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Semantic Feedback and Identity-Responsive Design in Cultural Platforms: A Case Study of the Shu Brocade Repository

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Abstract:
This study focuses on the Digital Collection Repository on the official website of the Chengdu Shu Brocade and Embroidery Museum. Based on the Shu brocade pattern images displayed, to explore how User Perception, User Satisfaction and User Identity affect their Participation Intention and Feedback Behaviour. A Mixed-Methods Design was used to collect 209 Structured questionnaires and Open-ended Feedback texts. A user-platform Interaction Predictive Model was constructed. The results showed that users generally accepted the Intelligent Functions in the platform, such as AI-based Pattern Recognition and Data Clustering, However, they were dissatisfied with the Image Quality and Cultural Interpretation Depth. General Users were more positive, while Digital Experts were significantly less willing to participate. Binary Logistic Regression analysis showed that Satisfaction was a Significant Positive Predictor. Expert Identity was a Negative Moderator variable. Six Major Feedback Themes were extracted through Thematic Analysis conducted by ATLAS.ti. It covers Personalisation, Platform Transparency and Collaborative Mechanisms. Combined with Grad-CAM heat map visualisation analysis, the study further revealed the Perception Gap between Model Attention Regions and User Expectations. It also reflects the issues of Structured Visibility and Semantic Justice. Based on the existing resources, a Dual-Path Feedback Model is proposed, and an optimisation strategy is constructed accordingly. It includes Identity-Responsive Interfaces, Feedback Loops and Semantic Co-creation. To support the implementation of Inclusive Governance of Algorithmic Cultural Platforms and Cognitive Data Justice.

Keywords:
Platform Governance; Intangible Cultural Heritage, ICH; Participation Intention; Cognitive Data Justice; Explainable AI, Grad-CAM; Semantic Feedback Mechanisms

1.Introduction

As digital platforms have become the core field of cultural Communication and social participation, the evolution of Information and Communication Technologies (ICTS) has profoundly changed the path of

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knowledge acquisition, identity expression and cultural participation structure. Especially in the context of Intangible Cultural Heritage (ICH), digital platforms not only carry the function of content display, but also gradually evolve into a cultural power scheduling mechanism. In recent years, with the systematic configuration of platform governance, algorithmic recommendation and interaction thresholds, visibility, navigability, and semantic framing of cultural content are increasingly dependent on platform logic. It is not the users own cultural experience and cognitive habits [1].

With the trend of increasingly structured and operationalised cultural data, study pointed out that data governance should no longer only focus on regulatory or privacy issues but should face up to its institutional role in restructuring collective expression and social structure[2]. The platform is not a neutral medium, but an information infrastructure embedded with categorisation logic and control modes, interaction mechanisms and recommendation systems that often reinforce existing knowledge structures and constitute technological governance of participation structure with asymmetric participation. Especially in cultural platforms, there are differences in the understanding of information systems among public users, expert users and marginal groups. Once these differences are solidified by platform logic, they may evolve into structural exclusion and feedback failure.

Compared with traditional physical preservation methods, digital resource platforms have significant advantages in accessibility, infusibility, and participatory potential. However, many intangible cultural heritage platforms still mainly focus on content archiving and static display, ignoring the user feedback mechanisms and semantic equality mechanisms emphasised by Cognitive Data Justice [3]. In the absence of structural collaboration mechanisms and semantic input channels, public users are often excluded from platform collaboration, and it is difficult to generate effective inputs from users. It forms a typical Cultural Accessibility Gap and Participation Mobilisation Dilemma.

This study focuses on the Digital Collection Repository on the official website of Chengdu Shu Brocade and Embroidery Museum, a representative intangible heritage project in Southwest China. The platform displays many images of Shu brocade, Shu embroidery and clothing collections, providing important visual materials and knowledge carriers for cultural communication and educational research. On this basis, the research team independently built an AI pattern recognition and interpretability analysis module and combined with a user survey and semantic feedback mechanism to carry out platform optimisation research. In the actual use process, several structural issues are exposed in the platform content presentation and user interaction. First, the resource content architecture is fragmented, and the classification is fuzzy, which makes it difficult for users to retrieve and understand efficiently. Secondly, the processing results of specific patterns by the AI recognition module were inconsistent, and the image quality and structural coherence did not meet the users' expectations. Third, lack of effective user feedback mechanisms and interaction incentive pathways. The long-term participation intention of both the public and expert users showed a downward trend. These problems indicate that there is a structural break between cultural governance mechanisms and user cognitive pathways of intangible cultural heritage platforms.

To systematically reveal the user experience and participation logic in the intangible cultural heritage platform, this paper starts from a user-centred perspective, combining social structural variables (such as user identity and technological literacy) with platform functional perception, to explore the following three Re-

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search Questions:

· RQ1: How do users evaluate the main functional modules in the repository, including image quality, multidimensional display, AI-based pattern recognition and value display? Do these perceptions show group differences?

· RQ2: Are there significant differences in functional evaluation and satisfaction among users with different identities (public users, digital technology experts, textile practitioners)? Does its identity category affect its platform usage patterns?

· RQ3: Does user satisfaction significantly predict their participation intention in platform optimisation and co-construction? Does identity have a moderating effect?

This study adopted a mixed-methods approach, integrating a structured questionnaire and open-ended suggestion analysis. A closed-loop behavioural model of satisfaction-participation willingness-feedback mechanism was established. In the quantitative part, descriptive statistics, factor analysis and logistic regression were used to analyse the prediction path of user behaviour based on 209 valid questionnaires. In the qualitative part, ATLAS.ti was used to extract thematic structure and feedback logic. Semantic participation network and platform cognitive map were constructed. To enhance the explanatory power, an explainable AI mechanism -- Grad-CAM (gradient-weighted class activation mapping). The matching differences between platform structural design and user attention zones were identified in Digital platforms.

Theoretically, this paper combines Cultural human-computer Interaction (HCI), data governance and cognitive justice framework, responding to the complexity of the platform-identity-culture interaction mechanism in the contemporary information society; In practice, meanwhile, identity tags based on functionally adaptive design and open-text-driven structural feedback are proposed mechanism. And a multi-actor collaborative incentive path, to provide a theoretical basis and empirical enlightenment for the structural iteration and user participation governance of intangible cultural heritage digital platforms.

2 . Literature Review

2.1 User Perception and Digital Cultural System Experience

Intangible Cultural Heritage (ICH) digital platforms not only reconstruct cultural preservation and dissemination, but it also has a profound impact on users' cognitive pathways, information comprehension and mechanisms of semantic participation. User perception not only determines the usability of the platform, but it is also the starting point for understanding platform functional evaluation, identity interaction and mechanisms of social exclusion [1].

Bearman (1993) was the first to propose that interactive design in digital museums should emphasize non-linear navigation and user control[4]. It lays the theoretical foundation of decentralized navigation and cognitive guidance mechanisms. Study further state that cultural content should be constructed in a multimodal, contextually clear and structured control manner[5]. To improve cognitive efficiency and reduce the risk of cultural misinterpretation. Study propose that voice-coordinated navigation systems and configurable

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interfaces can be used in complex informational environments environments) to significantly improve the transparency of cognitive pathways and prevent users from getting lost in high-information-density systems[6].

However, these cognitive mechanisms are not only design issues, but also part of the semantic power allocation mechanism within platforms. Study state that the structural bias of algorithmic mechanisms often reinforces existing semantic classifications and generates cultural mainstream visibility and marginalized silence at the visual level[7]. It is a kind of symbolic suppression in the age of datafication. A study on multimodal tactile interaction shows that tangible interaction feedback and information pathways are more conducive to vulnerable users or low tech-literacy users[8]. This finding can be extended to the cognitive load-structural justice of the ICH platform when serving general users and marginalized cultural groups justice.

2.2 User Satisfaction, Platform Trust, and Participation Intention

The construction of satisfaction and trust mechanisms is the core of sustained interaction and collaborative co-creation of digital platforms. Cultural platforms not only need to respond to user preferences at the interface level, moreover it is also necessary to protect cultural belonging and channels of expression through structural mechanisms.

Study pointed out that when studying cultural crowdsourcing platforms, identity relevance and achievement motivation are the core psychological variables that affect participatory behavior[9]. It is especially effective when the platform provides social identification pathways and a sense of functional control. A study based on cultural identity and institutional trust, the tripartite cooperation model of public-community-institution is proposed. To explain the dynamic relationships among platform structure, cultural governance and participation behavior[10]. They emphasized that when platform mechanisms lack transparent feedback, users tend to view them as closed systems. Furthermore, participation motivation is weakened. This is especially true in public cultural systems. Study further showed that, through cross-national data analysis, the trust asymmetry in expert-led platforms is widening[11]. In the context of information asymmetry, algorithmic opacity and opaque platform mechanisms, general users are increasingly reluctant to participate in expert-dominated structure-building processes. This trend makes the relationship among satisfaction-participation intention-identity need to be included in the moderated pathways involving social structure variables social structural variables). The empirical provides quantitative validation on this basis[12]. It points out that interface clarity, content richness and technological trust are the key predictive variables of satisfaction. Satisfaction is an important antecedent factor of user co-creation behavior. This mechanism provides theoretical support for the binary logistic regression model used in this paper to explore user participation pathways.

2.3 Platform Structure, HCI Optimisation, and Participatory Governance

In recent years, human-computer Interaction (HCI) systems of cultural platforms not only focus on interface responsiveness, Furthermore, it turns to the governance function of mechanisms of cultural institutional expression.

Study uses Heritage Building Information Modelling (HBIM) and Virtual Reality interactive system (Virtual Reality, VR-based interaction systems) points out that multidimensional immersive interfaces can not

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only improve user comprehension, but it is also more helpful to establish the trust-based interaction pathway between user and system, to construct the sense of cognitive engagement[13]. Study bronze artefact digital platform based on youth users[14]. The ternary model of interaction, instructional guidance, and contextual feedback is proposed. It provides a theoretical foundation for building a cultural platform with a pedagogical function and self-directed learning logic. And the five principles of tactile interaction proposed by Avni et al. (2025) principles - multimodality, adaptability, affordability, refresh ability and multi-touch capability constitutes the core standard of structural inclusivity, suggesting that cultural platforms should not only respond but also adapt. To achieve diverse user groups path guidance and interface equity.

However, this optimisation pathway is not only functional, but also governance related. Study pointed out that current data governance logic often focuses on individual privacy and systemic legitimacy[2], However, it ignores the construction of collective semantic rights and platform co-creation mechanisms. If the design mechanisms of the platform fail to translate user feedback into structural adjustment, there is no way to convert the user from user to participant.

2.4 Theoretical Integration and Research Gaps

To sum up, the current literature on digital cultural platforms has been divided into content presentation - cognitive modelling - interaction structure Rich achievements have been accumulated on the triple path.

Visual accessibility [4], [5], semantic structuring [6], behavioural prediction models [9], and platform adaptation mechanisms [8], [14] jointly constructed the basic logic of HCI. The introduction of cultural identity, institutional trust and social structural differences [10], [11] further enhances the sociological explanatory power of the governance of cultural platforms.

But three key gaps have not been adequately addressed: First, most predictive models of user satisfaction and participation intention are still based on structured survey data. The construction of explanatory mechanisms of open-ended semantic feedback in platform governance is lacking. Secondly, there is a lack of theoretical pathways about how user suggestions are translated into system structure. There is a lack of multi-layered modelling re-modelling that integrates semantic expression, behavioural platform mechanisms studies. Third, there are no studies that have identified Cognitive Data Justice and combined with the structural design mechanisms of cultural participation platforms[3]. A closed-loop modelling logic called from semantic expression to structural transformation is proposed.

2.5 Research Positioning and Contributions

In response to these theoretical and methodological gaps, in this paper, a method of integrating structured questionnaire analysis, logistic regression modelling, and thematic network coding was proposed coding). From the three dimensions of user functional perception, identity structure and platform usage behaviour, the system constructs the user participation prediction model. Furthermore, the interpretable mechanisms of user feedback for platform structural reconstruction are explored.

The research integrates cultural HCI, data governance and the cognitive justice framework at the theoretical level. How do platforms in the information society generate social participation and structures of cultural ex-

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pression through interaction mechanisms and expression?

At the practical level, taking Chengdu Shu Brocade and Embroidery Museum Digital Collection Repository on the official website as a case study, three types of platform optimisation strategies are proposed: identity-adaptive interfaces, multi-actor feedback channels and semantically explainable mechanisms mechanisms), To provide operational reference for transparent cultural platform governance and iterative participation mechanisms guidance.

3. Methodology

3.1 Research Design

This study adopted a Mixed-Methods research strategy. The system reveals the users understanding of the Chengdu Shu Brocade and Embroidery Museum Digital Collection on the official website of the Chengdu Shu Brocade and Embroidery Museum Repository. Perception, satisfaction and participation intention, to support platform functional optimisation and interaction structure enhancement.

The study process included five key stages: first, a structured questionnaire was designed; second, questionnaires were distributed, and user samples were recruited through social media platforms and research networks. And then, descriptive statistics and exploratory factor analysis were conducted by SPSS software. EFA), independent samples t-test and binary logistic regression analysis; Then, open-ended questions in the questionnaire were imported into ATLAS.ti for coding, and six high-frequency themes were extracted. Finally, thematic network views are constructed. Visualising structural features of user feedback and supporting the generation of system optimisation suggestions and recommendations.

It is worth emphasising that this study not only takes user feedback as the technological optimisation goal, Furthermore, platform structure as a sociotechnical space embedded with semantic governance and identity negotiation mechanisms[2]. Therefore, the design of mixed-methods approaches not only serves causal analysis among variables, but it also responds to the information society research on Cognitive Data Justice (Souza, 2025) and feedback-loop governance mechanism. It aims to reveal the structural relationship between semantic power in cultural platforms and user participation.

3.2 Questionnaire and Variable Definition

A total of 12 items were designed in the questionnaire, and the structure included five parts. Corresponding to user identity, usage experience, functional perception, satisfaction and participation intention) and other dimensions. Q1 is the Informed Consent Statement, and Q2 is used to determine user identity. It is divided into General Users, Digital Experts and Textile Practitioners. Q3 and Q4 were used to evaluate the level of awareness and usage frequency of the platform, respectively. Q5 and Q6 constitute the functional perception dimension, which covers the following six items: Image Quality, AI Pattern Recognition, 3d Display, Big Data Categorisation, User Interaction Experience. And Value Display. The above items were measured using a 7-point Likert scale. Q8 is a multiple-response question, which is used to collect users function preference suggestions. Q10 is the satisfaction rating item, and Q11 is the participation intention item. binary categorical variable: willing/unwilling) Modelling predicts whether users are willing to participate in platform co-con-

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struction. Q12 was an open-ended suggestion item, and its text was used as the main text corpus source for qualitative analysis with ATLAS.ti.

The core variables included: user identity (Q2), functional perception (Q5-Q6), satisfaction (Q10), and participation intention (Q11). Open-ended text responses (Q12) were used to explore the semantic feedback structure of users and their relationship with the platforms cognitive logic.

The questionnaire structure of this study is shown in Appendix Figure A1. The overall coverage includes user identity, usage experience, functional perception, satisfaction and participation intention. And other variable dimensions constitute the logical foundation and data source flowchart of subsequent modelling analysis.

3.3 Sampling and Data Collection

Purposive sampling was used for data collection, supplemented by online questionnaire distribution in the form of community-based distribution. The survey covered three core user groups: general users, digital experts and textile practitioners. A total of 209 valid responses were obtained, including 181 public users (86.6%), 18 digital experts (8.6%), and 10 textile workers (4.8%). It has a certain representativeness in ICH platform research. The questionnaire was mainly distributed through the WeChat platform. All participants completed the questionnaire through anonymous participation, and an informed consent statement was provided at the beginning of the questionnaire. Ensure ethical compliance.

This research is conducted solely for academic purposes, and the data collection process strictly adheres to principles of user privacy and data protection. The study has undergone the required institutional ethics review and documentation procedures in accordance with research governance guidelines to ensure full ethical and regulatory compliance.

3.4 Data Analysis Methods

To fully reveal the interaction among variables and feedback mechanisms among users, this study used a combination of quantitative statistical analysis and qualitative coding strategy. Firstly, Descriptive Statistics were used to calculate the means and standard deviations of the six functional perceptions to understand the overall evaluation trend of the users. And then, Exploratory Factor Analysis was conducted by the Kaiser-Meyer-Olkin test (KMO test) and Bartletts Test of Sphericity. EFA), extracted principal components, and confirmed the factor structure of the functional perception dimension. And then, Independent Samples t-Test and Cohens d effect size analysis were used to test different user identity groups. In functional scores, satisfaction and willingness to participate (statistical significance differences), to quantify the moderating effects of social identity variables on cognitive mechanisms. Then, the Binary Logistic Regression model was constructed with participation intention (Q11) as the dependent variable. Satisfaction (Q10), functional ratings, and identity variable were independent variables. To test its predictive power on the co-creation intention of users. Finally, open coding and thematic extraction of Q12 open-ended suggestions were carried out using ATLAS.ti. Six high-frequency feedback themes were formed, and Thematic Network views were constructed. To visualise the user-suggested structural aggregation logic and behavioural drivers.

In the qualitative analysis, the research focuses on semantic redundancy, identity-linked expression patterns

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and structural silences in user feedback. Using ATLAS.ti. To identify the semantic space of who is heard, who is ignored in the platform, the dynamic tension between the feedback power structure and paths of cultural expression is presented. This process responds to the Accessibility of Expression and structural response mechanism proposed by Cognitive Data Justice Responsiveness[3], [7].

Explainable AI via Grad-CAM is also introduced as described in Chapter 4. Assist in identifying mismatches between attention regions in visual recognition models and actual user visual feedback, to reveal the Structured Visibility and model-trust Misalignment problems in platform structural design. Provide a human-AI collaborative perspective for platform optimisation [7].

To ensure the transparency and reproducibility of the research, all the questionnaire structure, variable definitions and coding framework have been standardised. Related materials can be shared with the permission of the author, to support cross-platform and cross-cultural context comparative studies and behavioural mechanism validation.

4. Results

This chapter focuses on the Research Questions (RQ1-RQ3), integrating the results of quantitative analysis via SPSS and thematic analysis via ATLAS.ti, The system presents the users Functional evaluation of the Digital Collection Repository on the official website of Chengdu Shu Brocade and Embroidery Museum. Perception, User Satisfaction, Participation Intention, and open-ended textual feedback are structured expressions. During the analysis, the semantic focus, identity-based differences and governance in the structural feedback mechanisms of the platform are also addressed responsiveness) to address the core issues of Cognitive Data Justice and platform semantic power structures.

4.1 User Function Evaluation (RQ1)

To understand the overall evaluation of users on the core functions of the platform, the study used Descriptive Statistics to analyse the six functional dimensions, which are: AI Pattern Recognition, Big Data Categorisation, User Experience, 3d Modelling, Image Quality), Value Display (Value Display). As shown in Figure 1, the mean scores of the six functional dimensions were all higher than the median Likert scale of 4. Among them, AI pattern recognition (M = 5.10), big data clustering (M = 5.09) and user interaction experience (M = 5.07) scored the highest. It indicates that users have a strong recognition of the intelligent processing capability and interactive functionality of the platform.

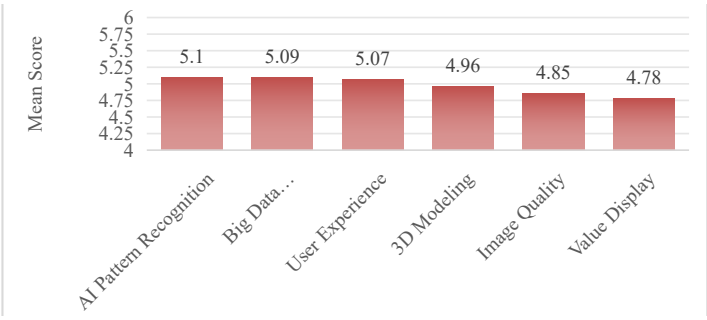


Figure 1. Mean Scores of Functional Evaluation Dimensions

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To test whether the six indicators could be integrated into a unified Factor, Exploratory Factor Analysis (EFA) was further carried out. The analysis results showed that the KMO value (Kaiser-Meyer-Olkin Measure) was 0.913, and Bartletts Test of Sphericity was significant (p <.001). The results showed that the data were suitable for factor extraction. As shown in Figure 2, the Scree Plot shows that the eigenvalue of the first principal component is much larger than 1, explaining 83.12% of the total variation. Thereafter, the eigenvalues declined rapidly, supporting the consolidation of the six measures into a single Functional Experience Factor.

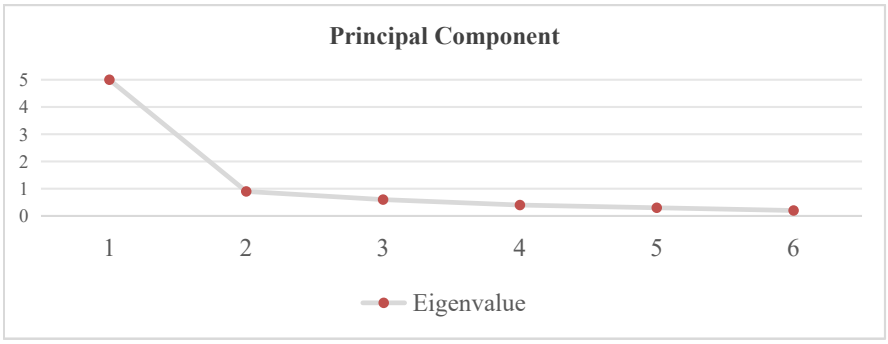


Figure 2. Scree Plot of Exploratory Factor Analysis

In addition to further understanding the user-perceived experience and system recognition mechanism reflected in the scoring dimension of AI Pattern Recognition, in this paper, Gradient-weighted Class Activation Mapping (Grad-CAM) was used to generate an attention heatmap during model recognition. Appendix Figure A2 shows the main areas that the model focuses on when performing Shu brocade pattern recognition. It focuses on structural edges and decorative centres, reflecting the effectiveness of the system in semantic focus. This explainability analysis not only enhances the user's confidence in the rationality of the intelligent scoring dimension but also reveals the possible mismatch between model output and user perception (model-user perception gap). As Pronzato (2024) point out, this dislocation suggests that in the interaction system design of digital cultural platforms, it is necessary to pay attention to algorithmic performance and how to reconstruct structured visibility and platform trust mechanism. For detailed records of the visualisation method, image source and visualisation parameters of the heat map, please refer to Appendix Table A2.

4.2 User Identity Difference Analysis (RQ2)

Independent Samples t-Test was used to test the difference of User Identity in functional evaluation (functional evaluation) evaluation), satisfaction and participation intention. User identities were classified into three categories: General User, Digital Expert and Textile Practitioner. The results showed that the score differences among the three categories of identity in all functional domains did not reach statistical significance (p >.05). As shown in Table 1, public users scored slightly higher in AI Pattern Recognition (Cohens d = 0.229) and Image Quality (d = 0.159). The subjective experience was more positive. According to Cohens d effect size guideline, d = 0.2 is considered a small effect, 0.5 is a medium effect, and 0.8 is a large effect. Etc t Our results therefore fall into the small-to-medium effect size range. Digital Experts are more cautious in many functional evaluations, reflecting their professional concerns about system performance and scalability.

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Table 1. Comparison of Functional Ratings by User Identity

Function	General User (M)	Digital Expert (M)	Textile Practitioner (M)	Cohen's d
AI Pattern Recognition	5.15	4.76	4.92	0.229
Big Data Categorization	5.12	4.91	5	0.186
Image Quality	5.08	4.82	4.89	0.159
3D Display	4.97	4.74	4.88	0.153
User Interaction	5.11	4.87	4.97	0.183
Value Display	4.91	4.61	4.75	0.147

Although the difference in ratings did not reach statistical significance, public users were generally more positive, while expert users showed a more cautious attitude. This phenomenon reflects the underlying tension between functional evaluation, identity structure and system trust. Therefore, it is worthwhile to introduce more identity-adaptive feedback mechanisms into platform design. In response to the trust pathways and participation expectations of different groups [2].

4.3 Prediction Model of Participation Intention (RQ3)

To verify whether functional experience and user satisfaction significantly affect user Participation Intention, Q11 Willingness to participate in resource optimisation design was used as the dependent variable to construct a Binary Logistic Regression model. Independent variables included satisfaction (Q10), AI Pattern Recognition, Big Data Categorisation and User Identity, etc.

The regression model results showed that the model was significant overall (Omnibus $\chi^2 = 15.31$, $p < .01$), the interpretation rate (Nagelkerke R^2) was 0.190, and the classification accuracy was 73.2%. Among them, satisfaction was a significant positive predictor (B = 0.313, p =.045, OR = 1.368), indicating that when satisfaction increased by one unit, the user's willingness to participate was increased by about 37% (Odds Ratio = 1.368). Meanwhile, the participation probability of Digital Experts was significantly lower than that of General Users (B = -1.185, p =.029, OR = 0.306). Professional status may lead to a higher participation threshold. Although the two variables of AI pattern recognition and big data clustering have a positive relationship, they do not reach statistical significance. The specific coefficients and test results are shown in Table 2.

Table 2. Logistic Regression Coefficients and Significance

Variable	B	S.E.	Wald	p-value	Odds Ratio (OR)
Overall Satisfaction	0.313	0.156	4.025	0.045	1.368
AI Pattern Recognition	0.205	0.188	1.196	0.274	1.228
Big Data Categorization	0.197	0.181	1.188	0.276	1.218
User Identity: Digital Expert	-1.185	0.54	4.817	0.029	0.306
User Identity: Textile Practitioner	-0.638	0.679	0.884	0.347	0.528

As shown in Figure 3, the accuracy rate of the model in predicting the willing to participate group was as high as 88%. However, the performance in the unwilling to participate group was weaker, indicating a clear asymmetry in the predictive performance of the model.

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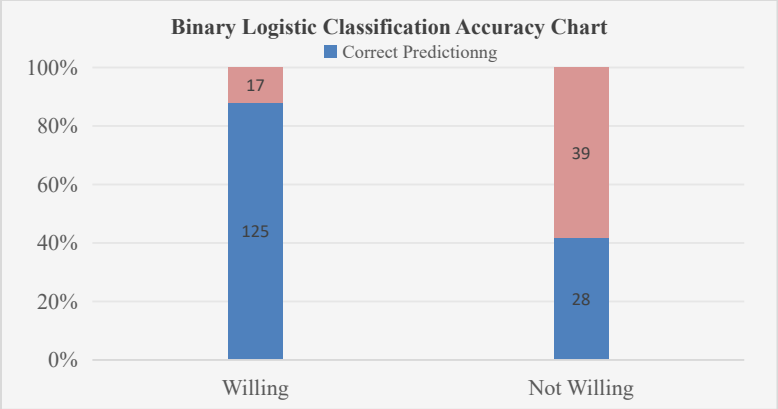


Figure 3.Binary Classification Accuracy of Logistic Regression

The model shows that system satisfaction can effectively stimulate users' participation intention. However, expert identity turned out to be a significant negative predictor, it is suggested that the incentive structure of the current platform is still biased towards public expression and lacks the structural design of a professional co-creation pathway. This finding further confirms the inequity of the identification-role embedding mechanism in cultural platforms [11].

4.4 User-open suggested topic structure (Q12)

A total of 209 open-ended suggestions were coded by ATLAS.ti, and 11 basic codes were summarised, which were further integrated into 6 themes. A structured semantic network of user feedback was constructed. As shown in Figure 4, the network not only presents a clear functional clustering logic and semantic hierarchy, but it also reflects the semantic flow chain of user suggestions in the path of feedback - thematic categorisation - design implications. This structural analysis provides semantic support for the predictive model of satisfaction-participation intention-feedback mechanism proposed in this study.

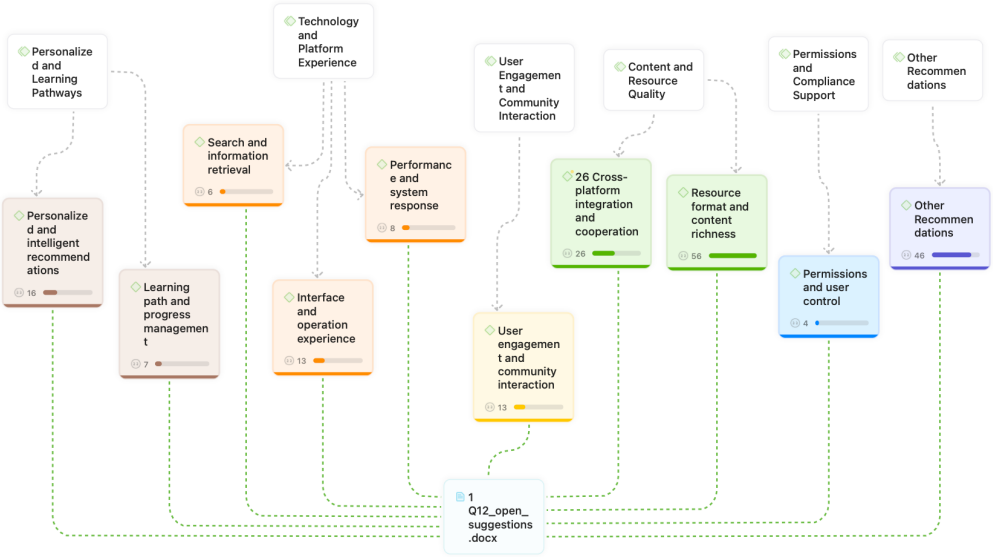


Figure 4. Thematic Network of User Suggestions from ATLAS.ti

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Based on the open-ended coding results of Atlas. This figure shows the six major themes and their subthemes that were summarised from user feedback. The graph not only shows semantic clustering relationships between topics, but the visualisation structure also reveals the inductive chain from user perception to platform design implications. Empirical structural evidence is provided for platform optimisation and interaction design.

Among them, Content and Resource Quality is the most frequent and critical theme, Users generally focused on image clarity, terminology consistency, and content richness. Technology and Platform Experience focuses on system performance and interaction logic. Personalisation and Learning Pathways reflect users' expectations for personalisation and AI-driven recommendation systems. User Engagement and Community Interaction point to commenting functions, Q&A systems and feedback mechanisms. The establishment of channels); Permissions and Compliance Support covers account tiering, copyright, and other compliance management matters; Other Recommendations focused on technical details such as visual enhancements, mobile responsiveness, and platform update frequency.

From the overall semantic structure, User feedback was aggregated around core topics such as functional performance, platform openness and participation mechanism. It shows the collective expectation of system transparency and cultural negotiation capacity. Combined with cognitive data justice theory[3], this feedback not only reflects the users' functional demands for service optimisation, but it also reflects whether the platform has the structural ability to respond to marginal voices, support plural identity coexistence and achieve shared governance.

5. Discussion

This chapter focuses on three Research Questions (RQ1-RQ3). Based on the data results in Chapter 4, Combining current information society studies and platform governance theory, The Functional evaluation of users on the Digital Collection Repository in the official website of Chengdu Shu Brocade and Embroidery Museum is deeply discussed Perception, User Identity Differences and Participation Intention. At the same time, in this paper, we discuss the mechanism of Cognitive Data Justice(Souza, 2025), platform structural feedback [2], and cultural negotiation mechanisms, and put forward systematic optimisation suggestions with structural adjustment value.

5.1 Regarding RQ1: User functionality and structural transparency

The results showed that the overall evaluation of the six functional dimensions was positive, especially for AI Pattern Recognition and Big Data Categorisation. It reflects the publics expectation of intelligent processing and visual clustering. This trend is consistent with the classic design principles of Bearman (1993) on non-linear navigation paths and user control, it is also highly consistent with the interaction-instruction-feedback ternary cognitive model[14].

However, image quality and value representation scored slightly lower, there are still shortcomings in visual performance and cultural meaning construction of the cue platform. Both stydies emphasise that the cultural system should provide cognitive support through the structural organisation of contextual clarity, high

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accessibility and semantic coherence[5], [6]. These factors are not only the content level of technical representation, but also the mechanism of cultural encoding rights and knowledge accessibility.

The Grad-CAM visualisation heatmap (see Appendix Figure 1) shows the image attention of the AI model during the recognition process, regions, enhance visual transparency, but also reveal the potential misalignment between user perception and system algorithm. This model-user perception gap constitutes an important case of structured visibility imbalance. It suggests that platform optimisation should consider both algorithmic explainability and user perception alignment.

In summary, the platform should build a dual semantic-layer structure: On the one hand, modular instructional pathways and text-image-based cultural narratives (Narrative Layer) are designed for public users. On the other hand, open raw data access, deep annotation and Grad-CAM mapping output for experts. To enhance the system transparency and trust-as-transparency. These structures are not only a cognitive design, but also the basis of semantic governance.

5.2 Regarding RQ2: User identity differences and platform trust structure

Statistical analysis showed that although the statistical significance of functional ratings and satisfaction for different user identities is not strong, However, Cohens d effect size shows that general users show more positive evaluations in dimensions such as AI recognition and image quality. This result is consistent with the operational pathway divergence[8], that is, non-expert users are more likely to form quick reviews based on novelty appeal. Expert users, on the other hand, take a more cautious approach with functional rigour as the benchmark. In the platform governance framework, user identity is not only about using background variables, but it also constitutes the core factor of data input rights and semantic construction rights. Study points out that in expert-dominated platforms, the public is often treated as guided actors[11]. Its feedback mechanisms fail to form a true structural collaboration loop.

This study found that expert users showed lower participation intention in multiple functional dimensions. It is suggested that the current platform structure lacks incentive mechanisms and trust-support structures for high-threshold expert users.

Therefore, platforms should build Identity-Responsive Interfaces that not only provide tiered interface access (e.g. basic browsing mode and expert analysis mode), and bidirectional role collaboration structure should also be constructed: If experts can participate in pattern comparison, data validation and AI model training processes, The public can form a community co-creation context through Q&A sections, learning tasks and commenting mechanisms. This inter-role collaboration structure is an important condition for realising platform collectively[2].

5.3 Regarding RQ3: Structural paths of satisfaction, identity variables, and willingness to participate

The logistic regression model showed that user satisfaction was a significant positive predictor ($p = .045$). Expert identity was found to be a significant negative predictor ($p = .029$). This shows that although the functional identification of the platform can effectively drive the participation behaviour of general users, the

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participation threshold of experts is higher. This may be due to structural barriers such as opaque feedback mechanisms and a lack of output transparency in the system. Participation behaviour in cultural platforms not only depends on cognitive motivation[10], but it also relies on institutional trust and semantic affiliation. When users can't see that their opinions are structurally acknowledged (e.g., recommendations are adopted, actions are approved), even if satisfaction is high, they may still enter a passive observational state rather than an active engagement. In addition, the model was weaker in predicting the non-participating users' group, indicating greater behavioural heterogeneity in this group. This may be influenced by a sense of structural disempowerment or cognitive exclusion experience; it is suggested that the platform should pay attention to the structural situation of culturally marginalised users.

Therefore, it is recommended that the platform establish a visual feedback loop, including suggestion acknowledgement logs, function update changelogs, user contribution points system, badge system, and introduce cultural task mechanisms, such as pattern naming, semantic interpretation competition, etc. To enhance users' sense of belonging and structural visibility. This design idea is a response to cognitive data justice and emphasizes the dual requirements of right to semantic expression and systemic responsiveness[3].

5.4 Summary and systemic model integration

The satisfied-participation intention pathway in quantitative modelling was combined with open-ended feedback coding. Extracted six-theme network. This study constructed a platform optimisation behavioural feedback loop model (see Appendix Figure A3). It is presented from functional perception - satisfaction formation - participation motivation - semantic feedback synthesis: a continuous behavioural chain of platform structural response. This closed-loop model not only serves for the systematic optimization of platform interaction design, but also responds to two key issues in current cultural platform governance: The first is social accessibility of mechanisms, that is, whether users with different identities can enter the decision-making chain of the platform structure; The second is governance feedback transparency, which is the ability of the platform to translate user input into structural responses.

In addition, Grad-CAM heatmap analysis complements a socially critical understanding of structured visibility from an explainable AI perspective, it emphasises how the algorithm model affects the display focus of cultural content and the user trust structure. This mechanism also provides a technical path and practical value for the future development of human-AI collaborative mechanisms in the context of an intangible cultural heritage platform.

To sum up, Chengdu Shu Brocade and Embroidery Museum Digital Collection on the official website of Chengdu Shu Brocade and Embroidery Museum Repository as a representative experimental field for cultural platform governance, it constructs a behavioural closed loop between user cognition, feedback articulation and institutional responsiveness. For the future of digital cultural systems, institutionalised participatory design, identity coordination mechanism and cognitive fairness reconstruction cognitive fairness reconstruction provides a theoretical framework and a strategic model that can be used for reference.

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6. Discussion

6.1 Summary and systemic model integration

This study focuses on the cognitive path of users of the Chengdu Shu Brocade and Embroidery Museum Digital Collection Repository on the official website. And participation behaviour, from the perspective of platform governance and cultural construction, a mixed-methods method was used to integrate a structured questionnaire (n = 209) and semantic coding analysis. The system answers three core research questions (RQ1-RQ3) and explores the dynamic coupling relationship between platform structure design and user feedback mechanism.

In RQ1, it was found that users highly rated AI-based pattern recognition and big data categorisation. It reflects that intelligent processing mechanisms have positive significance in improving system trust and interaction efficiency. However, image quality and value display scored relatively low. It suggests that users have higher expectations for the accuracy and semantic depth of cultural information.

In RQ2, although the differences in the scores of satisfactions and functional perception among different user identity groups were not significant, However, effect size analysis showed that general users had a slightly higher overall rating, while expert users were more cautious. This difference reflects the structural space for optimisation in identity adaptivity and semantic equity.

In RQ3, logistic regression analysis showed that satisfaction was a significant positive predictor of willingness to participate (p =.045), and digital expert identity was a negative predictor (p =.029). It is suggested that the current platform mechanism has not fully activated the collaborative potential of expert users. The ATLAS.ti semantic analysis further concluded six feedback themes. They focus on content quality, technological experience, personalised pathways and user interaction engagement, permission and compliance support and general recommendations. It forms the semantic network structure of user feedback and provides multi-dimensional input for platform reconstruction.

6.2 Theoretical Contributions & Practical Implications

Based on the modelling of user behaviour and feedback mechanism of cultural platform, focusing on the key issues of platform governance, cognitive data justice and semantic feedback structures in contemporary information society research, it emphasises the synergistic mechanism among technical architecture, identity structure and expression pathways. At both theoretical and practical levels, this paper makes structural contributions: In terms of theoretical contributions, The study constructed functional perception - user satisfaction - participation intention and identity variable (user) Dual-path behaviour model of identity – feedback structure -- platform response Integrating Likert quantitative data and ATLAS.ti open-ended semantic coding, A hybrid evaluation framework with explainability, semantic depth and structural feedback value is proposed. This model not only expands the structural dimension of Cultural HCI Models, but it also responds on collective semantic negotiation, cognitive repressibility and accessibility.

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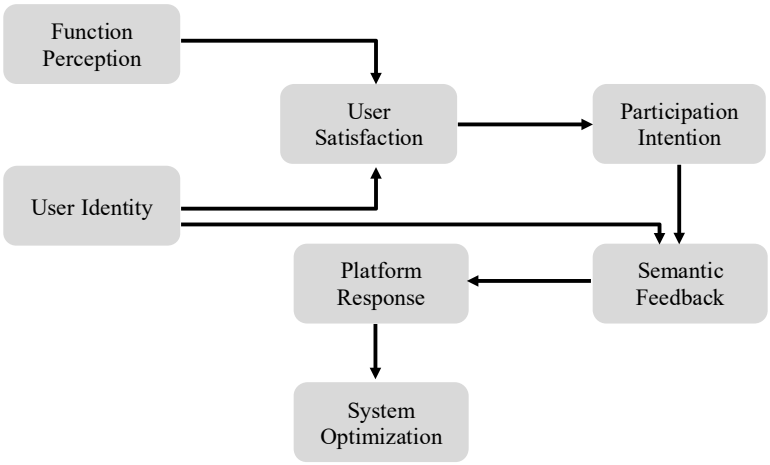


Figure 5. Predictive Model of User Participation Intention

As shown in Figure 5, this study integrates the themes of functional perception and semantic feedback and proposes a behaviour prediction model with satisfaction as a mediating variable. A feedback-to-response loop from cognitive-intention-feedback to feedback-response-optimisation is constructed. This paper provides a theoretical modelling framework for the semantic governance mechanism and user collaboration system of cultural platforms.

In addition, the study introduces the Grad-CAM visualisation mechanism to compare the focus area of the AI model with the user's visual focus. It provides technical support for structured visibility and trust mechanism formation in the digital culture system. It also expands a new social significance for the research of AI explainability in cultural situations.

In terms of practical implications, the study proposes three types of platform optimisation suggestions: First, functional modularity: High-resolution images, modular teaching guidance and contextual learning paths were introduced to improve cognitive efficiency and cultural immersion. Second, identity adaptability: A dual-interface system was constructed to open expert annotation tools and deep search paths, and to promote public-expert collaboration through label collaboration and identity verification mechanisms. Third, participation incentives: Introducing visual feedback, user points system and semantic co-creation mechanisms (such as pattern naming, AI training collaboration tasks), enhances the sense of belonging and transparency of platform response.

6.3 Theoretical Contributions & Practical Implications

Firstly, the sample structure has a high proportion of general users and a small sample of digital experts and industry practitioners. It limits the in-depth analysis and model generalizability of the influence of identity variables. Secondly, structured questionnaires were used to collect the data. Not combining user behavioural logs (e.g., navigation paths, click frequency, feedback submission history), it is difficult to capture implicit behavioural patterns during actual interactions. Third, the participation intention variable is based on self-reported intention. Lack of objective behavioural validation (e.g., platform logs, feedback volume) leads to the potential risk of attitude-behaviour gap. In addition, although open-ended text analysis forms a clear semantic structure, However, quantitative text vector models and inter-coder reliability checks across samples have not

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been introduced yet. The development space of deep learning-assisted interpretation is limited.

6.4 Future Research Directions

To further deepen the research on platform architecture and user-oriented semantic governance mechanism, it is suggested to expand from the following four directions in the future: First, expand cross-cultural comparison and platform benchmarking: The Digital Collection Repository in the official website of Chengdu Shu Brocade and Embroidery Museum Digital Collection Repository and international intangible cultural heritage platforms (such as Google Arts & Culture, European Textiles) to compare semantic hierarchy and functional response mechanisms, To explore the moderation effect of cultural preference and identity alignment in different platforms. Second, combine behavioural data with experimental mechanism: Behavioural data such as user operation logs, heatmap tracing and dwell time were introduced, and combined with A/B testing, A causal chain experimental mechanism of interface structure-behavioural pathways-feedback - feedback effects were established design). Third, deepen the expert co-creation mechanism design: To develop an expert co-creation platform, ICH inheritors, researchers, design educators and other parties are invited to participate in function development and pattern annotation annotation) and AI optimisation processes, to achieve a cultural platform ecosystem of knowledge co-creation, joint evaluation, and collaborative governance. Fourth, develop explainable AI-based cultural narrative mechanism: The mechanisms, such as Grad-CAM and SHAP, are extended to construct semantic image narrative structures, so that AI is no longer just a recognition tool. As a part of the cultural visibility construction mechanism, it realises the three-layer linkage of technology, narrative, and understanding.

In this study, the mixed-methods model construction, the semantic feedback mechanism and social trust construction were discussed. A replicable research framework has been established in this paper. Future research can extend this model to educational technology platforms, digital museums, and cultural community collaboration systems. In a broader context, continue to explore the socio-technical construction logic and structural optimisation mechanism between human-platform-culture mechanisms. To provide theoretical support for equitable cultural expression and collaborative governance in the information society support) and institutional pathways.

7. Conclusion

This study examined the Chengdu Shu Brocade and Embroidery Museum Digital Collection Repository to reveal how user perception, satisfaction, and identity jointly influence participation intention and feedback behavior within cultural digital platforms. By integrating quantitative modelling and qualitative semantic analysis, the research constructed a comprehensive Semantic Feedback and Identity-Responsive Design framework grounded in the principles of Cognitive Data Justice and Cultural HCI.

Empirical results confirmed that satisfaction acts as a significant positive predictor of participation intention, while expert identity exerts a negative moderating effect, indicating a structural asymmetry between general and professional users. Thematic analysis of 209 open-ended responses uncovered six major feedback dimensions—content quality, technological performance, personalization, engagement, compliance, and general improvement—reflecting the users shared demand for transparency, inclusivity, and collaborative gover-

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nance.

Through Grad-CAM–based explainable-AI visualization, the research further exposed the mismatch between model-attention regions and user-perceived value areas, illuminating how algorithmic visibility can reproduce cultural bias. To address these gaps, a Dual-Path Feedback Model was proposed that links satisfaction-driven participation with identity-adaptive co-creation loops. This model underscores three strategic imperatives for future platform design: (1) Functional Transparency – combining interpretable algorithms with high-quality visual narratives to rebuild user trust; (2) Identity Adaptivity – designing tiered, role-responsive interfaces to balance expert precision and public accessibility; and (3) Semantic Co-Creation – embedding continuous feedback loops and participatory governance mechanisms to ensure plural cultural expression.

Theoretically, this work extends Cultural HCI and data-governance studies by integrating semantic feedback, user identity, and explainable-AI perspectives into a single participatory model. Practically, it offers a replicable framework for optimizing intangible-heritage repositories and other algorithmic cultural systems. Ultimately, the Shu Brocade Repository case demonstrates that inclusive digital-heritage platforms require not only technical enhancement but also institutional responsiveness—transforming users from data subjects into co-creators of cultural meaning.

Conflicts of Interest

The authors declares that there is no conflict of interest regarding the publication of this article.

Author Contributions

Conceptualization: S.C.; Methodology: S.C., Y.H.; Software: S.X.; Validation: Y.Z., Q.Y.; Formal analysis: S.C.; Investigation: S.C., X.F.; Resources: Chengdu Shu Brocade and Embroidery Museum; Data Curation: S.C.; Writing – original draft preparation: S.C.; Writing – review and editing: X.F., Y.Z., Y.H.; Visualization: S.X.; Supervision: S.C.; Project administration: S.C.; Funding acquisition: S.C.

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tributed valuable insights to this study.

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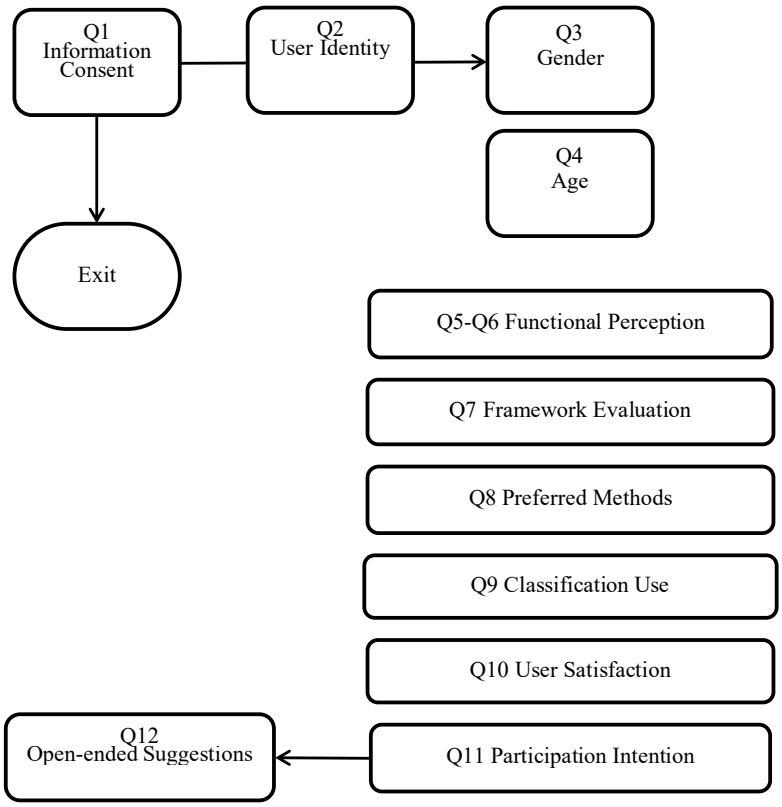
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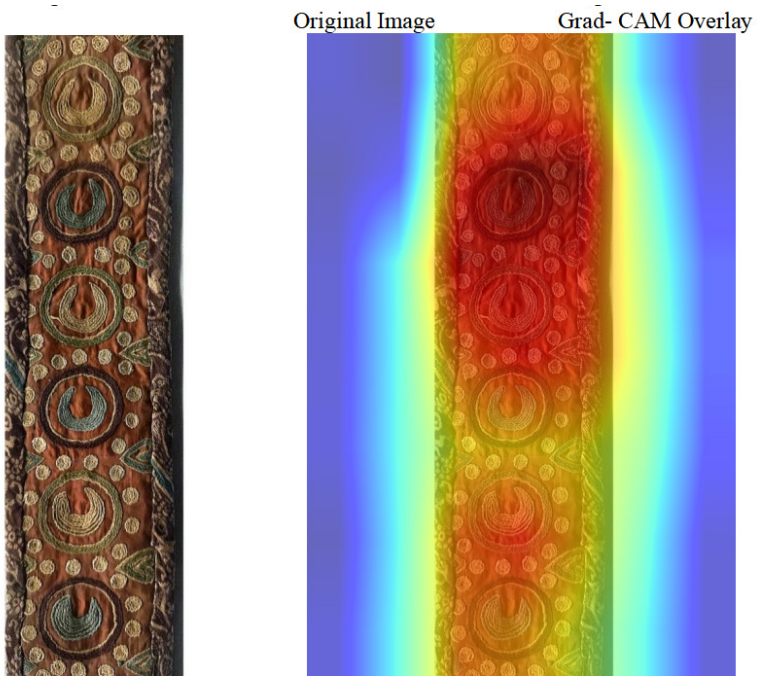
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Appendix Figure A1: Questionnaire structure and variable flowchart illustrating the sequential logic and input paths of Q1–Q12.

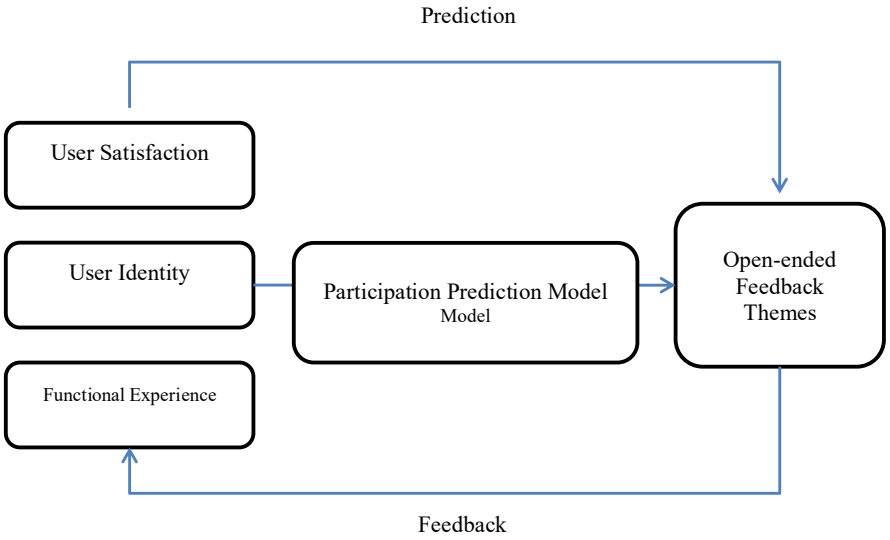


Appendix Figure A2: Grad-CAM Visualization of Model Attention Regions



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Appendix Figure A3: User Participation Prediction and Feedback Optimization Loop Model



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