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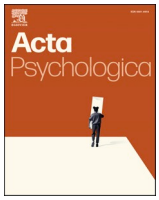

Interactive visual communication for cultural learning and preservation: A mixed-methods study of user engagement with China's intangible heritage

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ABSTRACT

China possesses one of the world's richest collections of Intangible Cultural Heritage (ICH), yet rapid digitization and urbanization pose pressing challenges to its interactive visual communication for cultural learning and preservation. Taking the Uses and Gratifications Theory (UGT) and Technology Acceptance Model (TAM) as the theoretical lens, this study examines how interactive visual communication, encompassing interactivity, aesthetic appeal, cultural relevance, trust, and educational value, shapes public engagement with digital ICH platforms and influences intentions to support heritage preservation. Drawing on the mixed-methods research design, we surveyed 400 Chinese consumers and conducted 15 in-depth interviews to explore both cognitive and emotional responses to immersive ICH learning experiences. Findings show that user experience (UE) plays a mediating role between immersive design features and preservation intent, with visual appeal and valuable learning outcomes emerging as the key determinants of digital engagement. Thematic analysis further reveals how emotional resonance, nostalgia, authenticity, and interactive immersion foster sustained cultural communication and learning in digital environments. By integrating psychological and sociological perspectives on users' digital experience, this study offers practical contributions to enriching sustainable digital heritage engagement and cultural learning.

1. Introduction

Intangible Cultural Heritage (ICH) refers to those living expressions and traditions, knowledge, and skills that communities, groups, and in some cases, individuals recognize as part of their cultural heritage (Wu et al., 2025). With a history spanning over 5000 years, China holds one of the richest collections of ICH in the world. The national advocacy considers the preservation of ICH an urgent cultural priority, especially amidst rapid urbanization and socio-technological transformations (Chipangamate & Nwaila, 2024). According to the Ministry of Culture and Tourism of the People's Republic of China, as of 2023, China holds the record for being one of the ICH-richest countries in the world, with 43 elements currently inscribed on the UNESCO Representative List of Intangible Cultural Heritage of Humanity (Li, Wu, & Du, 2025). As China increasingly exports its cultural products through multinational platforms such as the Belt and Road cultural exchange programs, the digital preservation and communication of ICH carries not only domestic significance but also strategic implications for international soft power (Jiang et al., 2025, b; Yu et al., 2024).

Yet, despite this international recognition, nearly 40% of intangible cultural practices in China are at risk of extinction, particularly those not digitally preserved or actively transmitted to younger generations (Sun, 2025). The challenge is compounded by rapid digitalisation in smart cities and socio-technological transformation, which have reshaped how cultural traditions are produced, consumed, and valued..

Digitalization has become a defining driver of production, distribution, and audience engagement in the cultural sector, particularly through data infrastructures, platformization, and interactive delivery formats (e.g., immersive/AR/VR). This trend is documented across cultural policy and creative industries research and is salient in the Chinese context of state-led cultural digitization initiatives (Xu et al., 2025). One such strategy underlies the power of interactive visual communication, which is an emergent discipline associating digital storytelling, design, animation, gamification, and user engagement

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technology to communicate the nuances of messages and cultural values (Hao et al., 2025). Interactive digital platforms have emerged as a promising strategy for sustaining and revitalizing ICH, innovatively offering interactive experiences to an otherwise rather passive mode of heritage experience (Lai et al., 2025). Furthermore, digital initiatives such as the "Digital Dunhuang", which recreates and displays an array of ancient Buddhist cave murals in immersive 3D formats at a global scale, illustrate the potential for educational and cultural outreach both in research and practice (Zhang, 2025).

Although many cultural and creative organizations have transitioned their products to digital platforms (Cao et al., 2025), what remains unclear is the individual-level mechanism that links design choices to preservation behaviour in the ICH context. Prior work typically discusses organisational digitalisation and its conditions of effectiveness in general industries, yet whether—and how—those effects translate to intangible heritage has not been specified. This gap is consequential in China, where rapid demographic and technological shifts create unprecedented opportunities for digital engagement, over 1.05 billion internet users and $>$ 70% smartphone penetration, even as younger cohorts, despite heavy media use, show growing detachment from traditional heritage.

To avoid a diffuse problem definition that treats organisational digitalisation, user trust, and cultural meaning as parallel agendas, we centre the inquiry on a single psychological construct: user experience (UE). In our framework, design cues (interactivity, visual appeal), heritage-specific cues (cultural relevance/authenticity), credibility cues (trust), and perceived educational value operate as antecedents of UE, and UE is the proximal driver of intention to support ICH preservation. This reframing preserves the practical urgency while yielding testable paths and boundary conditions, thereby preventing digital preservation from devolving into superficial, archive-like displays and instead orienting it toward living, participatory cultural experiences.

Despite these advances, three non-overlapping gaps remain. First (process gap), prior work has not specified a single proximal psychological mechanism that links design/content cues to preservation behaviour. We therefore centre user experience (UE) as that mechanism and explicitly distinguish UE-mediated from residual direct effects in our hypotheses. Second (asymmetry & scope-conditions gap), heritage cues are unlikely to operate symmetrically: we predict cultural relevance/authenticity to act primarily through UE, whereas credibility/quality signals (e.g., trust, visual appeal) may retain direct influence; we also examine boundary conditions across common ICH formats (web—3D, interactive storytelling, AR/VR) and user cohorts (e.g., age, prior ICH exposure, cultural capital), addressing the single-format limitation of prior evidence. Third (identification gap), existing studies typically isolate adoption factors or interpretive accounts; we adopt a convergent mixed-methods design—CFA/SEM to estimate the hypothesized mediation structure and thematic analysis to triangulate mechanisms and qualify scope—moving beyond construct inventories toward causal-process inference in digital ICH.

We shed light on this research gap by exploring intangible cultural heritage and digital engagement. To address these questions, we employ a convergent mixed-methods design that integrates a theory-driven survey with semi-structured interviews to test the hypothesized UE-mediated process and probe boundary conditions; full methodological details are reported in the Methodology section. Answering the above research questions, this study contributes to the culture management literature and managerial practice with novel evidence. Our study, therefore, responds to recent calls for research on global Sustainable Development Goals (SDG 11.4) by offering implications to preserve the world's cultural and natural heritage. In this sense, our study offers both new insights into the theory and new findings in a distinctive research context of cultural heritage, addressing a critical policy and practice gap in digital heritage communication, offering actionable guidance for practitioners, culture education institutions, and policymakers seeking to develop digital products that are culturally relevant, interactive and trustworthy.

The remainder of this article is organised as follows: Section 2 reviews literature on ICH preservation, interactive visual communication, and the Technology Acceptance Model. Section 3 outlines the mixed-methods research design, including survey and interview components. Section 4 presents quantitative and qualitative findings. Section 5 discusses these results in light of existing theories and the identified research gaps. Section 6 concludes with theoretical and practical implications for cultural institutions, digital designers, and policymakers.

2. Theory and hypothesis development

2.1. Theoretical overview

In the digital era, the long-term sustainability of Intangible Cultural Heritage (ICH) depends increasingly on how it is communicated, experienced, and valued through digital platforms. China's rich array of intangible assets, traditional music, folk arts, oral traditions, and craftsmanship—now faces both new threats and unprecedented opportunities as digital technologies reshape cultural engagement (Saud et al., 2023). Rather than presenting Uses and Gratifications Theory (UGT) and the Technology Acceptance Model (TAM), we specify a causal linkage between them. Interactive-visual cues on digital ICH platforms (interactivity, visual appeal, cultural relevance/authenticity, credibility, educational value) first activate UGT gratifications, control/agency, hedonic enjoyment, identity affirmation, informational gain, and social validation (Pettersson, 2020). These gratifications then update TAM beliefs: control/agency translates into perceived ease of use (PEOU); informational gain and identity affirmation raise perceived usefulness (PU); hedonic enjoyment increases perceived enjoyment/perceived value; credibility cues reduce perceived risk and strengthen trust as a TAM extension in heritage settings.

We model user experience (UE) as the proximal integrator of these belief states—an overall experiential appraisal that fuses usefulness, ease, enjoyment, and credibility—which in turn drives preservation intention. This process account yields testable implications: (i) cues primarily tied to identity or learning should influence intention indirectly via UE, whereas (ii) credibility/quality signals (trust, visual appeal) may retain residual direct effects beyond UE.

The UGT highlights that users are active agents in their media consumption, seeking out content to fulfil specific psychological and social needs (Archambault et al., 2022). It shifts the focus from what the media do to users toward what users do with media. This perspective provides a valuable lens for examining how perceived cultural relevance, content attractiveness, and educational value function as gratifications that stimulate user engagement and, ultimately, commitment to heritage preservation (Wang et al., 2025, b). Perceived cultural relevance can be interpreted within UGT as tapping personal-identity gratifications, users may be more inclined to support and interact with content that reflects or affirms their cultural beliefs and values (Wang et al., 2025, b). Likewise, content attractiveness is often discussed as engaging hedonic/aesthetic gratifications, whereby appealing imagery and design tend to enhance enjoyment and engagement (Ul Hassan et al., 2026). Finally, perceived educational value is commonly treated as an informational gratification, insofar as digital ICH platforms provide gateways to learning about history, traditions, and cultural diversity (Asmal et al., 2022).

Digital heritage platforms are not only repositories of information but also spaces where culture is reimagined, experienced, and shared. The TAM offers a useful starting point for understanding why people choose to engage with such platforms, highlighting two key beliefs: that technology is useful and that it is easy to use (Natasia et al., 2022). The TAM (FakhrHosseini et al., 2024) is one of the most widely applied frameworks for explaining user adoption of technological systems. It posits that Perceived Usefulness (PU) is the belief that using a system will enhance performance, and Perceived Ease of Use (PEOU) is the

belief that using the system will be free of effort. Both PU and PEOU are the primary drivers of technology acceptance. Yet when applied to Intangible Cultural Heritage (ICH), these beliefs take on additional layers of meaning. Usefulness is about whether the digital platform deepens cultural understanding rather than efficiency. Ease of use is about whether the interaction feels intuitive, inviting, and true to the spirit of the heritage it represents, rather than simplicity.

In the context of Intangible Cultural Heritage (ICH), the TAM theoretical framework is particularly important. Interactivity aligns closely with the PEOU dimension. For instance, digital platforms with intuitive, responsive, and immersive features reduce cognitive effort and enhance user satisfaction. Trust in digital content has increasingly been incorporated into recent extensions of the Technology Acceptance Model, where it is modeled both as an antecedent to perceived usefulness and perceived ease of use and as a direct predictor of behavioral intention (FakhrHosseini et al., 2024; Musa et al., 2024). In heritage applications—where authenticity, provenance, and institutional credibility condition perceived legitimacy—we therefore treat trust as an antecedent to PU and as a residual direct pathway to preservation intention.

Digital accessibility, including inclusive design, interface usability, and technical affordances, further influences both PU and PEOU by determining how easily users can discover, navigate, and engage with heritage content (Leow, & Ch'ng, E., 2021). Scholars have argued that TAM's predictive power increases when extended to include factors such as trust, interactivity, user experience, and accessibility, allowing it to better capture the complexities of digital engagement (Yaiprasert & Hidayanto, 2023).

The integration of UGT and TAM offers a dual perspective by illustrating the technology-specific view and the human-agency perspective. The UGT explains why users are drawn to ICH content and what they seek from it, while TAM complements this by explaining how perceptions of usefulness, ease of use, and trust influence their adoption and sustained engagement. Draw theoretical insights, these frameworks offer a comprehensive basis for understanding the psychological, cultural, and technological drivers of preservation intention. By applying the UGT theory and TAM to research these heritage-specific constructs in the context of ICH, this study extends the existing research beyond its traditional focus on utilitarian and efficiency-driven adoption, integrating cultural authenticity and emotional resonance as key predictors of behavioral intention. Rather than treating UGT and TAM as parallel lenses, we integrate them through a process account: UGT specifies why users approach ICH platforms (identity/entertainment/information gratifications), while TAM specifies how those gratifications are evaluated and converted into action via perceived value and usability. We operationalize this integration by modelling user experience (UE) as the process mechanism that fuses affect/identity routes (cultural relevance, aesthetics, trust/credibility) with cognitive routes (learning/usefulness) into preservation intention. This integration is heritage-specific because authenticity/provenance and identity resonance are constitutive drivers in ICH that general UX studies typically treat as peripheral cues.

Taken together, adoption-based explanations (usefulness, ease, credibility) and heritage-specific concerns (authenticity, identity resonance) converge on perceived value but diverge on mechanisms and scope. Visual richness can lift perceived quality yet undermine authenticity if over-stylised; interactivity can deepen learning but backfire when cognitively taxing (Kozyreva et al., 2020). These tensions motivate treating user experience as the integrating process that channels design/content features into preservation-oriented intentions, setting up the path-specific hypotheses consistent with Fig. 1. (See Fig. 2.)

While we model authenticity/trust as heritage-specific cues, we acknowledge that authenticity is not a fixed attribute but a contested, negotiated judgment embedded in what critical heritage scholars call authorized heritage discourses. In digital settings, authenticity may be performed, co-created, or strategically mobilized by institutions, communities, or platforms rather than simply represented (Samadilashkariani & Engström, 2025). Likewise, trust is multi-sourced: beyond interface quality and content provenance, it depends on institutional credibility, community endorsement, media ecologies, and broader socio-political contexts, many of which lie outside a platform's direct control (Aharoni et al., 2022). Our model therefore treats authenticity/trust as cues with context-dependent meanings and scope conditions, and we use UE as a process mechanism precisely because such meanings typically require experiential consolidation before motivating action.

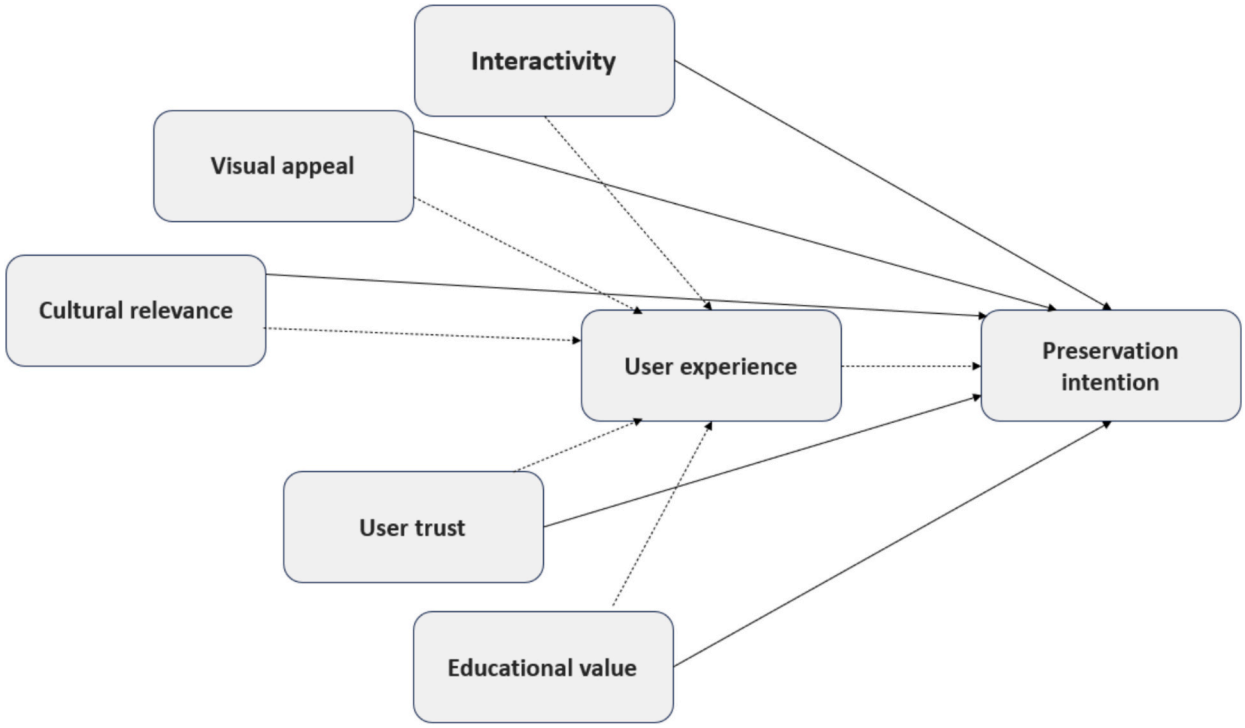

Fig. 1. Conceptual framework.

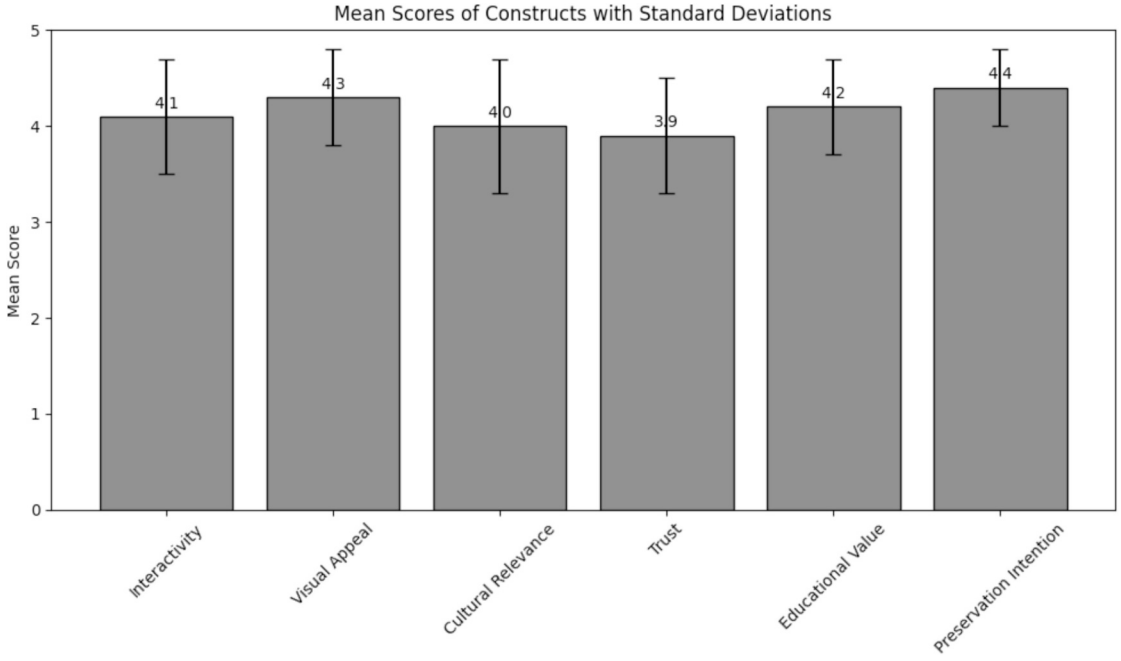

Fig. 2. Mean scores.

2.2. Hypothesis development: intangible cultural heritage and digital engagement

The preservation of Intangible Cultural Heritage (ICH) in the digital era requires more than simply digitising artefacts or recording traditions, it depends on creating compelling, interactive experiences that motivate sustained engagement and support. China's extensive intangible heritage, including oral traditions, craftsmanship, performing arts, and festive rituals, is at a crossroads. Previous studies on the digital transformation of intangible cultural heritage (ICH) highlighted the vital part different media forms and technical solutions play in enabling cultural preservation, user interaction, and emotional transmission (Hou et al., 2022; Shen, 2024). Digital platforms present a unique opportunity to broaden access and participation but also introduce challenges of authenticity, relevance, and user retention (Aguinis et al., 2024).

The core expectancy value routes derived from the Technology Acceptance Model (TAM) and Uses and Gratifications Theory (UGT) are retained, while heritage-specific drivers (trust/credibility; cultural relevance) are explicitly incorporated, and user experience is positioned as the mediator that links design/content factors to preservation intention (Camilleri & Falzon, 2021). Accordingly, each hypothesis presented below (H1–H6) specifies three components: the general mechanism, its refinement tailored to Intangible Cultural Heritage (ICH), and a boundary condition. Each hypothesis also corresponds to a numbered path in Fig. 1.affective and behavioral routes may vary by user cohorts (e.g., age, cultural capital, prior ICH exposure) and by representation forms (e.g., web 3D, interactive storytelling, AR/VR), such that nostalgia and immersion are not uniformly elicited across platforms. In particular, the integrated UGT–TAM view predicts asymmetric routes: identity-linked cues (cultural relevance) should rely more on UE mediation, whereas credibility/quality cues (trust, visual appeal) may retain residual direct effects. These testable differences are not implied by single-theory baselines.

2.2.1. Interactivity

Interactivity is central to digital engagement because it transforms the user from a passive observer into an active participant. Interactive features, such as clickable story elements, virtual tours, 3D object manipulation, and real-time feedback, allow users to explore heritage content at their own pace and according to their own interests (Troussas et al., 2025). Extending the possibilities of immersive technologies, interactive holographic systems that combine both digital and computer-generated holograms to create real-time 3D displays that can integrate virtual and real objects together (Alsamhi et al., 2025). This study demonstrated how computational holography enriched the user experience in overlaying contextual information and improved realism by offering additional spatial visuals in an augmented manner. The approach produced improved signal-to-noise ratios and reduced alignment errors compared to other forms of holography, underscoring its importance to provide more genuine and immersive ICH experience.

From a TAM perspective, higher interactivity can enhance perceived ease of use by reducing navigational barriers and providing intuitive controls (Luo et al., 2021). It can also enhance perceived usefulness by enabling deeper exploration and personalised learning experiences. From a UGT perspective, interactivity addresses users' needs for active engagement and control over content, making the experience more gratifying and memorable (Thomas et al., 2023). In the ICH context, interactivity can foster a sense of co-creation, where users feel they are not merely consuming heritage content but actively participating in its preservation. Interactive workshops on traditional crafts allow users to virtually try techniques, increasing both their knowledge and emotional connection. This active participation is likely to strengthen commitment to preservation efforts (Li, Wu, & Du, 2025). Path expectation under the integrated view: Interactivity should primarily elevate UE (ease/agency/flow), with any direct effect on intention expected to be smaller once UE is modeled. We therefore propose:

H1. *Interactivity of digital platforms positively influences users' intention to support the preservation of ICH.*

2.2.2. Visual appeal

Visual appeal refers to the aesthetic quality of the platform's design, imagery, and overall presentation. Digital ICH platforms that use high-resolution photography, immersive video, harmonious colour schemes, and culturally resonant motifs can capture attention and evoke emotional responses (Reppa & McDougall, 2022). The S-O-R model in their study to examine how serious games were able to influence users' continued intentions to use an ICH-themed serious game such as Nishan Shaman (Jiang et al., 2025, b). Authenticity, information richness,

aesthetics, and interactivity positively influenced players' perceived usefulness and enjoyment in the game (Jo & Park, 2023). Perceived enjoyment had a greater influence on continuance intention than perceived usefulness, and there is a moderating role for cultural identity in the relationship between authenticity and enjoyment, highlighting the importance of culturally-embedded design in digital experiences (Jiang et al., 2025, b). Audience satisfaction with ICH in a digital context and acknowledged the importance in identifying meaningful construct for audience satisfaction measures (Periaiya & Nandukrishna, 2024). They also found gaps in the public's satisfaction with ICH and reiterated that personalised services can increase the effectiveness of ICH dissemination for audiences.

Expanding on this, the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and immersion theory to develop a three-tier framework to evaluate consumer attitudes regarding digital ICH (Chokshi & Chakraborty, 2023). They administered a survey of 311 consumers who previously experienced digital ICH to completing fsQCA (fuzzy-set Qualitative Comparative Analysis) and NCA (necessary Condition Analysis) of the survey results. Immersion, technological readiness, ease of access, and perceived-value strongly motivated adoption and led to more positive usage attitude and patterns. A conceptual model on the effects of digital events on user engagement with ICH (Wang et al., 2025, b), indicated perceived value of ICH by users (utilitarian/hedonic/symbolic forms) was positively influenced by the event design and historical re-enactments found in the digital events. The perceived value then contributed to satisfaction, attraction, and creating engagement in longer-term relationships with ICH. When digital events are designed for specificity in cultural fidelity and functionality, and narrative context, digital events can engender emotional commitment and appreciation for cultural symbols (Wang et al., 2025, b).

Visual appeal also plays a subtle role in shaping perceptions of system quality and trust, which users may interpret a visually polished interface as a sign of professionalism and reliability (Park et al., 2022). In the heritage context, visual richness can also enhance the authenticity perception of cultural artefacts, making them appear more vivid and "alive" in digital form. Furthermore, visually engaging design can help bridge the gap between traditional heritage and modern digital consumption habits (Zhang et al., 2025). Visually striking animations of ancient dance forms can appeal to younger audiences who might otherwise overlook static textual descriptions (Wibowo et al., 2024). Visual appeal contributes to UE and functions as a credibility/quality signal; thus a residual direct path may persist beyond UE. We consequently expect the following:

H2. The *visual appeal of digital ICH content positively influences users' intention to support the preservation of Intangible Cultural Heritage (ICH).*

2.2.3. Perceived cultural relevance

Perceived cultural relevance reflects the extent to which the content resonates with users' personal and collective identities (Sheets et al., 2023). UGT frames this as a form of personal identity gratification—people are more likely to engage with and support media content that aligns with their cultural beliefs, heritage, or values (Kumar et al., 2023). In the case of ICH, cultural relevance can evoke pride, belonging, and responsibility toward preservation. Enjoyment, cultural identity, and aesthetic experience as important variables that shaped players' perceptions of usefulness, ease of use, entertainment, and empathy. These intermediate perception variables, in turn, were found to predict players' behavioral intentions, reinforcing the power of serious games to communicate ICH in an educational capacity (Jo & Park, 2023). Undergraduates' engagement with visual arts-based ICH and identified cultural capital, intrinsic motivation, and digital tools (e.g., AI, VR, gamification) as three of the most important variables (Kumar, 2024). And there is a moderation of digital engagement on the effects of cultural capital and motivation, thus refreshing young people's gravitation to traditional arts.

If users see content as culturally meaningful to their lives, they are more likely to view the platform as a valuable resource. In practice, platforms can enhance perceived cultural relevance by incorporating local dialects, region-specific traditions, and personalised heritage recommendations (Yao, 2025). For example, a platform that curates content based on a user's regional heritage, featuring familiar folk songs, crafts, and customs, can trigger an emotional connection that increases the likelihood of continued engagement and preservation advocacy (Liang et al., 2021). Path expectation under the integrated view: Cultural relevance heightens reflective meaning/identity, translating into intention chiefly through UE; any direct path is expected to be weaker. Accordingly, we argue:

H3. *Perceived cultural relevance of digital ICH content positively influences users' intention to support the preservation of Intangible Cultural Heritage (ICH).*

2.2.4. Trust in digital content

Trust is indeed consequential for engagement, but in digital heritage it is better understood as a relational and contested construct rather than a uniform determinant (Xia & Hou, 2024). Users must believe that the representations of ICH are accurate, respectful, and verified. TAM positions trust as a factor influencing perceived risk and, by extension, the decision to engage with a platform (Chaudhuri et al., 2021). Trust in ICH platforms is shaped not only by interface consistency and transparent sourcing but also by institutional authority (e.g., museums, archives), community custodianship, policy narratives, and platform-external media dynamics. These sources can reinforce or undermine platform-level trust regardless of design quality. Accordingly, we expect trust to show residual direct effects where normative/competence signals (institutional logos, expert voice, provenance trails) are salient, and to rely more on UX-mediated routes where identity negotiation and community validation are central (Chaudhuri et al., 2021).

UGT also suggests that credibility can serve as gratification, particularly for users seeking reliable, authoritative information (Chu et al., 2025). Collaborative frameworks in ICH protection and introduced relationship quality, which includes measures of trust, communication, and fairness as an important variable in the pursuit of partnering in partnerships aimed at protecting ICH (Xia et al., 2022). Attitude toward collaboration and collaborative ability led to a positive relationship quality, which contributed to the goals of collaboration (Rojas et al., 2022). To thrive in a digital age, trust can be established through transparent sourcing in the ICH context, expert endorsements, partnerships with recognized cultural institutions, and clear communication about the authenticity of artefacts (Guo & Ahn, 2023). Without trust, even the most visually appealing or interactive platform may fail to convert casual visitors into committed preservation supporters (Wang et al., 2025, b). Trust reduces perceived risk and signals provenance/competence, so a residual direct effect on intention may remain after UE. Therefore, we expect:

H4. *Trust in digital content positively influences users' intention to support the preservation of Intangible Cultural Heritage (ICH).*

2.2.5. Perceived educational value

Perceived educational value represents the informational gratification users gain from engaging with a platform (Pan et al., 2024). UGT explicitly identifies *information seeking* as a core motivation for media use, and in the ICH domain, this translates into learning about history, traditions, craftsmanship techniques, and cultural diversity (Temeltas & Kaya, 2021). Educational value directly contributes to perceived usefulness (Tennakoon et al., 2023). If a platform effectively increases users' knowledge, it is seen as serving a meaningful learning purpose. Digital ICH platforms that offer structured learning experiences, such as guided narratives or interactive timelines, can help users contextualize heritage within broader historical and social frameworks (Mathioudakis et al., 2022). This deeper understanding can lead to stronger preservation

intentions, as users appreciate not only the artefacts themselves but also the cultural significance behind them. Educational value primarily increases perceived usefulness and flows through UE, with limited residual direct impact once UE is included (Luarn et al., 2025). Therefore, we posit:

H5. *Perceived educational value of digital ICH content positively influences users' intention to support the preservation of Intangible Cultural Heritage (ICH).*

2.2.6. User experience as a mediator

User experience refers to the holistic impression that emerges from a user's interaction with the platform, encompassing both emotional satisfaction and functional efficiency (Schunk et al., 2022). In our model, interactivity, visual appeal, cultural relevance, trust, and educational value all contribute to the perceived quality of the user experience. A high-quality user experience integrates multiple perspectives, including cognitive, affective, and social, into a seamless encounter (Nah et al., 2022). User experience reflects the interplay between perceived ease of use and perceived usefulness, making it a logical mediator between design/content factors and behavioral intentions (Kim et al., 2023). When users perceive a digital heritage platform as both enjoyable and effective in meeting their needs, they are more likely to translate that satisfaction into proactive preservation support, whether through advocacy, content sharing, or participation in heritage initiatives (Liang et al., 2021). Therefore, we posit:

H6. *User experience mediates the relationship between interactivity, visual appeal, cultural relevance, trust, and educational value, and users' intention to support the preservation of Intangible Cultural Heritage (ICH).*

Building on the theoretical foundations and the hypotheses developed, this study proposes a conceptual model (Fig. 1) that integrates key factors influencing users' intention to support the preservation of Intangible Cultural Heritage in digital environments. The conceptual model visually represents the relationships between interactivity, visual appeal, cultural relevance, trust, educational value, user experience, and preservation intention, providing a comprehensive framework for understanding digital engagement with ICH. Each numbered path corresponds to H1–H6, with user experience specified as a mediator.

3. Research methodology

We adopt a convergent mixed-methods design to both estimate the hypothesized mediation structure and qualify its scope conditions. Study 1 (quantitative survey) tests H1–H6 using validated multi-item measures, confirmatory factor analysis (CFA), and structural equation modelling (SEM). Study 2 (qualitative interviews) uses maximum-variation sampling and thematic analysis to triangulate the UE-mediated mechanism and examine boundary conditions (e.g., format and cohort differences). Data collection took place between 15 June and 15 July 2025, including an online questionnaire survey and follow-up semi-structured interviews.

After the pilot study, the main survey (Study 1), and the interviews (Study 2) were each conducted subsequently. Adopting a convergent mixed-methods research design, this study integrated both quantitative and qualitative methods to thoroughly investigate the emotional and cognitive reactions of consumers interacting with interactive digital Intangible Cultural Heritage (ICH) content in China. The logic behind selecting a mixed-methods strategy is its ability to record both the quantifiable patterns and the subtle, subjective opinions of consumers. The quantitative strand used a structured survey and SEM to test H1–H6, whereas the qualitative strand used semi-structured interviews and thematic analysis to probe mechanisms and boundary conditions suggested by the theoretical discussion. Taken together, these techniques helped triangulate and increase the validity and depth of the results.

In this study, we recruited research participants between the ages of 18 and 45 who had experience utilising digital tools created to conserve or promote ICH, such as interactive mobile apps, web-based 3D exhibits, digital storytelling sites, or augmented/virtual reality cultural simulations, which consisted of the target population. National data on digital consumption (China Internet Network Information Center, 2023) shows that this age group comprises the main audience interacting with digital media. To guarantee that participants had pertinent exposure to interactive ICH platforms, a purposive sampling strategy was employed. Inclusion criteria demanded that participants had interacted with such platforms during the last six months and were able to reflect critically on their experiences. Exclusion criteria included those with no prior exposure to the pertinent tools and those without any digital heritage involvement.

The target population for this study is active users of digital ICH platforms (interactive web—3D, storytelling apps, and AR/VR experiences). Given national usage patterns, this population is disproportionately younger; therefore, the realised age distribution reflects the intended coverage of the active user base rather than a sampling error. Our inferences are thus framed with respect to digital-ICH users, not the general population.

Study 1 is the quantitative survey. The stratified purposive sampling method was used to recruit 400 research participants to ensure the data saturation of gender, education, and regional diversity across megacities in China, including Beijing, Shanghai, Chengdu, and Guangzhou. Cochran (1977)'s formula for a 5% margin of error and a 95% confidence level for a population proportion of 0.5 determined the sample size, therefore generating a minimum suggested sample of 385 responses. 400 valid responses were gathered to boost statistical power and allow subgroup analysis. To prevent biased outcomes from either tech-savvy or unfamiliar users, the sampling also took into account digital literacy and platform usage frequency. Through university mailing lists, online cultural forums, and local WeChat groups aimed at art and culture, participants were invited.

Study 2 is the in-depth semi-structured interviews with fifteen research participants chosen from the quantitative survey pool. To represent a variety of experiences based on age, degree of digital involvement, and kind of ICH content ingested, the interview sample was chosen using maximum variation sampling. With thematic redundancy appearing by the twelfth interview, this number was sufficient to reach data saturation. Furthermore, interview protocols were strengthened by well-established literature themes. Interviews were held through Zoom or WeChat Meeting functions with a duration of 45 to 60 min so that respondents are considered as sufficiently articulate in their emotional and cognitive responses.

To conduct a pilots study test, a planned questionnaire derived from already verified instruments in the fields of media. The final instrument is comprised of 28 items measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was created in English and translated into Chinese using the back-translation technique to guarantee semantic and cultural equivalency. Minor revisions in wording to enhance clarity and dependability were made after a pilot study with thirty volunteers. Cronbach's alpha coefficients for the final scale were over 0.85 for every subscale, therefore showing high internal consistency. All latent constructs were measured with validated multi-item instruments adapted to the ICH context and rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Interactivity (4 items), adapted from validated perceived-interactivity scales capturing active control, two-way communication and temporal responsiveness (McMillan & Hwang, 2002). Sample item: "I can actively control how I explore the heritage content on this platform." Visual appeal (4 items). Adapted from Moshagen and Thielsch (2010). Sample item: "The interface is aesthetically pleasing and well-designed."Cultural relevance / authenticity (4 items). Items were phrased with reference to heritage design practice to capture identity fit and perceived authenticity in digital representation (Mason & Vavoula, 2021), tailored to ICH contexts. Sample item: "The content reflects

traditions that are meaningful to me/us."Trust in digital content (4 items), adapted from widely used trusting-beliefs measures in information systems (ability/integrity/ benevolence wording), with minimal terminology changes for heritage content (McKnight et al., 2002). Sample item: "I consider the information on this platform credible." Educational value (4 items), adapted from informational-gratification / perceived-learning formulations commonly applied to digital media and learning platforms (Papacharissi & Rubin, 2000). Sample item: "Using this platform increases my understanding of ICH practices." User Experience (4 items) established by user-experience formulations (Hassenzahl, 2001). Sample item: "Overall, my experience with this platform is excellent." Preservation intention (4 items) also revised from Hassenzahl (2001), refers to support/advocacy intention wording used in culture and tourism contexts and aligned to ICH behaviors (e.g., sharing, advocating, participating). Sample item: "I intend to support the preservation of these heritage practices (e.g., by sharing, advocating, or participating)."

All items underwent bilingual back-translation and expert review; the pilot ($n = 30$) suggested only minor wording refinements without changing construct meaning. As reported in the Results, Cronbach's α for every subscale exceeded 0.85, and CFA/SEM supported the intended measurement structure.

For the qualitative data collection, an interview guide was created in light of the theoretical framework supporting the study, which draws from affective computing, user experience theory, and cultural heritage communication. Important issues examined were participants' emotional responses during and following digital ICH contact, the factors that caused engagement or disengagement, authenticity views, and reported learning results. Two cultural communication specialists examined interview methods for relevance and simplicity. With participants' permission, interviews were audio-recorded and verbatim transcribed in Mandarin, then translated into English for analysis.

Using SPSS v28 and AMOS v26, the quantitative data analysis included both descriptive and inferential techniques. First, EFA served instrument adaptation during the pilot phase to examine dimensionality and item performance in the ICH context; findings were used to refine wording before main data collection. Second, on the main survey sample, CFA established the measurement model for the latent constructs prior to any structural testing. Third, the hypothesized process model was tested via SEM, specifying interactivity, visual appeal, cultural relevance, trust, and educational value as exogenous predictors, user experience (UE) as the mediator, and preservation intention as the dependent variable; covariates (e.g., age, gender, education, digital-media experience) were included as controls on UE and/or preservation intention to account for demographic heterogeneity. Indirect effects were estimated with bias-corrected confidence intervals, and overall fit was evaluated using conventional global indices. Finally, ANOVA and independent *t*-tests were conducted post hoc as descriptive subgroup comparisons (e.g., by age band or platform type) to contextualize patterns; these tests did not substitute for, nor override, SEM-based inferences about the hypothesized paths.

Thematic analysis of the transcribed interviews following six-phase model: familiarization, coding, theme creation, review, definition, and reporting, was used for the qualitative analysis. An inductive coding technique enables themes to arise organically from the data, albeit directed by the variables investigated in the quantitative phase. Two researchers independently coded transcripts, resolving disagreements via comparisons. To integrate the qualitative themes with the quantitative strand, a joint-display triangulation protocol was specified a priori. Each survey construct was mapped to candidate code families—interactivity to agency/flow and exploratory control; visual appeal to aesthetic salience and credibility signaling; cultural relevance to identity resonance and nostalgia; trust to provenance and authenticity judgments; and educational value to knowledge gain and reflective learning. During memoing, emergent themes were compared against these linkages, and confirmations or divergences were documented for reporting in the Results.

A codebook-oriented thematic analysis consistent with the six-phase procedure was implemented, using NVivo 14 (QSR International) for transcript management, memoing, and maintenance of an audit trail. An initial codebook was developed from a purposive subset of interviews (spanning different engagement profiles), with operational definitions refined iteratively before double-coding the remaining transcripts. Intercoder agreement was evaluated at two abstraction levels: Cohen's κ for code-level agreement (via NVivo's coding-comparison query) and Krippendorff's α for theme-presence matrices at the thematic level. Interpretive thresholds followed established benchmarks for substantial reliability, and any discrepancies were resolved through adjudication (discussion, re-inspection against definitions, and documented decisions). The finalized coding hierarchy underpins the four overarching themes presented in the Results section. A summary of agreement statistics is reported with the qualitative findings, and the versioned codebook, coding framework, and reliability tables are provided in the Supplement (Braun & Clarke, 2021; O'Connor & Joffe, 2020).

Ethical approval was obtained from the Institutional Review Board (IRB) of Baoshi Academy of Arts, Jiangxi University of Engineering (Approval Code: IRB-BAA-2025-007; approval date: 03 June 2025; valid until: 03 June 2026) prior to any data collection. All study procedures were conducted in accordance with the approved protocol. The quantitative survey and semi-structured interviews were carried out between 15 June and 15 July 2025. Participation was voluntary and anonymous, and informed consent was obtained from all participants prior to participation.

4. Results

4.1. Quantitative findings

In Table 1, Chi-square tests indicate that age distributions differ across usage strata (18–25: $p = 0.01$; 26–35: $p = 0.02$), whereas gender does not ($p > 0.05$). Educational level shows differences mainly at the bachelor group ($p = 0.03$). We therefore interpret age-related heterogeneity cautiously in robustness checks and focus inference on the structural model.

In terms of educational qualification level, only the bachelor's degree group 56.5% statistically different to the other groups with (p = 0.03); and this group had significance as being statistically meaningful engagement on the topic area. The master's degree's participation was (30.4%) with significance ($p = 0.06$) while PhD students and graduates were even fewer participants (13.0%) with no significance level $p = 0.78$. This suggests, while people with bachelor's and master's degrees are interested in digital art and immersive technologies it is less likely that highly skilled or professionals and a specialist of the discipline are engaged in digital art or immersive technology.

Significantly, digital media experience came up as an important

Table 1
Sample characteristics and chi-square tests across demographic strata ($N = 400$).

Variable		Percentage (%)	Chi-square (*p*-value)
Gender	Male	47.8	0.32
	Female	52.2	0.45
Age	18–25	34.8	0.01*
	26–35	43.5	0.02*
	36+	21.7	0.56
Education	Bachelor	56.5	0.03*
	Master	30.4	0.06
	PhD	13.0	0.78
Experience with Digital Media	Low	17.4	0.02*
	Medium	52.2	0.04*
	High	30.4	0.15

Note. Percentages reported per subgroup; *p*-values from chi-square tests of distributional differences.

demographic. Both medium-level experience (52.2%, $p = 0.04$) and low-level experience (17.4%, $p = 0.02$) combined showed a statistically significant relationship, indicating that these groups are greatly influenced by immersive content. High-level experience did not show significance ($p = 0.15$) and could potentially indicate either all users have been "turned-off" their engagement level or that saturation has been reached from users who are already very active with tech. This younger-leaning composition is consistent with the current user profile of interactive digital-media platforms in China; accordingly, subsequent analyses should be interpreted for active digital-ICH users.

The significant differences observed for the 18–25 and 26–35 cohorts are interpreted through proximal psychological constructs rather than as standalone demographic effects. From a Uses and Gratifications lens, younger users typically report stronger hedonic/aesthetic gratification and a greater sense of agency/control during immersive interactions. In TAM terms, higher digital fluency plausibly elevates perceived ease of use (PEOU) and perceived enjoyment/value, which together raise user experience (UE)—the proximal driver of preservation intention in our model. Age was included as a covariate on UE and/or intention; therefore, the structural relations among design/content cues, UE, and intention are interpreted independently of sample composition, with age functioning as contextual amplification rather than a competing explanatory pathway.

The observed age-group effects are interpreted as differences in proximal psychological drivers rather than as standalone demographic outcomes. From a Uses and Gratifications perspective, younger cohorts are more likely to report stronger hedonic/aesthetic gratification and a greater sense of control/agency when interacting with immersive content, consistent with the digital-media habits typical of these groups. In TAM terms, higher digital fluency plausibly elevates perceived ease of use (PEOU) and perceived enjoyment/value, which combine to raise user experience (UE) as the proximal mediator of preservation intention. In the structural models, age was included as a covariate on UE and/or intention, so the theoretical paths among design/content cues, UE, and intention are interpreted independently of demographic composition; the age pattern is therefore used to contextualize, rather than to redefine, the hypothesized mechanism.

Descriptive statistics confirmed support for the constructs (Fig. 2). Table 2 shows that Preservation Intention had the highest mean (M = 4.4, SD = 0.4), indicating that users intended to support or advocate for the preservation of digital art. Educational Value also achieved a high mean (M = 4.2, SD = 0.5), indicating that users perceived AR and digital art as educationally or cognitively enriching. The remaining constructs scored close to 4.0, including Interactivity (M = 4.1), Visual Appeal (M = 4.3), and Cultural Relevance (M = 4.0). In relation to reliability measures, all constructs achieved good reliability. Cronbach's alpha values were between 0.80 and 0.89, exceeding the 0.70 threshold, indicating acceptable internal consistency. Similarly, measures for AVE, Average Variance Extracted, were acceptable, ranging from 0.58 (Cultural Relevance) to 0.68 (Preservation Intention), thus satisfying the convergent validity threshold of AVE > 0.50. Lastly, Composite Reliability (CR) scores for the constructs also supported the reliability and internal consistency of scores (0.83 to 0.90).

The correlation matrix illustrated several strong positive correlations among all variables (Table 3). The construct Preservation Intent was correlated highly with Educational Value ($r = 0.65$), Trust ($r = 0.61$), and Visual Appeal ($r = 0.63$). This shows that engaging visual content, perceived trustworthiness, and educational aspects are significant factors to drive users' intention to advocate for digital cultural heritage. Moderate correlations were found for Interactivity and Preservation Intent ($r = 0.55$) and Cultural Relevance and Preservation Intent ($r = 0.59$), showing while they are important factors for cultural advocacy they are not as influential. Overall, the correlation matrix illustrates an interconnected series of variables where each construct is positively related to the other, reinforcing the hypothesis that immersive features relate to viewer engagement and intent. And Fig. 3 portrys the correlation heatmap.

Further confirmation of the measurement model's correctness came from the CFA results. Table 4 illustrates that high indicator dependability was shown by all standard factor loadings exceeding 0.77. Confirming the great representation of their latent constructions, the strongest loadings were found under the Trust and Visual Appeal domains (e.g., TRU1 = 0.87, VIS2 = 0.85). Strong measurement quality was emphasized by CR and AVE scores. The highest CRs were for Trust and Cultural Relevance (0.91 and 0.90, respectively); Preservation Intention had the highest AVE (0.68). Thus, the convergent validity of the ideas was demonstrated. Non-perfect inter-construct correlations (see Table 3) indicated discriminant validity, so preserving conceptual independence for each factor.

The model (Table 5) illustrated a good fit to the data across a variety of indices of goodness-of-fit. The Chi-square/df value was 1.87, below the cutoff of 3.00 indicating an acceptable fit in terms of parsimony. CFI (0.960) and TLI (0.951) exceeded the acceptable cutoff of 0.90 indicating excellent relative fit. RMSEA (0.045) and SRMR (0.042) were both within acceptable limits ($\leq$0.06 and $\leq$ 0.08 respectively) indicating a good approximation of the population model. All of these indices support the appropriate measurement structure used for SEM analysis.

The structural model examined direct and indirect pathways through constructs on Preservation Intention through the mediator User Experience (Table 6). Each independent variable had direct pathways to the mediator with each statistically significant ($p < 0.001$), providing evidence that the constructs significantly influenced the quality of user interaction. Not surprisingly, Visual Appeal ($\beta = 0.52$) and Educational Value ($\beta = 0.49$) were the most significant, while Cultural Relevance had a slightly lower beta ($\beta = 0.38$). In our data, visual appeal and educational value are substantial via UE and show small-to-moderate residual direct paths to preservation intention, which supports a partial-mediation pattern rather than an unconditional necessity. By comparison, cultural relevance is marginal directly ($\beta = 0.15$, $p = 0.059$) but exerts a meaningful indirect effect via UE, consistent with identity work requiring experiential consolidation. These effects are attenuated on text-forward/catalogue-style platforms and among instrumental visitors, and can reverse when over-stylization undermines perceived authenticity.. Overall, the model is partially supported. User experience strongly predicts preservation intention ($\beta = 0.60$, $p < 0.001$) and transmits sizeable indirect effects from interactivity, visual appeal, cultural relevance, trust, and educational value. Direct paths remain significant for most factors; cultural relevance is marginal ($\beta = 0.15$, p = 0.059), consistent with a scenario where relevance primarily increases intention through improved experience quality rather than directly.

With regard to direct effects, Interactivity ($\beta = 0.21$), Visual Appeal ($\beta = 0.18$), Trust ($\beta = 0.19$), and Educational Value ($\beta = 0.23$) impacted Preservation Intention, and their beta values were reduced in the models with the presence of a mediator. Cultural Relevance ($\beta = 0.15$, p = 0.059) was indicative of a marginally significant relationship. This suggests that the impact may be more direct through the mediating construct than a direct path from Cultural Relevance to Preservation Intention, since all other direct effects were statistically significant.

Taken together, Fig. 4 support a process account in which design/content features act through user experience (UE) to shape preservation

Table 2
Descriptive statistics and measurement quality (means, SDs, α, AVE, CR).

Construct	Mean	SD	Cronbach's Alpha	AVE	CR
Interactivity	4.1	0.6	0.82	0.60	0.84
Visual Appeal	4.3	0.5	0.85	0.62	0.86
Cultural Relevance	4.0	0.7	0.80	0.58	0.83
Trust	3.9	0.6	0.83	0.61	0.85
Educational Value	4.2	0.5	0.87	0.64	0.88
Preservation Intention	4.4	0.4	0.89	0.68	0.90

Note. *AVE = Average Variance Extracted; CR = Composite Reliability; all items measured on 5-point Likert scales.*

Table 3
Inter-construct correlations among focal variables ($N = 400$).

	Interactivity	Visual Appeal	Cultural Relevance	Trust	Educational Value	Preservation Intention
Interactivity	1.00					
Visual Appeal	0.58	1.00				
Cultural Relevance	0.52	0.60	1.00			
Trust	0.47	0.53	0.49	1.00		
Educational Value	0.50	0.57	0.51	0.54	1.00	
Preservation Intention	0.55	0.63	0.59	0.61	0.65	1.00

Note. *All coefficients are Pearson correlations; all $|r| \geq 0.47$, $p < 0.001$ unless otherwise indicated.*

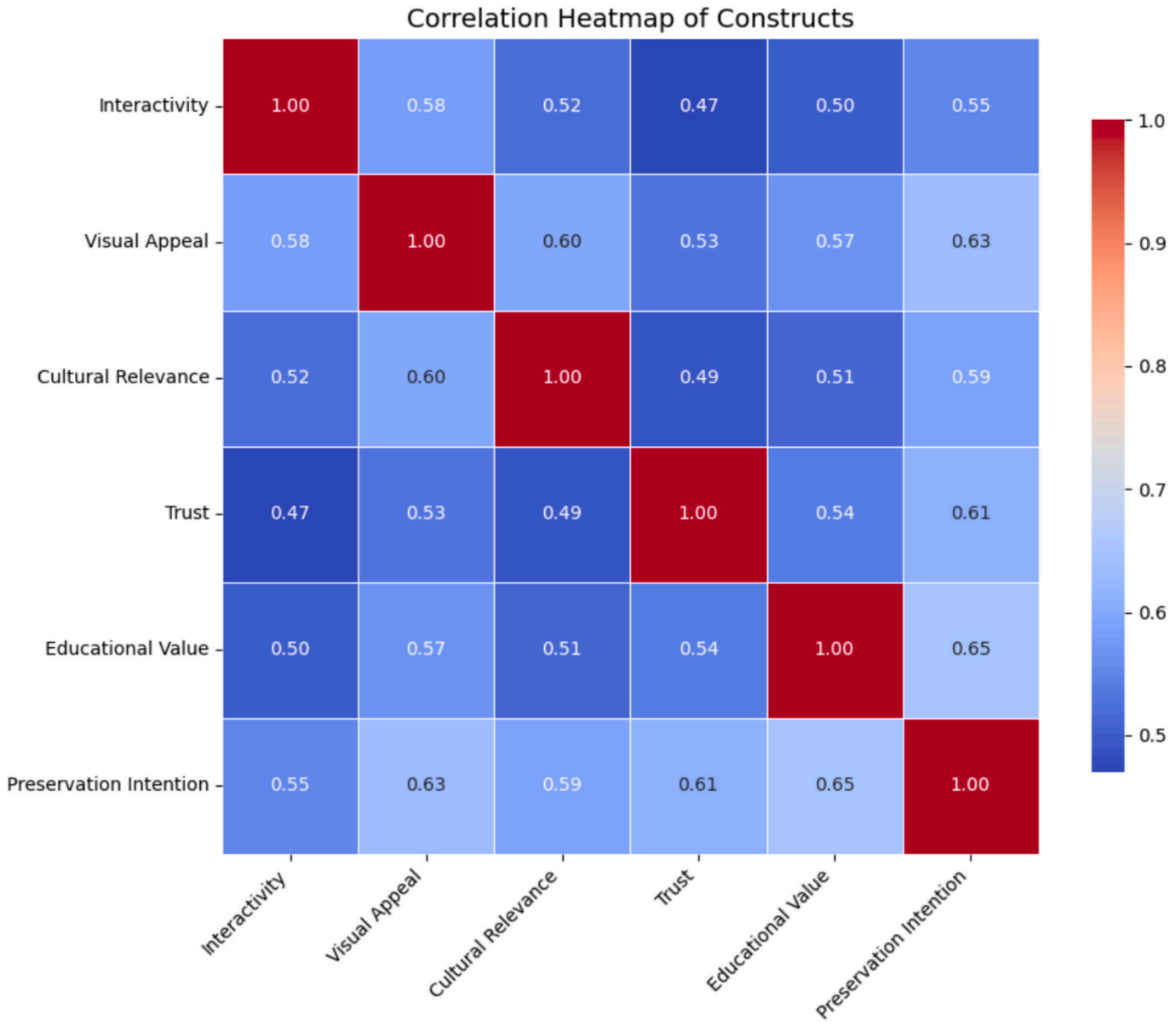

Fig. 3. Correlation heatmap.

intention. This pattern both confirms adoption-based expectations (usefulness/learning and credibility cues matter) and complicates them in heritage contexts. Notably, the direct effect of cultural relevance is marginal ($p = 0.059$), while its indirect effect via UE is meaningful—suggesting that identity resonance often heightens reflective meaning before action. By contrast, visual appeal and trust retain residual direct effects beyond experiential integration, consistent with quality/credibility signaling. This pattern is diagnostic of the integrated account and would be opaque under single-theory interpretations that treat identity and credibility cues as homogeneous drivers. The following discussion unpacks where our results align with, extend, or challenge prior studies and considers alternative explanations and scope conditions grounded in the qualitative themes. Emotional resonance (e.g., nostalgia) and UE may be sample- and format-contingent. We therefore interpret affective reports as contextual outcomes rather than inherent properties of all digital heritage experiences and highlight user-

Table 4
Standardized factor loadings from the CFA measurement model.

Latent Variable	Indicator	Std. Factor Loading
Interactivity (INT)	INT1	0.81
	INT2	0.83
	INT3	0.79
	INT4	0.77
Visual Appeal (VIS)	VIS1	0.84
	VIS2	0.85
	VIS3	0.80
	VIS4	0.81
Cultural Relevance (CUL)	CUL1	0.82
	CUL2	0.84
	CUL3	0.83
	CUL4	0.78
Trust (TRU)	TRU1	0.87
	TRU2	0.84
	TRU3	0.85
	TRU4	0.83
Educational Value (EDU)	EDU1	0.82
	EDU2	0.81
	EDU3	0.79
	EDU4	0.80
Preservation Intention (PRE)	PRE1	0.83
	PRE2	0.84
	PRE3	0.80
	PRE4	0.82

Note. *All standardized loadings ≥ 0.77; all $p < 0.001$.*

Table 5
Fit indices for the CFA measurement mode.

lFit Index	Value	Threshold	Interpretation
Chi-square/df (CMIN/df)	1.87	< 3.00	Good fit
CFI (Comparative Fit Index)	0.960	≥ 0.90	Excellent fit
TLI (Tucker-Lewis Index)	0.951	≥ 0.90	Excellent fit
RMSEA (Root Mean Square Error of Approximation)	0.045	≤ 0.06	Good fit
SRMR (Standardized Root Mean Square Residual)	0.042	≤ 0.08	Acceptable fit

Note. *Thresholds follow conventional cutoffs (*e.g., *CFI/TLI ≥ 0.90; RMSEA ≤ 0.06; SRMR ≤ 0.08).*

Table 6
Structural model estimates with UE mediation (standardized paths).

Pathway	β	C.R.	S.E.	p-value
Interactivity → User Experience (Mediator)	0.45	4.89	0.073	<0.001**
Visual Appeal → User Experience	0.52	5.31	0.068	<0.001**
Cultural Relevance → User Experience	0.38	4.02	0.082	<0.001**
Trust → User Experience	0.41	4.23	0.079	<0.001**
Educational Value → User Experience	0.49	5.02	0.070	<0.001**
User Experience → Preservation Intention (Dependent Variable)	0.60	6.11	0.065	<0.001**
Interactivity → Preservation Intention (Direct Effect)	0.21	2.15	0.081	0.032*
Visual Appeal → Preservation Intention (Direct Effect)	0.18	2.02	0.079	0.044*
Cultural Relevance → Preservation Intention (Direct Effect)	0.15	1.89	0.083	0.059
Trust → Preservation Intention (Direct Effect)	0.19	2.05	0.080	0.041*
Educational Value → Preservation Intention (Direct Effect)	0.23	2.31	0.078	0.021*

Note. *UE = User Experience; C.R. = critical ratio; all p-values two-tailed.*

group and representation-form heterogeneity in the Discussion. Moreover, authenticity judgments may be driven by community discourses and institutional histories that we do not directly observe; in such cases, measured "trust" partly proxies field-level legitimacy rather than only platform design. Future work should combine institutional/field measures (e.g., museum accreditation, community co-curation status) with behavioral outcomes to separate interface-driven from field-driven trust.

To contextualize these statistical patterns and probe their mechanisms and scope conditions, we now turn to the qualitative strand. Specifically, we use thematic analysis to (a) unpack how users interpret interactivity, visual appeal, cultural relevance, trust, and educational value during actual encounters; (b) examine why cultural relevance appears to act primarily through experiential consolidation; and (c) explore boundary conditions and alternative explanations (e.g., sample composition, platform design choices, or novelty effects) that the SEM cannot adjudicate. The qualitative results below therefore enrich and qualify the model-based inferences rather than restating them.

4.2. Thematic analysis results

Building on the SEM evidence, the qualitative findings illuminate the experiential routes through which design/content cues become meaningful and actionable for users. In the narrative that follows, each theme is explicitly related to the corresponding structural path estimated in the quantitative model so that experiential accounts are read alongside the mediated process through user experience. Four main themes emerged from the thematic analysis of user interviews interacting with interactive digital platforms for Intangible Cultural Heritage (ICH) in China:

4.2.1. Theme 1: Emotional resonance and cultural nostalgia

One of the most significant threads that emerged across the analysis was the strong emotional pull users felt interacting with digital ICH platforms. In many cases, they evoked a strong sense of cultural nostalgia and reminded users of ancestral memories, lost practices and personal heritage. Participants consistently expressed these moments as "emotional bridges" that evoked feelings and previously unexpressed pride in their past cultural practices.

"*When I saw the virtual embroidery demo, I thought of my grandmother stitching in the afternoons, which I had not thought about in years, and in a split second, I had an emotional response*." (Participant 3).

This was true of participants who did not have family histories with the traditions being represented. Even users who described no direct line to the heritage practices they engaged with still expressed a strong sense of feeling attached to the content and immediately highlighted the effect that sensory stimuli such as music, colour, and symbols had on it.

"*The music, the rhythm of the dance, brought tears to my eyes. I can't explain it, but I felt a connection to something ancient and meaningful.*" (Participant 7).

Taken together, these accounts are consistent with the structural relation in which cultural relevance operates through user experience and, in turn, predicts intention to support preservation; the evidence indicates that identity resonance is consolidated at the experiential level before it translates into action.

4.2.2. Theme 2: Interactive immersion and cognitive engagement

Another major theme was the effects of interactivity on mental participation. Participants repeatedly underlined how touch-responsive interfaces, gamified investigation, and virtual simulations sharpened their concentration, curiosity, and knowledge recall. This dynamic interaction motivated consumers to actively investigate components of ICH instead of simply ingesting them.

"*I felt like I was learning via discovery rather than simply reading material when I could rotate the 3D model of the pottery and click on each pattern to discover its significance*." (Participant 5).

This impulse for active exploration coincides with the results, who noted that immersive VR systems let users view ICH methods from a first-person perspective, fostering more intense interaction. Participants noted increased attention spans and a sense of agency, which helped them to more quickly assimilate cultural information.

"*Almost 40 minutes of my time were spent merely examining the festival scenes. It felt more like sightseeing than learning. Because I was involved in every stage, I could recall everything*." (Participant 6).

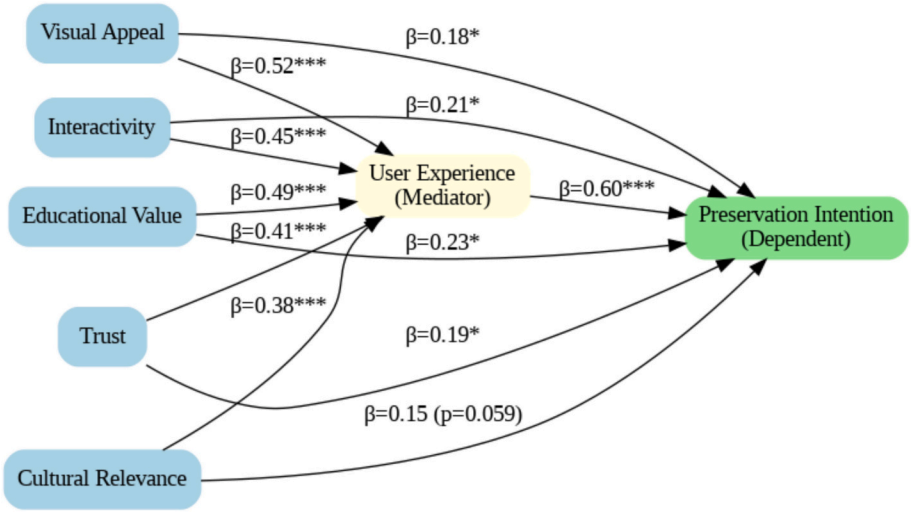

Fig. 4. Pathway diagram.

Furthermore, users valued the freedom to explore the material in a nonlinear manner, therefore, digital interaction reduces intrinsic motivation and cultural learning. Cognitive involvement was most evident when consumers considered the interactive features intuitive and meaningful rather than gimmicky or excessively intricate. The navigation was fluid, and each click revealed something new to explore. Participant 10 kept me mentally present and ready to investigate further. Participants' descriptions of agency, flow, and exploratory control align with the quantitative finding that greater interactivity is associated with higher user experience, which subsequently underpins preservation-oriented intentions.

4.2.3. Theme 3: Trust and authenticity in digital representation

Users often brought up worries and ideas about authenticity and trust in the digital representation of ICH. Most respondents saw the need to preserve cultural traditions while also underlining the need to preserve fidelity. Trust was sometimes tied to the platform's reliability, the origin of information, and the aesthetic correctness of the portrayal. "*Because a local craftsperson told the tale, it felt real. That calmed my mind that the content was grounded in experience, not just a scripted performance*." (Participant 4).

Participants observed that to gain their trust, visual elements like traditional clothing, tool use, and ceremonial customs had to be represented precisely. Echoing the issues brought up by Amirova et al. (2024) about deficiencies in public satisfaction caused by false representations, mistakes, or oversimplifications, which caused scepticism and disengagement. "*One area on paper cutting appeared overly glossy, like a cartoon. That caused me to wonder how much of it was genuine*." (Participant 8).

When platforms included cultural custodians' contributions and alluded to historical records or actual customs, trust was also encouraged. These actions greatly affect user pleasure and long-term involvement. Participants favoured sites that honestly recognized the cultural roots and development of every custom. They exhibited archived footage and discussed how the custom evolved. That helped me to appreciate and trust the information I was gathering. (Participant 5) References to provenance trails, expert endorsement, and institutional credibility corroborate the model in which trust enhances user experience and also retains a small direct association with preservation intention, consistent with credibility signaling that extends beyond experiential appraisal.

4.2.4. Theme 4: Educational value and cognitive reflection

Finally, many participants emphasized the educational advantages of interactive digital ICH platforms. Strong cognitive reflection was expressed; their experiences made them reevaluate cultural identity, intergenerational knowledge transmission, and the fragility of traditional customs. Learning via interactivity and multimedia was regarded as more successful than conventional classroom-based methods.

"*Until I attempted the simulation, I never grasped the degree of Chinese shadow puppetry. It wasn't only humorous; it got me pondering on what we have lost and what we have to save*." (Participant 1) Younger consumers especially appreciated the educational value because gamified material and real-time comments aided them in retaining knowledge and connecting to current events.

"*Though also reminding me of little things, the drag-and-drop activities and tests were just wonderful. I now include these points in class debates*." (Participant 9) This fits the observations, happiness and cultural identity boost the instructional effectiveness of serious games and gamified material. Participants also emphasized how their digital ICH encounters motivated them to seek more knowledge or even to attend live cultural events and classes.

"*Having viewed the weaving video and worked with the 3D loom, I sought out nearby courses to study it in person. It really got me wanting to join actively*." (Participant 12) Users sought platforms that related their knowledge of cultural customs to larger historical, philosophical, and social backgrounds, as well as taught them about them. This reflexivity fostered more cultural appreciation, "*deliberate design could increase symbolic and emotional value of ICH via digital events. The rite justified the causes behind it, its connection to Confucian principles and seasonal changes; this made me feel like I gained something significant, not simply arbitrary trivia.*" (Participant 11).

Reports of knowledge acquisition and reflective understanding correspond to the pattern whereby perceived educational value improves user experience and, through that route, is associated with stronger intentions to support heritage preservation.

5. Discussion

Our research confirms core TAM/UGT insights that perceived usefulness/learning (via UE) and credibility cues (trust, visual quality) underpin engagement. Accordingly, we interpret aesthetic and informative influences as UX-mediated and context-bound: their average contributions are large to UE with modest direct effects on intention, not as essential in an absolute sense. It extends digital-heritage work by showing that aesthetic design contributes not only affect but also residual credibility signals beyond experiential integration. The results challenged the assumption that identity-linked variables exert uniformly strong direct effects,

In our setting, cultural relevance primarily operates indirectly through UE rather than directly prompting preservation intentions. Strong nostalgia and emotional resonance in our interviews may reflect the composition of our sample (urban, digitally active participants with non-trivial cultural capital) and the specific platforms studied (rich narrative scaffolds, curated soundscapes, heritage-linked visual motifs). Such designs intentionally foreground mnemonic triggers; On platforms emphasising cataloguing or transactional search, affective yield may be attenuated. We therefore refrain from treating nostalgia as an intrinsic property of digital heritage overall and instead view it as conditional on user histories (family ties, regional identity, prior exposure) and representational choices (degree of re-enactment, sonic cues, fidelity claims).

A UGT-only view explains why users seek identity/learning gratifications but not how these are converted into intention nor why credibility cues bypass experience. A TAM-only view captures usefulness/ease but misses identity/meaning-making that often requires experiential integration before action (Lee et al., 2025). The integrated view, operationalized via UE, accounts for both: identity-linked relevance needs experiential consolidation (hence an indirect route), whereas credibility/quality cues can motivate directly through normative/competence signaling, producing residual direct effects. Our findings should be read against critical accounts that frame authenticity as a negotiated cultural claim rather than a property of objects. The indirect role of cultural relevance via UE is consistent with the view that identity work and meaning-making require experiential scaffolding, interaction, narrative context, and reflexive cues, before translating into action. Conversely, the residual direct effects of trust/visual quality indicate that competence and provenance signals can motivate action even when experiential integration is held constant, yet such signals draw credibility from institutional fields and community endorsement, not solely from UI polish.

In culture-intensive interactions, identity-relevant content often first elicits reflection and meaning-making. UE integrates this reflection with cognitive ease and perceived value, becoming the proximal driver of intention. By contrast, trust and visual quality provide normative/competence signals that can motivate action even when experiential integration is held constant—explaining their stronger residual direct effects. These patterns cohere with the qualitative themes on authenticity/provenance, risks of over-stylisation, and didactic overload.

We interpret each finding, emphasising how user experience integrates cognitive (learning/usefulness) and affective/identity routes (aesthetics, relevance, trust). The explicit theme–construct links above provide a transparent bridge between interview narratives and the mediated pathways estimated in the structural model, thereby integrating qualitative explanation with the UGT–TAM process account. The higher engagement among younger respondents is consistent with a mechanism whereby gratifications (hedonic appeal, agency, informational gain) update TAM beliefs (higher PEOU and perceived value), thereby increasing UE, which in turn elevates preservation intention. This reading accords with the partial-mediation pattern in the structural model. Cues linked to aesthetics/visual quality and learning value exert sizable effects via UE, while credibility signals can retain small direct effects. Cohort differences are thus best viewed as shifts in the level of UE and related beliefs, not as changes to the causal ordering of the integrated UGT–TAM process. The results of the current study offer valuable contributions to understanding the processes of digital participation with Intangible Cultural Heritage (ICH) in China, identifying the importance of interactivity, visuality, cultural relevance, user trust and educational goodness on intention to advocate ICH preservation. Interactivity and visual design jointly increase UE, with interactivity's direct effect on intention reducing once UE is modele, whereas visual quality retains a small residual direct path. Various strengths of media types for representing ICH, while the current study identifies interactivity and visuality as not only channels of process, but interactivity and visual design as the underpinning elements of preservation practice with cultural relevance and educational context.

In this study, we found that cultural relevance was a key aspect that impacted both user trust and intention for preservation. Determined that users' cultural identity, as well as political and cultural aesthetic, affected users' enjoyment and empathy in ICH-themed serious games. However, primarily on exploring educational value through entertainment and the context of gaming, while we observed that educational value itself, when designed meaningfully, leads to sufficient cognitive processing and increased likelihood on the part of users for engaging in preservation. Our findings suggest that educational affordances can also be meaningful, by including cultural narratives, rather than just content that promotes gamification.

In addition, user trust emerged as a critical mediator and enabler of sustainable user engagement on digital ICH platforms, which aligns with the views, who argued that relationship quality (trust, fairness, and communication) needed to be established to implement successful collaborative ICH projects. Our findings supported their argument but focused on how trust at the user interface level—rooted in visual consistency, credible content, and smooth interactions shapes individual user attitudes through the lens of long-term cultural preservation. Specifically, user trust was identified as an important user experience, and directly influenced behavioral intention, which confirms that perceived integrity and transparency are foundational for digital heritage engagement. Importantly, the mediating effect of user experience in our study affirms and extends the research, in which satisfaction level was assessed through the Zhuhai ICH Database. Whereas emotional connection and usability as drivers for satisfaction and continuation (Lolemo & Pandya, 2025), we found that experience quality is a critical bridge between the initial interest induced by digital communication variables involving visual salience and interaction, to the final result of preservation intention, presupposing a positive experience first. This mediating effect suggests the need to ensure that user interface design and content flow are designed in such a way that the experience benefits attributable to interactivity, richness of visual experience, and depth of educational content can induce more meaningful and durable involvement and engagement with ICH.

The themed analysis from this study, which investigated the emotional and cognitive responses of users, identified recurring expressions of nostalgia, pride, curiosity, and reflective appreciation. This set of emotional reactions fits within the immersive scholarship, whose panoramic display system afforded users the ability to experience ICH practices from a first-person perspective, rather than simply in a physical or visual sense. Immersive VR environments, but our qualitative findings imply that when users have an emotional connection to and a cognitive encounter, regardless of VR, rich visual content, or participatory features, they are more inclined to endorse ICH preservation initiatives. Emotional resonance, in this sense, does not only stem from the novelty of the technology, but also from the amplification of culturally meaningful storytelling and interaction design. Although the application of storytelling, conventional symbols, and immersive soundscapes delivered emotional affect, narrative aesthetics can amplify cultural emotions than visual media alone, and the emotional authenticity enabled through holographic systems. Thus, emotional resonance plays an important role in engaging users in digital heritage contexts.

Moreover, the corresponding integration of the emotional and cognitive dimensions supports the theoretical framework described, that digital events reflecting both historical fidelity and symbolic significance promoted users' satisfaction and their longer-term commitment. The thematic impressions of ICH that we captured support these notions as users often referred to their feelings of being “part of a living history”, or being “motivated to share and preserve” their experiences through the encounters that they had, indicating a general cognitive-emotional response to the digital ICH. These user reactions further highlight that digital vehicles can promote cultural transmission (in more than one way by passing timely information) by creating reflections and evocations for their respective experiences.

We develop a conceptual framework for sustainable digital

preservation of ICH from these documented dynamics, integrating principles from interactive visual communication with trust, cultural relevance and user experience. While these others fit together relatively coherently, our orange model explores ICH more broadly than the S-O-R model, where they showed that the ICH-themed game enhanced perceived enjoyment and usefulness of the games via authenticity, aesthetics plus interactivity. Importantly, our framework looks more broadly at multiple ICH formats in the sense of showing that design-based interactivity and visual storytelling can signal sustainable preservation behaviors that exceed platform modality.

This study contributes to joining the rising debate on the educational purpose of digital heritage is the link between expected educational value and conservation intention. Our results demonstrated that greater user participation and willingness to act are fostered when digital content is seen as both culturally real and intellectually stimulating. In China's multi-format ICH ecology (web—3D, interactive storytelling, AR/VR), users are saliently sensitive to provenance and fidelity; visual polish is read as a competence/credibility cue only when source transparency is evident (Chang & Suh, 2025). This heightens the residual direct role of trust/visual quality, while cultural relevance tends to work through experience (narrative scaffolding, hands-on exploration) before translating into intention. This points to a dual route of interaction, both emotional and mental, that maintains user interest and drives conservation (Pitakaso et al., 2025). Our results provide practical advice for digital designers as well as cultural organizations based on the actionable insights. Personalised interfaces, context-sensitive content, and interactive modules designed to meet user preferences can amplify emotional connection and cultural understanding, a theory supported, the need of individualized services in enhancing public satisfaction. Both of which are crucial in turning passive users into active cultural supporters, our results show that personalization when guided by cultural context and users needs, can improve consumer trust and experience quality.

Technologically, investigated how computational holography enhanced the realism and participation of digital heritage exhibits. Even if holographic systems were not used in our research, the claimed effect of visual appeal in our model supports the notion that realistic, aesthetically appealing digital settings can greatly improve expected cultural immersion and user pleasure. Furthermore, our results show that well-planned visual stories and simple interaction can produce the same engagement impacts even without sophisticated holography. Regarding broader adoption patterns, our results are also in line with the fsQCA results, which stressed technical preparedness, seen value, and accessibility as adoption enhancers (Liu et al., 2025).

Our system implicitly supports similar dimensions even if the UTAUT2 model; specifically, accessibility, usability, and perceived educational worth together define user experience and conservation intent. Therefore, platforms need to be technically study, culturally aware, and pedagogically driven if digital heritage projects are to be successful. By methodically connecting communication design variables—interactivity, visual appeal, cultural relevance, trust, and education—to the mediated result of preservation intent via the prism of user experience. The contribution is deliberately restricted to one integration: user gratifications described by Uses and Gratifications Theory are translated into TAM beliefs through the proximal construct of user experience (UE), and TAM is extended by treating trust as both an antecedent of perceived usefulness and perceived ease of use and a small residual predictor of intention. The observed pattern is consistent with this account in four respects.

First, higher interactivity is associated with stronger UE, and UE, in turn, relates positively to preservation intention; this accords with a control-and-agency gratification that elevates ease-of-use beliefs before behaviour. Second, perceived educational value increases UE and retains a modest additional association with intention, in line with an informational gratification that updates perceived usefulness. Third, cultural relevance exhibits its primary association with intention indirectly through UE, indicating that identity-linked cues require experiential consolidation rather than exerting strong direct influence. Fourth, visual appeal and trust both load strongly on UE yet maintain small direct associations with intention, consistent with credibility/quality signaling that can motivate action beyond experiential integration. Collectively, these path-specific patterns substantiate the intended linkage from UGT motives to a trust-augmented TAM via UE and delimit the scope of direct versus UX-mediated effects.

References to S-O-R and UTAUT2 serve only as conceptual points of comparison; the present evidence does not claim to test those models in full. The results corroborate the UGT-into-TAM process by showing that design and credibility cues (as stimuli) influence an organismic integrator (UE) that precedes behavioral intention. Accordingly, the theoretical contribution is confined to clarifying this UGT–TAM integration and identifying where limited direct effects persist. Our study offers an integrative, multidimensional view on how user-centred design might promote sustainable interaction with ICH whereas previous research emphasized individual media formats or specific technologies

Several alternative accounts merit consideration. Self-selection into digital heritage platforms could inflate associations; we mitigate this by modelling indirect paths via UE and triangulating interviews, though residual bias cannot be ruled out. Reverse causality is possible with cross-sectional data (preservation-minded users may rate UE higher), motivating longitudinal/experimental tests. Part of the affective lift may be a novelty effect of immersive interfaces; qualitative reports of novelty decay suggest testing time-on-platform and the role of repeat-exposure. Platform ecology effects. Emotion and trust can be imported from off-platform sources (heritage influencers, local schools, community events), implying that measured effects may partly capture field-level legitimation rather than interface-only drivers. Finally, future work should incorporate behavioral outcomes (sharing, donations, event attendance) and multi-source measures to strengthen causal claims.

Crucially, our work bridges the experiential and structural aspects of ICH preservation. By emphasising the need for emotionally intelligent design, we validate that emotional responses such as pride, nostalgia, and awe are not just byproducts of digital contact but essential means of fostering preservation behaviour. This design philosophy should be educationally relevant, technically flawless, and culturally rooted. We thus help not only the academic debate on digital legacy but also the real design approaches cultural organizations and developers have to employ to guarantee long-term relevance and impact.

6. Conclusion, limitations and future research direction

The study advances a process-based account in which user experience (UE) functions as the proximal mediator transforming design cues (interactivity, visual appeal), heritage-specific cues (cultural relevance/authenticity), credibility cues (trust), and perceived educational value into preservation intention. Integrating UGT with TAM, the account specifies how agency, hedonic–aesthetic appeal, informational gain, and identity resonance are consolidated into perceived usefulness/ease and overall experiential value via UE; trust operates as an antecedent to these beliefs and retains a small residual path to intention. The synthesis clarifies an asymmetry: identity-linked content typically motivates action indirectly through experiential consolidation, whereas credibility/quality signals can exert limited direct influence beyond UE. Practically, the framework indicates staging priorities—establish provenance and transparency early, support agency/flow through intuitive interaction, and scaffold cultural narratives so identity resonance is converted into perceived value within the experience. The contribution is bounded by a digitally active ICH user base and self-report measures, underscoring the need to test generalizability and behavioral outcomes in future work. Overall, digital ICH preservation is framed as an experience-led pathway that fuses affect, identity, and learning into actionable support.

The thematic analysis found that interactive content elicited both emotional and cognitive responses from users, therefore stressing

sentiments of cultural pride, nostalgia, and curiosity that promoted closer interaction with ICH. Developing a conceptual framework for sustainable digital preservation of ICH based on interactive visual communication concepts is this study's unique contribution. It offers practical ideas for digital designers and cultural organizations to maximize user interaction. Different with earlier studies that focus on specific media formats or technology adoption models, this one combines several elements—interactivity, aesthetics, trust, and education, with user experience as a mediator, hence presenting a complete grasp of digital ICH preservation dynamics. Theoretically, we integrate UGT and TAM via UE and provide evidence of heritage-specific asymmetries—identity-linked relevance is primarily indirect, while credibility/quality cues retain residual direct effects, clarifying how cultural and cognitive routes combine to produce preservation intentions. This extends standard UX accounts and shows what single-theory approaches would likely miss in Chinese ICH contexts. Conceptually, we bring contested notions of authenticity and multi-sourced trust into an integrated UGT–TAM process account by specifying where these cues act indirectly through experiential consolidation and where they retain residual direct force via institutional/competence signaling. This framing moves beyond simplified determinants and clarifies scope conditions under which design, discourse, and field-level legitimacy jointly shape preservation intentions.

The context of data collection is in China. However, our findings are limited to extending its applicability to other countries. Affective responses (e.g., nostalgia) may be over-represented given our urban, digitally engaged sample and the narratively rich platforms examined. We therefore treat emotional uplift as conditional rather than universal and call for comparative designs across user groups and representation forms (e.g., catalogue-style vs. re-enactment-heavy platforms) to establish scope. Furthermore, reliance on self-reported data and thematic analysis could be subjected to participants' subjective assessment and articulation.; Building on these contributions, we outline testable next steps (e.g., longitudinal mediation; moderation by cultural capital/novelty; behavioral outcomes) and design guidelines (provenance-forward visual styling; scaffolded learning that preserves flow). Because our sampling purposefully mirrors the active digital-ICH user base, older cohorts are under-represented. While this aligns with the study's focus, external validity to less digitally active groups remains a limitation and merits future quota/stratified sampling in mixed online–offline settings. Therefore, future studies are called for conducting experimental research design and longitudinal data collection. While acknowledging the above research limitations, the study deepens our understanding of how interactive digital communication can promote intangible cultural heritage, while also guiding the broader digital transformation of heritage conservation, shedding light on ensuring that cultural legacies remain vibrant, accessible, and relevant for future generations to learn.

CRediT authorship contribution statement

Zhisheng Zhang: Writing – review & editing, Writing – original draft, Visualization, Supervision, Software, Resources. **Songyu Jiang:** Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Data curation. **Rong Zhang:** Writing – review & editing, Supervision, Resources, Conceptualization. **Rebecca Kecheng Dong:** Writing – review & editing, Validation, Conceptualization.

Ethical declaration

This study was conducted in full compliance with recognized ethical standards for academic research. Ethical approval for all study procedures was granted by the Institutional Review Board of Jiangxi University of Engineering, Baoshi College of Arts (Protocol IRB-BAA-2025-007). The pilot study, the quantitative survey, and the qualitative interviews were each executed thereafter under this approval. Participation was entirely voluntary, and all respondents were informed of the purpose of the research, their right to withdraw at any time, and the confidentiality of their responses. No personal identifiers were collected, and all data were used solely for academic purposes. The authors affirm that the research adhered to the principles of integrity, transparency, and respect for participants.

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Declaration of competing interest

The authors declare that there are no financial, commercial, or personal relationships that could be construed as potential conflicts of interest in the conduct of this study. All authors have reviewed and approved the final version of the manuscript and agree to be accountable for the integrity and accuracy of the work.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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