 years	31	8.5
	56 years and above	9	2.5
Education Level	High school or below	22	6.0
	Associate degree	49	13.4
	Bachelor's degree	212	58.1
	Master's degree or above	82	22.5
	University students	110	30.1
	University teachers	73	20.0
Identity	Cultural workers/Inheritors	73	20.0
	New media practitioners	55	15.1
	General enthusiasts	54	14.8
Region	Guangxi Zhuang Autonomous Region	235	64.4
	Other provinces	130	35.6
	Very familiar	58	15.9
Familiarity Level	Quite familiar	88	24.1
	Moderately familiar	119	32.6
	Not very familiar	74	20.3
	Not familiar at all	26	7.1
Platform Usage Duration	Less than 3 months	160	43.8
	3-6 months	94	25.8
	6 months to 1 year	111	30.4

#### 4.1.2 Reliability and Validity Testing

##### 4.1.2.1 Reliability Testing

Cronbach's  $\alpha$  coefficient was employed to assess the internal consistency reliability of the questionnaire (Nunnally & Bernstein, 1994). Results indicate (Table 2) that the overall scale reliability coefficient reached 0.976, significantly exceeding the excellent standard of 0.90. All dimension reliability coefficients surpassed the 0.90 benchmark, demonstrating strong internal consistency across questionnaire dimensions, high inter-item correlations, and robust reliability of the scale.

**Table 2.** Questionnaire Reliability Test Results

Dimension	Number of Items	Cronbach's $\alpha$
Technology Acceptance	6	0.964
Usage Motivation	6	0.965
Cultural Identity	6	0.966
Cross-Platform Interactivity	6	0.964
Digital Transmission Effectiveness	8	0.984
Total Scale	32	0.976

Note: Cronbach's  $\alpha > 0.90$  is excellent, 0.80–0.90 is good, 0.70–0.80 is acceptable

#### 4.1.2.2 Validity Testing

Validity testing comprised the KMO suitability test and Bartlett's sphericity test. The KMO value of 0.976 substantially exceeds the excellent threshold of 0.90 (Kaiser, 1974), indicating the data are highly suitable for factor analysis. Bartlett's sphericity test yielded significant results ( $\chi^2=15979.28$ ,  $df=496$ ,  $p<0.001$ ) (Bartlett, 1954), rejecting the null hypothesis that the variable correlation matrix is the identity matrix. This further confirms the data's suitability for factor analysis. Exploratory factor analysis (EFA) was conducted using principal component analysis, with variance-maximising orthogonal rotation (Kaiser, 1958). The results indicated that the cumulative variance explained by the five extracted factors was 86.46%, far exceeding the acceptable standard of 60% (Table 3).

**Table 3.** Results of Exploratory Factor Analysis

Factor	Eigenvalue	Variance Explained (%)	Cumulative Variance (%)	Number of Items
Factor 1: Digital Transmission Effectiveness	18.962	59.26	59.26	8
Factor 2: Technology Acceptance	2.792	8.72	67.98	6
Factor 3: Usage Motivation	2.336	7.30	75.28	6
Factor 4: Cultural Identity	1.998	6.24	81.52	6
Factor 5: Cross-Platform Interactivity	1.590	4.97	86.46	6

Note: Principal component analysis with variance-maximising orthogonal rotation was employed; KMO=0.976, Bartlett's  $\chi^2=15979.28$ ,  $df=496$ ,  $p<0.001$

#### 4.1.3 Descriptive Statistical Analysis

This section presents descriptive statistics for each research variable. Mean scores across all dimensions exceed the theoretical median of 3.0, indicating respondents' positive attitudes towards the digital educational dissemination of Guangxi Zhuang Tianqin art (Table 4). Among these dimensions, digital dissemination effectiveness received the highest ratings, followed by cultural identity. Usage motivation, cross-platform interactivity, and technological acceptance characteristics scored relatively lower but remained at elevated levels.

**Table 4.** Descriptive Statistics for Research Variables ( $N=365$ )

Variable	Number of Items	<i>M</i>	<i>SD</i>	Min	Max
Technology Acceptance	6	3.782	0.887	1.00	5.00
Usage Motivation	6	3.911	0.812	1.33	5.00
Cultural Identity	6	4.003	0.828	1.50	5.00
Cross-Platform Interactivity	6	3.789	0.857	1.17	5.00
Digital Transmission Effectiveness	8	4.411	0.716	1.63	5.00

Note: Scales employed a 5-point Likert scale, 1=Strongly Disagree, 5=Strongly Agree; theoretical median = 3.0

Regarding standard deviations, values ranged between 0.716 and 0.887, indicating a degree of dispersion in respondents' evaluations while maintaining overall concentration. This moderate variability ensures data validity while providing sufficient source of variance for subsequent correlation and regression analyses.

#### 4.1.4 Correlation Analysis

Pearson correlation analysis was employed to examine relationships between variables. All variables exhibited significant positive correlations ( $p<0.01$ ), with correlation coefficients ranging from 0.465 to 0.760, indicating

moderate to strong positive correlations (Table 5). Regarding the strength of correlation between each independent variable and the dependent variable (digital communication effectiveness): Cross-platform interactivity exhibited the strongest correlation with communication effectiveness ( $r = 0.760, p < 0.01$ ), followed by cultural identity ( $r = 0.721, p < 0.01$ ). The correlation strengths between usage motivation ( $r = 0.656, p < 0.01$ ) and technological acceptance characteristics ( $r = 0.650, p < 0.01$ ) were comparable.

**Table 5.** Pearson Correlation Matrix Among Variables

Variable	1	2	3	4	5
1. Technology Acceptance	1				
2. Usage Motivation	.465**	1			
3. Cultural Identity	.508**	.517**	1		
4. Cross-Platform Interactivity	.535**	.509**	.531**	1	
5. Digital Transmission Effectiveness	.650**	.656**	.721**	.760**	1

Note: \*\* denotes significant correlation at the 0.01 level (two-tailed)

It is noteworthy that correlations among independent variables generally remained at moderate levels, with the highest being 0.531 between cross-platform interactivity and cultural identity. This indicates that the four core variables possess good discriminant validity and exhibit no severe multicollinearity issues, laying a sound foundation for subsequent regression analysis.

#### 4.1.5 Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted with digital communication effectiveness as the dependent variable and technological acceptance characteristics, usage motivation, cultural identification, and cross-platform interactivity as independent variables (Table 6).

##### 4.1.5.1 Overall Model Fit

Regarding the overall model fit,  $R^2$  was .782 and adjusted  $R^2$  was .779. The model explained 77.9% of the variance in communication effectiveness, demonstrating strong explanatory power (Cohen, 1988). This indicates that the theoretical model constructed in this study can effectively predict the effectiveness of digital educational communication for the Vega culture. Further  $F$ -test results revealed an  $F$ -value of 322.65 with a  $p$ -value below .001, indicating the regression model achieved extreme significance overall. The four independent variables collectively exerted a significant predictive effect on the dependent variable. Additionally, the model's standardised estimated error of 0.336 demonstrated high predictive accuracy.

**Table 6.** Results of Multiple Linear Regression Analysis ( $N=365$ )

Variable	B	SE	$\beta$	t	Sig.	Tolerance	VIF
Constant	0.147	0.110	—	1.337	.182	—	—
Technology Acceptance	0.160	0.026	.198***	6.202	<.001	.648	1.544
Usage Motivation	0.175	0.028	.198***	6.250	<.001	.666	1.502
Cultural Identity	0.291	0.027	.336***	10.895	<.001	.638	1.568
Cross-Platform Interactivity	0.309	0.027	.370***	11.326	<.001	.561	1.783

Note: Dependent variable = digital dissemination effectiveness;  $R^2=.782$ , adjusted  $R^2=.779$ ,  $F(4,360)=322.65$ ,  $p<.001$ , standardised coefficient=0.336. \*\*\* $p<.001$

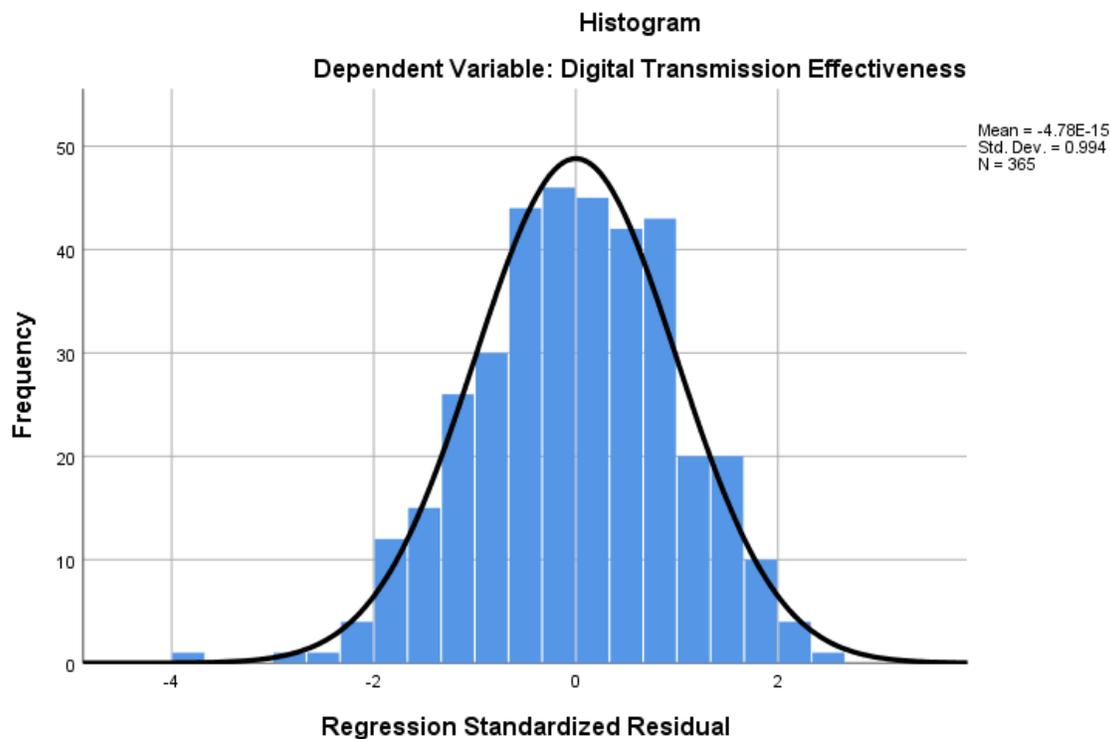
##### 4.1.5.2 Analysis of the Impact Effects of Each Variable

The regression coefficients for each variable reveal the key factors influencing the success of digital educational dissemination for the Guangxi Zhuang Tianqin art, ranked in order of importance. Firstly, the standardised regression

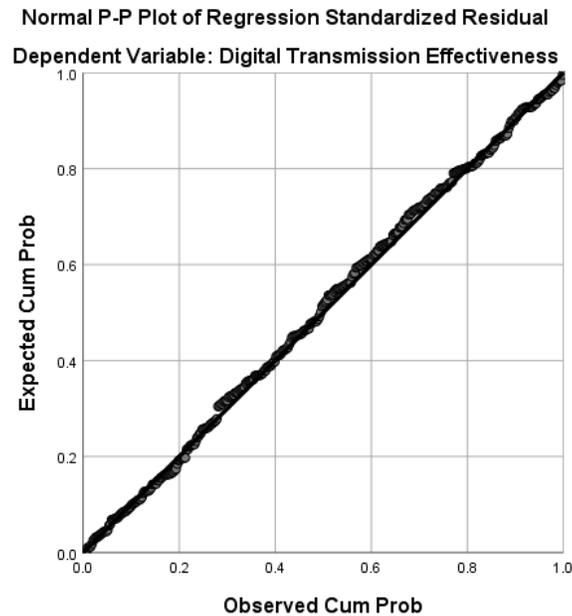
coefficient for cross-platform interactivity was the highest ( $\beta=0.370$ ,  $t=11.326$ ,  $p<0.001$ ), making it the most significant factor affecting digital dissemination effectiveness. This finding represents a significant theoretical breakthrough, demonstrating that within the digital dissemination context, multi-platform coordination, complementary content, and interactive design exert a greater influence on dissemination effectiveness than other factors. It validates the central role of media convergence theory (Jenkins, 2006) in the dissemination of intangible cultural heritage. Secondly, the standardised regression coefficient for cultural identity ranked second ( $\beta=0.336$ ,  $t=10.895$ ,  $p<0.001$ ), indicating that audiences' cognitive understanding, emotional resonance, and behavioural participation intentions towards Guangxi Zhuang Tianqin art significantly influence communication effectiveness. This validates the crucial role of cultural identity theory (Tajfel & Turner, 1979) in intangible cultural heritage dissemination. Finally, the standardised regression coefficients for usage motivation and technological acceptance characteristics were comparable ( $\beta=0.198$ ,  $p<0.001$ ), corresponding respectively to the Usage and Satisfaction Theory (Katz et al., 1973) and the Technology Acceptance Model (Davis, 1989). Together, these form the foundational conditions for digital dissemination. Although relatively minor, these factors remain significant contributors to dissemination effectiveness, indicating that platform usability, utility, and fulfilment of users' multidimensional needs warrant ongoing attention and refinement.

#### 4.1.5.3 Multicollinearity Diagnosis

Multicollinearity diagnostics revealed that all independent variables exhibited tolerances exceeding 0.56 and *VIF* values below 1.8, substantially lower than the critical threshold of 10 (Hair et al., 2010). This indicates no severe multicollinearity issues. Multicollinearity can increase the standard error of regression coefficients, compromising the stability and accuracy of parameter estimation. In this study, the *VIF* values for each independent variable were substantially below the critical threshold, indicating relative independence among variables and no adverse impact on regression outcomes. The assumptions for the regression model were thus satisfied, and the model's reliability was fully validated. Residual analysis (Figures 2-3) demonstrated that residuals followed a normal distribution, satisfying the assumption of homogeneity of variance. Consequently, the regression model complied with the fundamental assumptions of linear regression, rendering the analytical results credible.



**Figure 2.** Histogram of Standardized Residuals



**Figure 3.** Normal P-P Plot of Regression Standardized Residuals

#### 4.2 Analysis of Qualitative Interview Findings

To elucidate the relationships between variables within the quantitative model, this study conducted semi-structured interviews with 12 key informants. Employing thematic analysis, the research identified four core themes corresponding to quantitative factors, providing contextualised empirical evidence for understanding how digital platforms concretely facilitate cultural dissemination.

##### 4.2.1 Mechanisms for Building Cross-Platform Collaborative Ecosystems

Interview data strongly corroborated the pivotal role of cross-platform interactivity, though interviewees emphasised that effective collaboration extends beyond mere content distribution. Content creator M1 explained: *‘Different platforms serve distinct functions—short videos capture attention, while specialised platforms facilitate deep learning, effectively forming a filtering funnel’*; Cultural inheritor T2 described her practical strategy: *‘I showcase the aesthetic appeal of performances on Douyin, while writing in-depth cultural articles on my official account. The two complement each other, jointly constructing a complete learning ecosystem.’* Beyond content complementarity, the formation of community networks is also regarded as a significant outcome of platform synergy. Professor E1 observed: *‘Digital platforms not only transmit information but connect people. Students form learning communities through cross-platform interactions, where social connections often yield superior learning outcomes compared to one-way content consumption.’* This indicates that the essence of cross-platform synergy lies in constructing a digital ecosystem encompassing the entire process of “discovery, learning, and social interaction”.

##### 4.2.2 A Progressive Pathway for Cultivating Cultural Identity

Regarding cultural identity as an influencing factor, interviews revealed a deepening process from cognitive understanding to behavioural commitment. Heritage bearer T1 reflected: *‘Initially I merely demonstrated technique, but later realised I must recount the rituals and stories behind it. Only by grasping the cultural context can audiences truly develop reverence for the Tianqin, rather than merely viewing it as spectacle’*; Deep learner L1 shared an emotional awakening: *‘Upon learning that the melody embodied our ancestors’ prayers for bountiful harvests, I experienced profound emotional resonance. This connection became the bond sustaining my dedication to learning’*; Operator M2 further elaborated on behavioural manifestations of identification: *‘We observe many learners spontaneously posting videos or teaching others on social media after mastering the skill. This shift from passive recipients to active disseminators signifies that cultural identification has become internalised as part of their self-identity.’*

##### 4.2.3 Multi-dimensional Needs Fulfilment and Motivational Stratification

Interviews confirmed the effectiveness of digital platforms in driving dissemination by addressing users' diverse needs. Professor E1 noted: *‘User needs are stratified. Beginners require accessible introductory guidance, while*

researchers seek in-depth historical documentation. Platforms must provide differentiated resources to serve distinct groups.’ Addressing the tension between entertainment and culture, creator M1 argued: ‘Moderate entertainment is a necessary means. It acts as an entry point, first drawing young people in before guiding them to explore more serious cultural core.’ Furthermore, identity construction emerged as a significant motivator. Practitioner M2 observed: ‘Younger generations often pursue traditional crafts with a desire to express individuality. Sharing learning outcomes on social media serves not merely to showcase skills, but to cultivate a distinct image rooted in cultural heritage.’

#### 4.2.4 The Dialectic of Technological Empowerment and Constraints

Regarding technological acceptance, interviews revealed that while respondents acknowledged technological conveniences, they maintained a clear-eyed awareness of its limitations. Bearer T1 candidly remarked: ‘Digital technology breaks geographical barriers, enabling students miles away to attend classes – an advantage traditional methods cannot match. Yet screens remain a barrier; the fluid energy and subtle tactile nuances of in-person instruction are difficult to fully convey through video.’ Scholar E2 expressed concern from a cultural fidelity perspective: ‘While digitisation broadens dissemination, it risks disembedding cultural contexts. If only the form is learned while the connection to life’s rituals is lost, culture may become hollowed out.’ In response, Centre Director C1 proposed a compromise: ‘We favour a hybrid model combining online outreach with offline deepening, using digital technology to address accessibility while relying on in-person activities to ensure depth of experience and quality of transmission.’

## 5. Discussion

### 5.1 The Core Role and Theoretical Breakthrough of Cross-Platform Interactivity

The most significant finding of this study is that cross-platform interactivity markedly surpasses traditional technological acceptance and content quality factors, emerging as the primary variable influencing communication effectiveness. This outcome does not simply negate earlier research but empirically refines key assumptions. Previous studies regarded the conventional notion of ‘content is king’ as the core of communication, yet our data indicates its explanatory power falls far short of cross-platform synergy. This is because it constructs a communication ecosystem characterised by functional complementarity, content stratification, and social connectivity. Whereas the earlier ‘single-platform optimisation’ perspective focused on technological user experience, this study reveals that short-video platforms fulfil the function of ‘breaking through audience silos to drive traffic’, content platforms provide spaces for ‘knowledge accumulation’, and social platforms achieve ‘community cohesion’ in communication efficacy. The synergy among these three further unifies the breadth of dissemination with the depth of cultural transmission.

This discovery not only extends Jenkins’ (2006) media convergence theory from journalism and commercial marketing into the cultural heritage domain, but also reveals that media convergence constitutes not merely technical platform integration, but systemic construction at the ecosystem level. Cross-platform synergy constitutes a systemic audience cultivation mechanism, employing phased guidance based on audience cognitive patterns: initial short-form audiovisual stimuli capture attention; mid-stage systematic content fosters deepened understanding; and late-stage social interaction reinforces identity recognition.

### 5.2 The Dual Logic and Progressive Mechanism of Cultural Identity

Cultural identity, as the second most influential factor, is significant in that it reveals the spiritual core of cultural transmission. This study confirms that even within virtual spaces, cultural identity remains the core psychological mechanism driving deep audience engagement. The ranking of cultural identity and cross-platform interactivity reveals the dual logic of cultural transmission in the digital age: technological logic determines the breadth and efficiency of transmission, while cultural logic determines its depth and quality. Cross-platform coordination serves a traffic-driving function during the initial dissemination phase, while cultural identity plays a transformative role in the deepening stage, thereby correcting the earlier assumption that ‘cultural identity is merely an outcome’.

The ‘cognitive-affective-behavioural’ progressive pathway revealed through interviews in this study expands the explanatory framework of Tajfel and Turner’s (1979) cultural identity theory within digital contexts. Digital platforms facilitate the progressive deepening of cultural identification across three dimensions: promoting cognitive understanding through multimodal content presentation; stimulating emotional resonance via affective narratives and interactive experiences; and supporting behavioural expression through social functions and UGC mechanisms. This mechanism not only validates the digital applicability of Tajfel’s theory but further demonstrates that digital

platforms serve not merely as conduits for cultural information dissemination, but as practical arenas for the construction of cultural identification.

### *5.3 Foundational Positioning of Usage Motivation and Technology Acceptance*

The influence of usage motivation and technology acceptance characteristics on communication effectiveness is comparable yet significantly lower than the former two factors. This indicates that in the digital dissemination of intangible cultural heritage, technological and motivational factors constitute threshold conditions—prerequisites for communication to occur—but are not core drivers. The lower ranking of technology acceptance characteristics reflects the enhanced maturity of current digital platform technologies, where platform usability is no longer a primary barrier. Consequently, the competitive focus has shifted from technological competition towards content and ecosystem competition.

The influence mechanism of usage motivation demonstrates both the applicability and limitations of Katz et al.'s (1973) Uses and Gratifications Theory within cultural dissemination. While audience need fulfilment constitutes a necessary condition for participation, mere satisfaction of needs proves insufficient for achieving profound cultural transmission. Consequently, upon establishing need fulfilment, it is imperative to further guide audiences from functional needs towards cultural identification, and from instrumental participation towards value-based engagement.

### *5.4 The Dialectical Tension Between Technological Empowerment and Cultural Fidelity*

The interviews revealed the core tension in the digital dissemination of intangible cultural heritage: how to expand reach while preserving cultural authenticity and depth. Digital technology transcends temporal and spatial constraints, yet it also carries risks such as the disembedding of cultural contexts and insufficient experiential depth. This tension reflects the conflict between instrumental rationality (technological efficiency) and value rationality (cultural depth), demanding adherence to the principle that ‘technology serves culture’ rather than ‘technology substitutes for culture’ in technological applications (Zhang et al., 2022). A hybrid model integrating online and offline approaches offers a viable practical paradigm to resolve this tension: online dissemination addresses the issue of ‘popularisation’, while offline experiences tackle the challenge of “deepening”, achieving an organic balance between the breadth of dissemination and the depth of transmission. This stands in direct opposition to the earlier conflict of ‘technology replacing culture’, with empirical evidence supporting the feasibility of ‘technology serving culture’.

### *5.5 The Integrative Significance of Four-Factor Synergy*

The four core findings of this study constitute a comprehensive integrated theoretical framework. Cross-platform interactivity, cultural identification, usage motivation, and technology acceptance form an organically interconnected system: cross-platform synergy provides a vehicle for cultivating cultural identification, which in turn furnishes the intrinsic motivation for audience participation, while usage motivation and technological experience jointly form the foundational support. This synergistic mechanism exhibits a layered, progressive characteristic: during the initial dissemination phase, technology acceptance and usage motivation determine whether audiences engage with the platform; During the intermediate phase, cross-platform interactivity transforms initial engagement into sustained participation; In the deepening dissemination stage, cultural identification transforms audiences from passive recipients into active disseminators. These four factors collectively propel audiences through the complete transformation of ‘exposure—participation—identification—transmission.’ This provides a dynamic integration model for the holistic design of intangible cultural heritage digital dissemination, addressing existing research gaps in ‘mechanism dynamism.’

## **6. Conclusions**

### *6.1 Key Research Findings*

This study employed an explanatory sequential mixed-methods design to construct a multiple linear regression model demonstrating excellent fit, accounting for 77.9% of the variance in communication effectiveness. This provides scientific empirical evidence for integrating the Zhuang Tianqin art of Guangxi into the digital communication ecosystem.

Findings indicate that cross-platform interactivity constitutes the most critical factor influencing dissemination effectiveness. This outcome signifies that cultural transmission in the digital era has shifted from single-platform optimisation towards ecosystem construction. Cultural identity, emerging as the second most influential factor, confirms that the spiritual core of cultural transmission remains indispensable within digital environments. These

four factors do not operate as a simple summation but form a layered, progressive mechanism— ‘exposure-participation-identification-transmission’—collectively constructing a comprehensive ecosystem for the digital dissemination of intangible cultural heritage. Qualitative interviews further revealed the operational logic underpinning these statistical relationships: cross-platform interaction functions through three pathways—content complementarity, interactive design, and community linkage; the cultivation of cultural identity follows a progressive cognitive-emotional-behavioural trajectory; the fulfilment of usage motivations requires addressing four-dimensional needs for information, entertainment, social connection, and identity; while technological application faces dual challenges of both empowerment and limitation.

### 6.2 Research Contributions

Theoretically, this study constructs a multi-theoretical analytical framework integrating the Technology Acceptance Model, Uses and Gratifications Theory, Cultural Identity Theory, and Media Convergence Theory. It extends Media Convergence Theory from journalism and commercial marketing to the cultural heritage domain, revealing the progressive formation pathway of cultural identity within digital contexts. Practically, the study provides systematic strategic guidance for the digital dissemination of intangible cultural heritage, emphasising the prioritisation of building cross-platform communication ecosystems, implementing progressive cultivation of cultural identity, continuously optimising user experience, and adopting blended transmission models integrating online and offline approaches.

### 6.3 Research Limitations and Future Prospects

This study retains certain limitations. The sample primarily concentrated on the Guangxi region, necessitating caution when extrapolating findings across geographical boundaries; The sample size for qualitative interviews, while achieving thematic saturation, remains limited and insufficient for revealing richer contextual details.

Future research may validate the theoretical framework's universality through cross-cultural comparisons, employ longitudinal tracking designs to uncover the dynamic process of cultural identity formation, incorporate neuroscience and eye-tracking techniques to explore cognitive-affective mechanisms, and conduct intervention experiments to test the practical efficacy of different dissemination strategies.

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