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Research on the construction of participatory digital platform for Shanxi Puju protection

Min Liu[1], Kotchaphan Youngmee[2*], Khachakrit Liamthaisong[3]

[1,2,3]*Department of New Media, Faculty of Informatics, Mahasarakham University, Mahasarakham 44150, Thailand*.

Corresponding author: Kotchaphan Youngmee (*Email: kotchaphan@msu.ac.th*)

Abstract

Shanxi Pu Opera is an important traditional Chinese opera facing challenges in inheritance due to modernization. This study proposes a participatory digital platform model (PDPM-Puju) to facilitate its preservation and dissemination. The platform integrates an opera archive, interactive learning, live performances, and community engagement, leveraging AI, VR, and blockchain technologies to enhance the user experience. Research findings indicate that high-quality content, interactivity, and technological innovation effectively attract audiences and strengthen cultural identity. In the future, the platform will optimize community interaction, improve the user experience, and explore sustainable business models to ensure the long-term preservation of Pu Opera in the digital era.

Keywords: Digital, Participatory digital platform, Shanxi Puju, Traditional culture.

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1. Introduction

1.1. Research Background

Shanxi Pu Opera, also known as Puzhou Bang Opera, is one of the oldest and most significant regional operatic traditions in China. With a history of over four centuries, it embodies the cultural essence of northern China, particularly in the provinces of Shanxi, Shaanxi, and Henan. However, like many traditional art forms, Pu Opera is facing existential threats due to modernization, shifting entertainment preferences, and generational cultural disengagement. The decline of interest among younger audiences, coupled with the limitations of traditional inheritance methods, has led to a shrinking performer base and diminished public awareness.

To address these challenges, this study proposes a Participatory Digital Platform Model (PDPM-Puju) as an innovative solution for preserving and revitalizing Pu Opera. Digital platforms have transformed cultural engagement by making content more accessible and interactive, and their potential in the realm of traditional opera conservation is vast. By leveraging modern technology, this platform aims to bridge the gap between tradition and contemporary digital consumption habits. It

will integrate historical archives, interactive learning modules, live-streamed performances, AI-powered personalization, and community engagement features to ensure the opera's accessibility to wider audiences.

One of the key features of this digital platform is its participatory nature. Unlike traditional passive archival methods, PDPM-Puju encourages active user engagement through forums, workshops, and virtual performances. Users can learn singing techniques, engage in discussions with experts, contribute their own interpretations of Pu Opera, and even participate in gamified challenges to deepen their appreciation of the art form. By incorporating AI-driven content recommendations and VR/AR experiences, the platform seeks to create a dynamic, immersive learning and viewing environment that can captivate both seasoned enthusiasts and newcomers.

Furthermore, the study examines the feasibility and effectiveness of this digital conservation model through empirical research. By collecting data on user engagement, learning outcomes, and cultural perception shifts, it aims to refine the platform's structure to maximize impact. Findings suggest that enhancing content quality, community interaction, and technological innovation plays a crucial role in ensuring user retention and long-term sustainability.

In the broader context, this study highlights how digital platforms can serve as a model for safeguarding other intangible cultural heritages (ICH). The success of PDPM-Puju could pave the way for similar initiatives in preserving other Chinese opera traditions and folk arts. However, its long-term viability depends on factors such as institutional support, funding models, and public-private partnerships, which require further exploration.

1.2. Purpose of the Study

The primary objective of this study is to develop a participatory digital platform model dedicated to the preservation of Shanxi Pu Opera through systematic exploration and in-depth analysis. This platform is envisioned as a comprehensive digital space that facilitates the inheritance, exhibition, learning, and interactive communication of Pu Opera. A key focus of the design is enhancing user experience and interface usability, ensuring that it captures the interest of younger generations and encourages their active participation. By integrating modern technology with traditional cultural elements, the platform aims to offer innovative solutions for the sustainable protection and revitalization of Shanxi Pu Opera, ensuring its continued relevance in contemporary society.

1.3. Study Content

This study explores the development of a Participatory Digital Platform Model (PDPM-Puju) to preserve Shanxi Pu Opera by integrating interactive learning, AI-driven personalization, VR/AR experiences, and live performances. It addresses challenges such as declining audience interest and the limitations of traditional inheritance methods. The research focuses on analyzing user engagement, content quality, and interactive functions, employing structural equation modeling (SEM) to assess their impact on user retention. By leveraging digital technology, this model aims to enhance accessibility, sustain cultural appreciation, and provide a scalable solution for the long-term conservation of Pu Opera in the digital era.

2. Literature Review

2.1. Protection of Intangible Cultural Heritage

In recent years, the protection and inheritance of intangible cultural heritage (ICH) has attracted widespread attention and in-depth research worldwide. In terms of case studies of ICH projects, Zhang [1] analyzed the rich ICH resources and inheritance status quo by taking Xinyang tea as an example, and put forward measures to improve the inheritance system, data archive organization and development and utilization; Yang and Yang [2] explored the dilemmas and countermeasures of ICH protection and inheritance through the art of tearing paper; Cai and Wang [3] took Chaohua blowing song as an example, revealing that the protection and inheritance of ICH has become a major concern. Chaohua Blow Song serves as an example, revealing the close relationship between NRM protection and rural revitalization, while proposing corresponding protection mechanisms and innovative utilization strategies. At the same time, scholars also discussed the concept and methods of NRH protection in depth. Cheng [4] pointed out that the core concept of dietary NRH protection is changing from "dietary skills" to "dietary way", and put forward the concept of NRH process protection; Liu [5] emphasized the importance of material and material conservation; Liu [5] emphasized the importance of material and material conservation; and Liu [5] emphasized the importance of material and material conservation. Liu [5] emphasized the integration and synergy between material and non-heritage, and put forward the proposal of establishing a unified academic system, disciplinary system and discourse system of cultural heritage. In addition, the relationship between NRM protection and local development has also received extensive attention; Zeng et al. [6] investigated the current situation of NRM protection in traditional villages in Dongguan City, and put forward suggestions for improvement; Cocarico et al. [7] and other scholars took the Bolivian Jach' a Puni community's quinoa as an example to explore the importance of protecting it as a non-heritage. Donghui and Ziqing [8] explored the synergistic strategy of non-heritage protection and rural revitalization in Fengyang County, Anhui Province, from the perspective of collective memory.

2.2. Digital Platform Construction

In the extensive exploration of digital platform construction, several cutting-edge research studies have revealed their profound impact and complex mechanisms in multiple dimensions and fields. Liu et al. [9] analyzed the knowledge transfer mechanism of digital platforms in digital innovation ecosystems in depth by improving the SIR model embedded in the symbiosis theory, and emphasized its dynamic interactivity and symbiotic relationship in promoting knowledge exchange and sharing, which provides an opportunity for digital innovation main body to obtain digital value and enhance competitive advantage provides a theoretical foundation. Meanwhile, Zhou et al. [10] focused on the impact of digital platform value

perceived availability on consumer decision-making mechanism, proposed three types of availability, namely, functional, emotional and social, and explored how they affect key dimensions such as perceived usefulness, consumption motivation and word-of-mouth communication, which enriched the platform strategy and availability theory, and provided practical insights for digital platform marketing strategy. In addition, the study by Liao et al. [11] focuses on the impact of digital platform recommendation algorithms on vendor specialization and consumer welfare, and finds that the preference recommendation mechanism promotes vendor specialization, improves overall profit and consumer welfare, and provides policy recommendations for the further development of digital platforms. In terms of enterprise disruptive innovation, Tang et al. [12] based on platform ecosystem theory and dynamic capability theory, found that digital platform capability can significantly promote disruptive innovation and mediate through organizational structure agility and rounding learning, providing theoretical support for enterprises to achieve disruptive innovation using digital platforms in the context of digital transformation. Finally, Chi et al. [13] explored the mechanism of building supply chain ecosystems between digital innovation platform enterprises and digital trading platform enterprises through explanatory case studies, taking Haier and Jingdong as examples. They analyzed the key steps and influencing factors in depth, providing theoretical support and practical guidance for the construction of supply chain ecosystems in the context of global supply chain reshaping. Together, these studies demonstrate the important role and construction mechanism of digital platforms in knowledge transfer, consumer decision-making, vendor production, consumer welfare, enterprise disruptive innovation, and supply chain ecosystem construction, providing rich theoretical references and practical guidance for the development and application of digital platforms.

2.3. The Necessity of a Participatory Digital Platform for the Preservation of Shanxi Pu Opera

The preservation of traditional opera has historically depended on offline theatrical performances, written records, and academic research. While these methods have played a crucial role in documenting and safeguarding cultural heritage, they face significant limitations in the digital age. With evolving audience preferences, particularly among younger generations who increasingly consume content through social media, short-form videos, and interactive learning platforms, traditional methods struggle to maintain engagement and accessibility.

To bridge this gap, the development of a participatory digital platform that integrates advanced digital technologies becomes essential. Such a platform would not only serve as a repository of historical knowledge and performances but also provide an interactive, immersive, and engaging experience for a wider audience. By incorporating elements such as AI-driven content recommendations, virtual performances, and user-generated contributions, this platform can transform how people experience and learn about Shanxi Pu Opera, ensuring its longevity and relevance in the modern era.

3. Model Construction and Research Assumptions

3.1. Model Construction

During the construction of the participatory digital platform for Shanxi Pu Opera conservation, this study uses the SOR (Stimulus-Organism-Response) model as the core theoretical guide, aiming to effectively promote the users' interest in Shanxi Pu Opera and the enhancement of conservation awareness.

First, in terms of the Stimulus element, the platform's interface design is given high importance, aiming to provide users with a smooth experience through an intuitive and attractive interface layout, a clear navigation structure, and a reasonable display of information. At the same time, the platform carries out strict control over the quality of the content to ensure that the repertoire of Shanxi Pu Opera provided is not only rich and diverse but also detailed, and that the relevant cultural knowledge is deeply excavated to satisfy the users' demand for in-depth exploration of the art of opera. In addition, the platform also strengthens its interactive features, encouraging users to actively participate in interactive sessions such as commenting, liking, and sharing, with the aim of creating a positive community atmosphere.

Second, at the level of organism response, the platform focuses on users' cognitive, emotional, and physiological responses to the platform. Through the use of the platform, users can deepen their understanding of Shanxi Pu Opera, recognize its unique cultural value, and gradually become familiar with the platform's functions. At the same time, the platform aims to stimulate users' love and identification with Shanxi Pu Opera and their satisfaction with the platform through its beautiful interface design, high-quality content, and friendly interactive atmosphere. In addition, the platform also pays attention to the user's physiological reactions, such as concentration levels and emotional changes, in order to continuously optimize the user experience.

Finally, at the response level, the platform will focus on users' willingness to continue using the platform. By collecting user feedback and analyzing user behavioral data, the platform will assess its effectiveness in stimulating users' interest in Shanxi Pu Opera and their awareness of protection, and adjust the platform strategy accordingly to enhance user satisfaction and loyalty. An excellent participatory digital platform can not only provide users with a rich cultural experience of opera but also inspire them to love and protect traditional culture and jointly promote the inheritance and development of Shanxi Pu Opera.

Based on the above analysis, this study finally summarizes the four major external stimuli (S) that influence users' perceived value and continued use intention, including platform interface design, content quality, interactive functions, and technical support. Furthermore, this study subdivided the user-perceived value (O) into three dimensions: cognitive response, emotional response, and physiological response. The willingness to continue using is regarded as the final expression of this series of psychological responses and behavioral decisions, which is considered an individual behavioral response (R).

Based on the SOR theoretical model, this study aims to deeply explore the interrelationships among these three variables (see Figure 1).

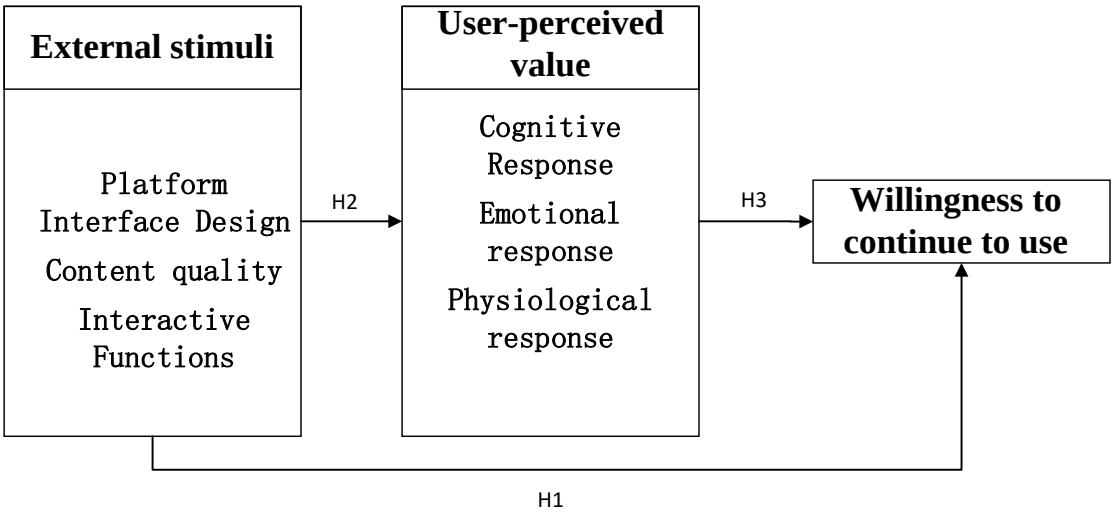

Figure 1.
Framework Model of Factors Influencing Willingness to Continuously Use.

3.2. Research Hypotheses

3.2.1. Influence of External Stimuli on Persistent Use Intention

Based on the SOR theory and the research questions of this study, combined with the "three major external stimuli affecting the intention to continue using" extracted from the in-depth interviews with users, this study puts forward the following hypotheses: H1a: there is a significant positive influence of platform interface design on the intention to continue using; H1b: there is a significant positive influence of content quality on the intention to continue using; H1c: there is a significant positive influence of interactive functions on the intention to continue using. This study proposes the following hypotheses: H1a: the platform interface design has a significant positive effect on the willingness to continue using; H1b: content quality has a significant positive effect on the willingness to continue using; H1c: interactive functions have a significant positive effect on the willingness to continue using.

3.2.2. Influence of External Stimuli on Users' Perceived Value

According to the SOR theory, external stimuli (S) will first act on the individual's cognition or perception (O), and then cause the individual to produce internal or external behavioral responses (R). Therefore, this study proposes the following hypotheses based on the influence of external stimuli on user-perceived value: H2a: platform interface design has a significant positive effect on user-perceived value; H2b: content quality has a significant positive effect on user-perceived value; and H2c: interactive features have a significant positive effect on user-perceived value.

3.2.3. The Influence of User-Perceived Value on the Willingness to Continue Using

After extensive research and empirical analysis, the results of studies in different industries consistently show that perceived value has a significant positive effect on the willingness to continue using (Figure 2). In view of this, this study proposes the following hypotheses: H3a: cognitive response has a significant positive effect on the willingness to continue using; H3b: emotional response has a significant positive effect on the willingness to continue using; H3c: physiological response has a significant positive effect on the willingness to continue using.

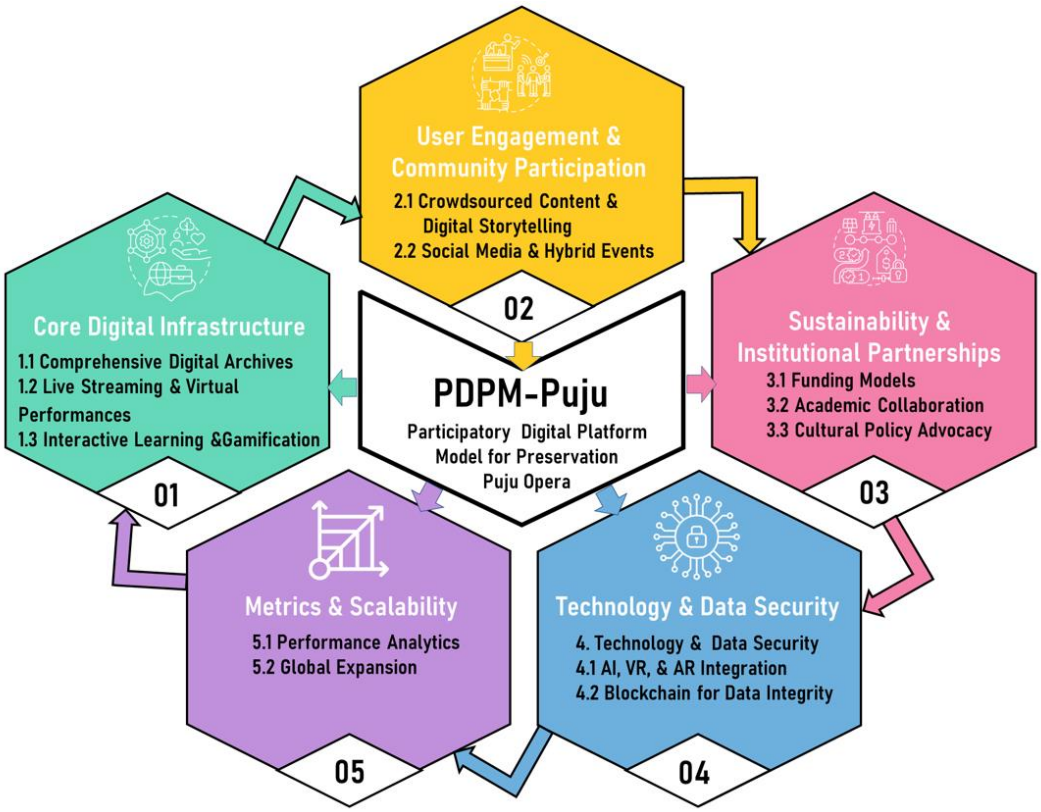

Figure 2.
Model construction conception process.

3.2.4. The Mediating Role of Users' Perceived Value

The SOR theory proposes that the mechanism variable (O) encompasses the user's emotional and cognitive factors and is located between the stimulus variable and the individual behavioral response variable. Therefore, this study hypothesizes that H4: User-perceived value plays a mediating role in the relationship between external stimulus factors and the intention to continue using.

4. Hypothesis Testing

4.1. Questionnaire Recovery

This study successfully recovered 234 questionnaires, and 209 valid questionnaires were finally retrieved after screening, with an effective recovery rate of 89.3%, which provides a solid foundation and valuable empirical support for the subsequent study. In order to verify the validity of the data, this study further conducted a reliability test, and the results are shown below:

Table 1.
Reliability statistics.

Cronbach's Alpha	Number of items
0.930	20

Table 1 shows that the Cronbach Alpha coefficient of this study's scale is .930, a value that is much higher than the commonly accepted threshold of .70, indicating that the scale we used, which contains 20 items, is highly reliable.

Table 2.
KMO and Bartlett's test

KMO Sampling Suitability Measure		0.901
Bartlett's test of sphericity	Approximate chi-square	2975.265
	Degrees of freedom	190
	Significance	0.000

The results of the data in Table 2 show that the KMO value reaches 0.901 and Bartlett's test of sphericity P<0.001, indicating a high degree of correlation between the variables.

4.2. Hypothesis Testing

4.2.1. Structural Equation Testing

This study applies the method of structural equation modeling to deeply analyze the complex influence relationship between external stimulus factors, users' perceived value, and continued use intention, and accordingly constructs an intuitive model diagram, as shown in Figure 3:

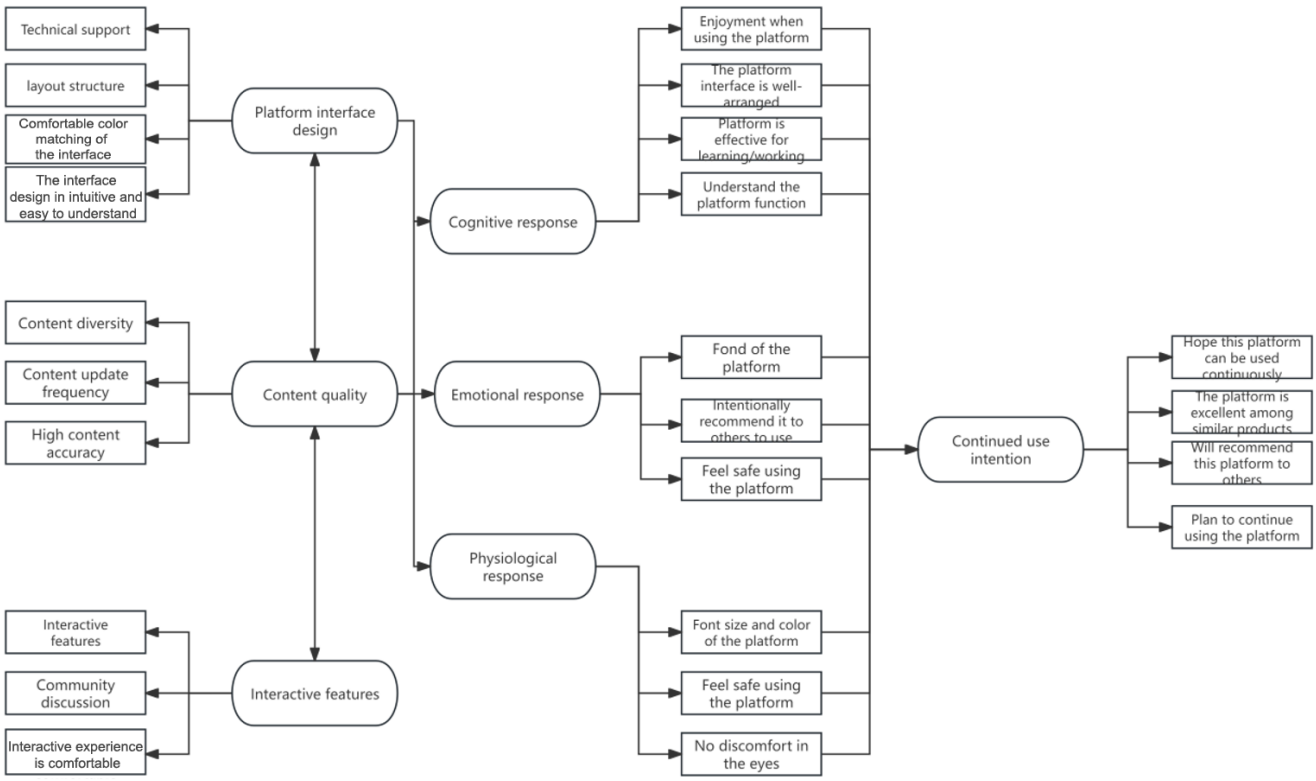

Figure 3.
Graph of model results.

Table 3.
Model fit.

Item	R Square value
Cognitive response	0.579
Emotional response	0.675
Physical response	0.528
Willingness to continue using	0.634

Based on the information provided in Table 3, we were able to analyze in depth the explanatory efficacy of the model and the credibility of the hypothesis testing. The data show that the corresponding R-squared values of cognitive response, emotional response, physical response, and willingness to continue using are 0.579, 0.675, 0.528, and 0.634 in that order, and these values are beyond the 0.5 threshold, indicating that the model has a strong ability to interpret the above four constructs.

Table 4.
Model Fit Indicators.

Common indicators	$\chi 2$	*df*	*p*	$\chi 2/df$	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judgment Criteria	-	-	>0.05	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
Value	642.409	234	0.000	2.745	0.912	0.061	0.110	0.952	0.927	0.944
Judgment standard value	TLI	AGFI	IFI	PGFI	PNFI	PCFI	SRMR	RMSEA 90% CI		
Judgment Criteria	>0.9	>0.9	>0.9	>0.5	>0.5	>0.5	<0.1	-		
Value	0.944	0.887	0.953	0.711	0.786	0.807	0.066	0.056 ~ 0.067		

Note: Default Model when $\chi 2(276) = 8856.457$, $p = 1.000$
AIC = 129.237, BIC = 402.611.

Based on the results in Table 4, it can be seen that:

(1) The chi-square value (χ^2) is 642.409 and the degree of freedom (df) is 234, which corresponds to a p-value of 0.000, indicating that there is a significant difference between the model and the data (since the p-value is less than the usual significance level of 0.05). However, it is important to note that the chi-square degrees of freedom ratio (χ^2/df) is 2.745, which is below the recommended threshold of 3, which is usually taken as an indication of better model fit.

(2) In terms of the model fit metrics, the goodness-of-fit index (GFI) is 0.912, which exceeds the recommended threshold of 0.9, indicating that the model is able to fit the observed data better. Meanwhile, the comparative fit index (CFI), the normative fit index (NFI) and the non-normative fit index (NNFI) were 0.952, 0.927 and 0.944, respectively, which exceeded the threshold value of 0.9, further supporting the goodness-of-fit of the model.

(3) The root mean square of approximation error (RMSEA) is 0.061, which is lower than the recommended standard of 0.10, indicating that the error between the model and the data is small. Meanwhile, the standardized residual root mean square (SRMR) is 0.066, which is also lower than the threshold of 0.10, further verifying the quality of the model's fit. The 90% confidence interval of the RMSEA is from 0.056 to 0.067, which is also at a low level, further supporting the stability of the model.

(4) The TLI (Tucker-Lewis Index) is 0.944, which exceeds the recommended standard of 0.9. The adjusted goodness-of-fit index (AGFI) is 0.887, which is slightly below the threshold of 0.9 but still within the acceptable range. The incremental fit index (IFI) was 0.953, which also exceeded the recommended standard of 0.9. Meanwhile, the parsimony fitting indices (including PGFI, PNFI, and PCFI) were 0.711, 0.786, and 0.807, respectively, all of which exceeded the recommended criterion of 0.5, indicating that the model still has a good fitting effect while maintaining parsimony.

In summary, according to the data in Table 4, the model showed good fitting effects on several fitting indicators, supporting the validity and reliability of the model.

Table 5.
Summary grid of model regression coefficients.

X	→	Y	Unstandardized regression coefficient	*SE*	z (CR value)	*p*	Standardized regression coefficient
Platform Interface Design	→	Cognitive response	0.295	0.054	5.504	0.000	0.345
Platform Interface Design	→	Emotional response	0.383	0.061	6.298	0.000	0.357
Platform Interface Design	→	Physical response	0.280	0.064	4.406	0.000	0.280
Platform Interface Design	→	Willingness to continue using	0.063	0.056	1.133	0.257	0.075
Content Quality	→	Cognitive response	0.254	0.048	5.301	0.000	0.311
Content Quality	→	Emotional response	0.303	0.054	5.583	0.000	0.294
Content Quality	→	Physical response	0.280	0.057	4.900	0.000	0.293
Content Quality	→	Willingness to continue using	0.124	0.050	2.459	0.014	0.154
Interactive Functions	→	Cognitive response	0.184	0.048	3.848	0.000	0.214
Interactive Functions	→	Emotional response	0.314	0.055	5.736	0.000	0.291
Interactive Functions	→	Physical response	0.263	0.058	4.559	0.000	0.262
Interactive Functions	→	Willingness to continue using	0.136	0.049	2.786	0.005	0.161
Cognitive response	→	Willingness to continue using	0.213	0.058	3.643	0.000	0.217
Emotional response	→	Willingness to continue using	0.156	0.054	2.879	0.004	0.200
Physical response	→	Willingness to continue using	0.118	0.045	2.605	0.009	0.141

Note: → indicates regression influence relationship or measurement relationship
The horizontal bar '-' indicates that the item is a reference item.

Based on the results of Table 5, can this study in 3.2 the hypotheses were tested and the results were:

The preservation of traditional opera has historically relied on offline theatrical performances, written records, and academic research. However, these methods face increasing limitations in the digital era, particularly in engaging younger audiences who prefer social media, short-form videos, and interactive learning platforms. To address this challenge, a participatory digital platform that integrates advanced digital technologies is essential for sustaining the interest and involvement of modern audiences in Shanxi Pu Opera.

(1) Examining the Impact of External Stimuli on Willingness to Continue Using the Platform

From the regression analysis in Table 5, we observe that different platform design elements influence users' willingness to continue using the platform to varying degrees:

Platform Interface Design had no statistically significant impact on users' willingness to continue using the platform ($p = 0.257$), despite its effect on cognitive ($\beta = 0.345$), emotional ($\beta = 0.357$), and physical ($\beta = 0.280$) responses. This suggests that while interface design plays a role in shaping user experience, it is not a primary driver for sustained engagement.

Content Quality had a significant positive effect on willingness to continue using the platform ($p = 0.014$, $\beta = 0.154$). This underscores the importance of high-quality, well-structured, and informative content in retaining users.

Interactive functions also showed a significant positive effect on willingness to continue using ($p = 0.005$, $\beta = 0.161$), indicating that features such as user discussions, participatory learning, and real-time engagement contribute to long-term user retention.

These findings highlight that platform usability alone is not enough to sustain user engagement—rich, engaging content and interactive functions are the key determinants.

(2) The Role of External Stimuli in Shaping User Perceived Value

The results also indicate that Platform Interface Design, Content Quality, and Interactive Functions all significantly impact user-perceived value (p-values < 0.05). Among these, Platform Interface Design strongly influences cognitive responses ($\beta = 0.345$) and emotional responses ($\beta = 0.357$), showing that while interface aesthetics and navigation improve users' perception, they do not directly translate into sustained usage.

Content Quality and Interactive Functions, on the other hand, had broader positive effects across all perceived value dimensions—cognitive, emotional, and physical. For example:

Content Quality significantly influenced cognitive responses ($\beta = 0.311$) and emotional responses ($\beta = 0.294$), confirming that well-curated, engaging content enhances users' intellectual and emotional connection to the platform.

Interactive functions had a strong effect on emotional responses ($\beta = 0.291$) and physical responses ($\beta = 0.262$), indicating that participatory elements enhance user engagement on both affective and behavioral levels.

These findings suggest that while interface design is necessary for first impressions and usability, content and interaction are the true drivers of perceived value critical for engaging users in cultural preservation.

(3) How Perceived Value Translates into Long-Term Engagement

The analysis confirms that users' cognitive, emotional, and physical responses all significantly influence their willingness to continue using the platform:

Cognitive response ($\beta = 0.217$, $p < 0.05$): Users who find the platform educational and informative are more likely to stay engaged.

Emotional response ($\beta = 0.200$, $p = 0.004$): If users develop a strong emotional connection with the platform whether through nostalgia, appreciation of the art form, or social interactions they are more likely to return.

Physical response ($\beta = 0.141$, $p = 0.009$): Factors such as ease of navigation, visual comfort, and accessibility also contribute to sustained usage.

This confirms that an effective participatory digital platform must not only provide information but also create an emotional and interactive experience that resonates with users.

(4) Strategic Implications for the Development of the Digital Platform

Based on these findings, the design of a participatory digital platform for Shanxi Pu Opera should prioritize the following:

Content is King:

The quality and diversity of Pu Opera materials, educational resources, and video content must be the platform’s top priority.

A well-structured knowledge archive featuring text, video, and interactive media can enhance cognitive engagement.

Interactivity Drives Engagement:

Live-streaming performances, discussion forums, and user-generated content (e.g., amateur Pu Opera recordings) should be incorporated.

Gamification elements like learning challenges, quizzes, and rewards can further encourage participation.

Aesthetic Design Matters, but Not for Retention:

While an intuitive interface improves user perception, it should not be prioritized over content or interactivity.

Features like personalized AI-driven recommendations can make the interface more effective.

A Holistic User Experience Approach:

The platform must cater to all three levels of user engagement: cognitive (education), emotional (cultural appreciation), and physical (usability and accessibility).

AI-driven adaptive learning, augmented reality (AR) features, and interactive storytelling can enhance the immersive experience.

4.2.2. Intermediate Analysis Test

Table 6.
Results of mediating role analysis.

	Willingness to continue using					**User-perceived value**					**Willingness to continue using**				
	B	**standard error**	***t***	***p***	***β***	***B***	**standard error**	***t***	***p***	***β***	***B***	**standard error**	***t***	***p***	***β***
Constants	0.591*	0.134	4.394	0.000	-	0.673*	0.094	7.120	0.000	-	0.234	0.132	1.777	0.076	-
External stimuli	0.828*	0.039	21.347	0.000	0.704	0.793*	0.027	29.101	0.000	0.804	0.407*	0.061	6.719	0.000	0.346
User-perceived value											0.531**	0.061	8.636	0.000	0.445
R 2	0.496					0.647					0.566				
Adjusted *R* 2	0.495					0.646					0.564				
F value	*F* (1,463) =455.696, *p*=0.000					*F* (1,463) =846.877, *p*=0.000					*F* (2,462) =301.355, *p*=0.000				

Note: * $p<0.05$ ** $p<0.01$.

(1) The Limitations of Traditional Preservation Methods and the Need for Digital Transformation

Historically, the preservation of traditional opera has heavily relied on offline theatrical performances, written records, and academic research. While these methods have contributed to cultural documentation, they have become increasingly ineffective in engaging younger generations, who are more inclined toward digital, interactive, and social media-driven experiences. This generational shift necessitates a modernized, participatory digital platform that integrates advanced digital technologies to ensure the continued interest and involvement of contemporary audiences in Shanxi Pu Opera.

(2) The Impact of External Stimuli on Willingness to Continue Using the Platform

Regression analysis from Table 5 highlights how various platform elements influence users' sustained engagement. The results indicate a nuanced relationship between interface design, content quality, and interactive functions, revealing key insights:

Platform Interface Design showed no statistically significant impact on willingness to continue using the platform ($p = 0.257$, $\beta = 0.075$). However, it significantly influenced cognitive ($\beta = 0.345$), emotional ($\beta = 0.357$), and physical responses ($\beta = 0.280$). This suggests that while a well-designed interface enhances first impressions and usability, it does not directly drive long-term engagement.

Content Quality had a significant positive effect on willingness to continue using ($p = 0.014$, $\beta = 0.154$). This underscores the importance of rich, well-structured, and high-quality information, suggesting that users are more likely to return if they perceive the content as educational and valuable.

Interactive Functions demonstrated an even stronger impact on continued usage ($p = 0.005$, $\beta = 0.161$), highlighting the role of engagement-driven features such as discussion forums, participatory learning, and live interactions.

These findings suggest that platform usability alone is not enough to maintain user engagement—the combination of compelling content and interactive experiences is crucial for retention.

(3) The Role of External Stimuli in Shaping User Perceived Value

Further analysis indicates that Platform Interface Design, Content Quality, and Interactive Functions all significantly affect user-perceived value (p-values < 0.05), but in distinct ways:

Platform Interface Design primarily influences cognitive ($\beta = 0.345$) and emotional responses ($\beta = 0.357$). This means that while interface aesthetics and navigation enhance user perception and comfort, they do not directly increase retention.

Content Quality affects all three perceived value dimensions, particularly cognitive responses ($\beta = 0.311$) and emotional responses ($\beta = 0.294$). This confirms that well-curated, engaging, and educational content is essential for intellectual and emotional engagement.

Interactive Functions strongly influence emotional responses ($\beta = 0.291$) and physical responses ($\beta = 0.262$). This suggests that participatory features, such as user comments, discussions, and interactive storytelling, enhance user engagement both affectively and behaviorally.

These findings emphasize that while interface design improves usability, content and interaction are the real drivers of engagement a crucial consideration for a cultural preservation platform.

(4) How Perceived Value Translates into Long-Term Engagement

The cognitive, emotional, and physical responses significantly influence users' willingness to continue using the platform, confirming the importance of a holistic user experience:

Cognitive Response ($\beta = 0.217$, $p < 0.05$): Users who perceive the platform as educational and informative are more likely to stay engaged.

Emotional Response ($\beta = 0.200$, $p = 0.004$): Users who form a strong emotional connection with the platform, whether through nostalgia, appreciation of the opera, or social interactions are more likely to return.

Physical Response ($\beta = 0.141$, $p = 0.009$): Usability factors such as ease of navigation, visual comfort, and accessibility contribute to sustained platform engagement.

This confirms that an effective participatory digital platform must not only provide information but also create an emotionally engaging and interactive experience.

(5) Strategic Recommendations for an Effective Digital Platform

Based on these findings, a participatory digital platform for Shanxi Pu Opera should prioritize the following aspects:

(a) Content is the Foundation of Engagement

The quality and diversity of Pu Opera materials, educational resources, and video content must be the top priority.

A comprehensive knowledge archive featuring text, video, and interactive media will enhance cognitive engagement.

Content should be regularly updated to keep users engaged and informed.

(b) Interactivity Enhances User Retention

Live-streaming performances, discussion forums, and user-generated content (e.g., amateur Pu Opera recordings) should be integrated into the platform.

Gamification elements such as learning challenges, quizzes, and rewards will encourage participation and long-term engagement.

Social media integration should be leveraged to allow users to share their experiences, fostering a sense of community.

(c) Aesthetic Design Matters, but Not for Retention

An intuitive, user-friendly interface improves usability and first impressions but should not overshadow content and interactivity.

Features such as AI-driven personalized recommendations can improve user engagement by curating relevant content based on user preferences.

(d) A Holistic Approach to User Experience

The platform must cater to three key engagement levels:

Cognitive engagement (education through structured content).

Emotional engagement (cultural appreciation through storytelling and social interaction).

Physical engagement (usability and accessibility improvements).

The use of AI-driven adaptive learning, Augmented Reality (AR), and immersive experiences can further enhance engagement.

(6) Conclusion: The Future of Digital Cultural Preservation

The statistical analysis highlights that traditional preservation methods are insufficient in the digital era. A participatory digital platform must go beyond simple documentation and usability improvements it must be interactive, content-rich, and emotionally engaging.

By prioritizing high-quality content, participatory features, and personalized experiences, the digital platform can revitalize interest in Pu Opera and ensure its sustainable transmission to future generations. Future iterations of the platform can expand beyond Pu Opera to other regional operas, fostering a national-level digital archive for traditional Chinese performing arts.

In summary, content and interactivity are the key drivers of digital cultural preservation, and the successful implementation of this platform will serve as a model for preserving other intangible cultural heritage forms in the digital age.

Table 7.
Summary of mediating effect test results.

Item	c Total effect	a	b	a*b Mediating effect value	a*b (Boot SE)	a*b (*z* value)	a*b (*p-value*)	a*b (95% Boot CI)	c' Direct Effects	Test Conclusion
External Stimuli => User Perceived Value => Willingness to continue using	0.828**	0.793**	0.531**	0.421	0.036	11.703	0.000	0.288 ~ 0.431	0.407**	Partial Mediation

Note: Remarks: * p<0.05 ** p<0.01.
bootstrap type = percentile bootstrap method.

Combined with the results in Table 7, it can be seen that there is a partial mediating effect of users' perceived value between external stimuli and Willingness to continue using.

Therefore, hypothesis H4 is not rejected.

In summary, all hypothesis testing results are summarized in Table 8:

Table 8.
Hypothesis testing results.

Hypothesis	Results
H1a	Reject
H1b	Accept
H1c	Accept
H2a	Accept
H2b	Accept
H2c	Accept
H3a	Accept
H3b	Accept
H3c	Accept
H4	Accept

5. Conclusion

This study is dedicated to exploring the intrinsic relationship between external stimuli, users' perceived value, and willingness to continue using the construction of a participatory digital platform for the protection of Shanxi Pu Opera, and verifying the preconceived hypotheses through empirical analysis, aiming to provide a solid theoretical foundation for the scientific construction of the platform.

In this study, structural equation modeling was used to analyze the complex relationship between the variables. The results show that the model fit indicators all meet the recommended standards, indicating that there is good consistency between the model and the data. Specifically, Content Quality and Interactive Functions of the platform had a significant positive effect on the willingness to continue using, while the effect of Interface Design was not significant. This finding has important guiding significance for the construction of a participatory digital platform for the conservation of Shanxi Pu Opera, suggesting that the platform design should focus on optimizing Content Quality and Interactive Functions.

In addition, the study also found that external stimuli had a significant positive effect on user-perceived value, and that user-perceived value partially mediated the relationship between external stimuli and Willingness to continue using. This finding further emphasizes the importance of enhancing the attractiveness of the platform at the user experience level.

In summary, this study reveals the intrinsic relationship between external stimuli, user-perceived value, and willingness to continue using through empirical analysis, which provides useful insights for the construction of a participatory digital platform for the conservation of Shanxi Pu opera. Based on the results of the study, it is suggested that during the construction of the platform, the focus should be on improving content quality and interactive functions to attract and retain users; at the same time, the focus should be on improving the user's perceived value and enhancing the user's willingness to continue using by optimizing the user experience. These suggestions are expected to be useful for the construction of a participatory digital platform for Shanxi Pu Opera conservation and are expected to provide strong support for the scientific construction of a participatory digital platform for the conservation of Shanxi Pu Opera.

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