The Impact of Design Thinking on the Contemporary Development of Shadow Play in Xiangtan of Hunan Province

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Abstract

Shadow play in Xiangtan is a local intangible cultural heritage project originating from Hunan, currently facing both challenges and opportunities presented by the transition to the digital age. The objective of this paper is to explore how design thinking can enhance the production and display effects of shadow play in Xiangtan, thereby improving audience viewing experience and satisfaction. This study employs a quantitative research methodology to validate its findings. Based on an innovation and development theoretical framework, this research constructs a theoretical model that examines the impact of design thinking technology on shadow play in Xiangtan.

This model is employed to investigate the relationship between design thinking and the development of shadow play in Xiangtan, identify key factors influencing the innovation and advancement of shadow play in Xiangtan play, and determine critical mediating variables related to design experience and design quality as informed by design thinking. The study sample comprised individuals of varying ages and backgrounds from Xiangtan City of Hunan Province, China, with a total of 450 questionnaires distributed. Data analysis was conducted using statistical software SPSS. The findings indicate that the application of design thinking exerts a mediating effect on enhancing user experience and satisfaction; furthermore, innovations in materials, patterns, technologies, and display forms significantly enhance both design experience and quality, subsequently exerting a positive influence on user satisfaction and behavioral intention.

This study finds that :(1) the application of design thinking method to shadow play in Xiang tan can be summarized into the following six indicators: material innovation, pattern innovation, technical innovation and performance form. (2) The effective way to innovate shadow play in Xiang tan is to use the method of design thinking to achieve a better sense of experience and satisfaction.

Keywords: Design Thinking; Contemporary Development; Shadow play in XiangTan

Introduction

"Design Thinking" by Brown (Tim), published in the Harvard Business Review in 2008, has the most citations, reaching 1,501 times. It can be seen from the statistics of highly cited literature that the academic influence of current design thinking research is mainly concentrated in management, design and education disciplines and their professional journals. (He Xiu Zhuan，2024)The requirements of users, the feasibility of science and technology, and the sustainability of business are the three important constraints of design thinking, and they run through the whole process of design thinking. At the same time, The design thinking approach places significant emphasis on "innovation" and the intrinsic relationship between innovation and the three essential prerequisites. which are interdependent and mutually promoting. (Zhang Xiangyi,2017)Innovation Diffusion Theory(Everett M. Rogers,1962) is a theory used in the social sciences to explain how new ideas, practices, or products spread and are adopted in society.

Based on the above research background and practical basis，the application of design thinking in different fields has achieved remarkable results, which is of great significance to promote the development of innovation in various fields. Innovation is not equivalent to technological invention, but to create value in the process of passing technology to users through design. The way of thinking to realize this innovation process is design thinking. Design thinking is an influential, efficient and widely adopted approach to innovation. Design thinking can be widely expanded and integrated into all fields and levels of society, and anyone or groups can use design thinking to efficiently create new ideas, realize these ideas, and make them work.

This study aims to explore the influencing factors of design thinking on the innovation and development of shadow play in Xiang tan, and to verify the concept of innovation and development based on the theoretical framework of design thinking and innovation diffusion. Through quantitative research, 4 independent variables, 2 dependent variables and 2 mediating variables will be used to verify the validity of design thinking. Quantitative research will investigate the influence of six indicators of design thinking innovation dimension on the behavioral intention and satisfaction of shadow play in Xiang tan.

Research Objectives

1. To investigate the impact of design thinking on the quality and experience of shadow play in Xiangtan: This objective analyzes how the application of design thinking can enhance both the aesthetic quality and viewer engagement, thereby fostering innovation within this traditional art form.

2. To develop contemporary strategies for implementing design thinking: Through empirical research, this objective assesses how the integration of design thinking into Xiangtan's shadow play affects audience satisfaction and behavioral intentions, thereby facilitating cultural transmission and market expansion.

Research Methodology

1. Research Methodology

This paper employs quantitative research methods to gather extensive and in-depth data from multiple information sources, thereby verifying the accuracy of the research objectives. Questionnaires were distributed to college students aged 18-28 who have grown up in the digital age, aiming to understand how these young individuals influence design thinking and the varying effects of different indicators on three dependent variables related to innovation development. Consequently, this study seeks to identify the influencing factors between each independent variable and its corresponding dependent variable, specifically investigating whether design thinking can facilitate innovation and development in shadow play among young people in Xiangtan. The main components of this section include research design, a summary of research methods, questionnaire analysis, and results derived from that analysis. The chosen methodology is quantitative (questionnaire-based), utilizing regression analysis to explore relationships between dependent and independent variables. Linear regression models are employed to establish linear relationships between a dependent variable and one or more independent variables, quantifying and evaluating the degree of correlation among various factors.

2. Population and Sample

Xiangtan City is the birthplace and main inheritance area of Xiangtan shadow play. Xiangtan City is selected as the main research area for the following reasons :(1) Cultural background: Xiangtan City has a rich historical and cultural accumulation of paper, which provides rich background information for the research. (2) Inheritors: there are many non-genetic inheritors and related cultural researchers in this region, which is easy to visit and interview. (3) Innovative practice: Xiangtan City has made many attempts and practices in paper film innovation in recent years, providing practical cases for the research.

Table 1 Sample design diagram summary

Population category	Total estimate	Sample size design	Sample recruitment channel
Researchers of intangible cultural heritage	100-200 people	20-30 people	Universities, research institutes
Non-genetic heirs	5-10 people	5-10 people	Cultural Bureau, intangible cultural heritage protection
Handicraft innovator	500-1,000 people	50-70 people	Handicraft Association, cultural and creative industry Park
College students aged 18-28	Close to 200,000 people	300-350 people	Campus channels, social media, online and offline activities
Total number of people	About 200,000 people	400-460 people	

In order to ensure the scientificity and representativeness of the research results, stratified random sampling method was adopted to cover the following four groups of people: intangible cultural heritage researchers, non-genetic inheritors, process innovation practitioners, and college students aged 18-28. The total population size of Xiangtan City is about 2 million people, and a reasonable sample size should be determined according to the actual distribution

and participation of each group. According to the sample size design formula algorithm in social research, assuming that the allowable error range is ±5% and the confidence level is 95%, the total sample size can be calculated to be about 400-450 people.

3. Research Tools

Literature management software: EndNote or Zotero was used for literature collation and citation management to ensure the standardization of references.

Questionnaire design tools: Online questionnaires were created using Google Forms or SurveyMonkey to facilitate data collection and statistical analysis.

Recording equipment: high-quality recording equipment used to record interviews for subsequent analysis and collation.

Observation record Sheet: A special observation form is designed to record the details of paper film performance and creation during field observation.

Data analysis software: SPSS or Excel was used for quantitative analysis of the questionnaire data to ensure the reliability of the results.

These tools will help systematically collect and analyze data, which will lead to an in-depth discussion on the influence of design thinking on shadow play in Xiangtan.

4. Data Collection

Questionnaire was mainly used as the survey tool to collect quantitative data.

Structure: The questionnaire consists of four parts: background information, design thinking evaluation, innovation development evaluation, and challenges and suggestions.

Question type: The questionnaire mainly uses Likert Scale questions to evaluate the impact of each indicator, ranging from 1 (completely disagree) to 5 (completely agree). According to the statistical data of the number of college students in each province, the number of questionnaires issued in the three cities of the selected samples can be obtained. The specific calculated number is shown in the table below. Quantitative data is obtained according to the number, and the data is analyzed by spss software to reveal the relationship between design thinking and the innovation and development of shadow play in Xiang tan.

Questionnaire Contents:

Background information: gender, age, educational background, occupation

Innovation development evaluation: Material innovation (H1), pattern innovation (H2), technology innovation (H3), performance form innovation (H4)

Design thinking evaluation: Design experience (M1), design quality (M2),

Influence results: Satisfaction (a) Behavior intention (b)

The questionnaire was divided into two sections as follows:

4.1 User information: Personal information. The questionnaire included age, identification, and basic information about whether to participate in the shadow play in Xiang tan experience. Four information points are listed.

4.2 The second part uses a five-point Likert scale. The variables designed in this study include material innovation, pattern innovation, technological innovation, display form innovation, design experience, design quality, satisfaction and behavioral intention, 4 independent variables, 2 dependent variables and 2 intermediate variables. A total of 54 questions are included.

Through 54 questions, we can understand which indicators play a decisive role in the innovation and development of shadow play in Xiang tan under the intervention of design thinking, and whether there is synergy between these indicators. This paper reviews the influence of design thinking on the innovation and development of shadow play in Xiang tan.

5. Data Analysis
5.1 Descriptive Analysis

Table 2 Study population information

Variable	Count	Add up the total%	Total %
Age			
18-28	141	33.9 %	33.9 %
29-38	138	33.2 %	67.1 %
39-55	104	25.0 %	92.1 %
55 and up	33	7.9 %	100.0 %
Occupation			
Students	169	40.6 %	40.6 %
Craft innovation experience	136	32.7 %	73.3 %
Non-genetic heirs	8	1.9 %	75.2 %
Researcher of non-heritage culture	103	24.8 %	100.0 %
Have you ever participated in shadow Play in Xiangtan related activities			
No	155	37.3 %	37.3 %
Yes	261	62.7 %	100.0 %

5.2 Reliability analysis
Table 3 Reliability analysis

Dimensionality	Number of terms	Sample size	Cronbach α系数
Pattern innovation	6	416	0. 838
Exhibition form innovation	6	416	0. 853
Technological innovation	6	416	0. 948
Material innovation	5	416	0. 828
Design experience	8	416	0. 872
Design quality	8	416	0. 862
Satisfaction	5	416	0. 827
Behavioral intention	6	416	0. 949

Reliability analysis is used to study the reliability and accuracy of responses to quantitative data (especially attitude scale questions). It is mainly judged by α coefficient. If the value is higher than 0.8, it indicates high reliability. If the value is between 0.7 and 0.8, the reliability is good. If the value is between 0.6 and 0.7, the reliability is acceptable. If this value is less than 0.6, it indicates poor confidence.

As can be seen from the above table, α coefficients of each dimension of the questionnaire are greater than 0.8, indicating high reliability of the questionnaire and reliable data.

Table 4 Validity analysis

KMO value	Bartlett Sphericity test		
	Approximate chi-square	df	Sig.
0.940	11503.068	1225	<0.001

Validity analysis assesses the design rationality of quantitative data, particularly attitude scale questions. This is judged using the KMO and Bartlett sphericity tests.For the KMO value:> 0.8 indicates strong suitability for information extraction and good validity.0.7－0.8 suggests a better suitability for information extraction, indicating better validity.0.6－0.7 suggests acceptable extraction, but validity is moderate.< 0.6 indicates difficulty in extracting information, reflecting poor validity.Additionally, the Bartlett test requires a P-value less than 0.05 to confirm good validity.

As shown in the table, the KMO value > 0.8 and Bartlett P-values are all less than 0.05, indicating strong validity for the questionnaire.

5.3 Confirmatory factor analysis

Subsequently, confirmatory factor analysis is carried out through the eight factors divided by the above analysis, and the results are as follows:

Table 5 Confirmatory factor analysis

Factor analysis	Entry	coefficient	standard error	Z-Value	P value	Standardized Coefficients
Material Innovation	A1	0.812	0.053	15.328	<.001	0.705
	A2	0.81	0.055	14.703	<.001	0.683
	A3	0.848	0.054	15.715	<.001	0.719
	A4	0.736	0.052	14.137	<.001	0.663
	A5	0.903	0.056	16.189	<.001	0.735
Innovative performance form	B1	0.879	0.055	16.064	<.001	0.723
	B2	0.83	0.054	15.288	<.001	0.698
	B3	0.871	0.058	15.05	<.001	0.689
	B4	0.853	0.054	15.888	<.001	0.716
	B5	0.79	0.054	14.647	<.001	0.674

	B6	0.812	0.052	15.529	< .001	0.704
Technological innovation	C1	1.172	0.052	22.494	< .001	0.877
	C2	1.13	0.05	22.374	< .001	0.874
	C3	1.107	0.051	21.574	< .001	0.855
	C4	1.114	0.052	21.629	< .001	0.856
	C5	1.147	0.051	22.342	< .001	0.873
	C6	1.079	0.049	21.997	< .001	0.865
Pattern innovation	D1	0.944	0.063	15.047	< .001	0.694
	D2	0.947	0.066	14.432	< .001	0.672
	D3	0.928	0.064	14.404	< .001	0.671
	D4	0.919	0.064	14.412	< .001	0.671
	D5	0.949	0.064	14.896	< .001	0.689
	D6	0.944	0.064	14.783	< .001	0.685
Design experience	M1	0.999	0.065	15.41	< .001	0.695
	M2	0.945	0.064	14.77	< .001	0.673
	M3	0.947	0.064	14.81	< .001	0.674
	M4	0.977	0.065	15.113	< .001	0.685
	M5	0.961	0.064	14.947	< .001	0.679
	M6	0.986	0.065	15.255	< .001	0.69
	M7	0.921	0.064	14.432	< .001	0.661
	M8	0.959	0.065	14.702	< .001	0.671
Design quality	MM1	0.902	0.063	14.393	< .001	0.663
	MM2	0.871	0.063	13.867	< .001	0.644
	MM3	0.887	0.062	14.217	< .001	0.656
	MM4	0.959	0.063	15.108	< .001	0.688
	MM5	0.948	0.065	14.597	< .001	0.67
	MM6	0.916	0.063	14.497	< .001	0.667
	MM7	0.948	0.064	14.754	< .001	0.675
	MM8	0.873	0.064	13.707	< .001	0.638
Satisfaction	Y1	0.839	0.052	16.012	< .001	0.732
	Y2	0.82	0.056	14.75	< .001	0.686
	Y3	0.842	0.056	15.06	< .001	0.699
	Y4	0.852	0.058	14.762	< .001	0.688
	Y5	0.806	0.054	14.925	< .001	0.694
Behavioral intention	YY1	1.199	0.052	23.168	< .001	0.892
	YY2	1.116	0.05	22.298	< .001	0.872
	YY3	1.151	0.051	22.398	< .001	0.874
	YY4	1.115	0.052	21.489	< .001	0.852
	YY5	1.115	0.05	22.2	< .001	0.87
	YY6	1.123	0.052	21.783	< .001	0.86

In terms of measurement relations, the absolute values of the standardized load system are greater than 0.6 for each measurement relationship and are significant, which means that there is a good measurement relationship.

Then this paper analyzes the discriminative validity and aggregation validity of each dimension.

Table 6 CR and AVE analysis

Factor	Combined reliability CR value	Average variance extraction AVE value
Pattern innovation	0.84	0.552
Exhibition form innovation	0.853	0.576
Technological innovation	0.95	0.793
Material innovation	0.83	0.593
Design experience	0.873	0.528
Design quality	0.864	0.509
Satisfaction	0.83	0.591
Behavioral intention	0.95	0.798

Confirmatory factor analysis AVE(mean variance extraction) and CR(combined reliability) are used for the analysis of polymerization validity (convergence validity). Generally, if AVE is greater than 0.5 and CR is greater than 0.7, the polymerization validity is high.

As can be seen from the above table, AVE values corresponding to a total of 8 factors are all greater than 0.5, and CR values are all higher than 0.7, which means that the analyzed data has good aggregation (convergence) validity.

5.4 Regression Analysis

In order to avoid the influence of collinearity problem between data, the structural equation model is established by PLS algorithm.

Firstly, the path coefficient is analyzed, and the results are as follows:

Direct effect

Table 7 Direct effect path coefficients

	Path coefficient	Standard deviation	T-value	P-value
Pattern I -> S	0.041	0.052	0.795	0.427
Pattern I -> B I	0.142	0.05	2.814	0.005
Pattern I -> D E	0.135	0.049	2.747	0.006
Pattern I -> D Q	0.125	0.056	2.245	0.025
Performance F -> S	-0.005	0.061	0.084	0.933
Performance F -> B I	0.138	0.055	2.489	0.013
Performance F -> D E	0.226	0.054	4.158	0
Performance F -> D Q	0.254	0.054	4.678	0

Technological I -> S	0.261	0.057	4.597	0
Technological I -> B I	0.179	0.057	3.131	0.002
Technological I -> D E	0.161	0.056	2.901	0.004
Technological I -> D Q	0.129	0.056	2.3	0.021
Material I -> S	0.123	0.063	1.931	0.053
Material I -> B I	0.11	0.055	1.994	0.046
Material I -> D E	0.173	0.054	3.192	0.001
Material I -> D Q	0.169	0.055	3.061	0.002
Design E -> S	0.155	0.057	2.717	0.007
Design E -> B I	0.17	0.054	3.13	0.002
Design Q -> S	0.156	0.055	2.845	0.004
Design Q -> B I	0.127	0.055	2.329	0.02

It can be seen from the data that "pattern innovation" has significant direct effects on behavior intention (path coefficient 0.142, p=0.005), design experience (path coefficient 0.135, p=0.006) and design quality (path coefficient 0.125, p=0.025). However, the direct effect of pattern innovation on satisfaction (path coefficient 0.041, p=0.427) is not significant, which indicates that although pattern innovation has a positive effect on improving participants' behavioral intention and design experience, it has no obvious effect on improving satisfaction.

Secondly, the innovation of the form of exhibition shows significant direct effects in many aspects. For example, the direct effects of presentation form on design experience (path coefficient 0.226, p<0.001) and design quality (path coefficient 0.254, p<0.001) are significant, as are behavioral intentions (path coefficient 0.138, p=0.013). However, the effect of presentation format on satisfaction is not significant (path coefficient -0.005, p=0.933), which may suggest that the improvement of presentation format affects design experience and quality more than it directly improves satisfaction.

Technological innovation showed significant direct effects on improving satisfaction (path coefficient 0.261, p<0.001), behavior intention (path coefficient 0.179, p=0.002), design experience (path coefficient 0.161, p=0.004) and design quality (path coefficient 0.129, p=0.021). This shows that technological innovation is a key factor that can improve results across the board.

In addition, although material innovation is close to the significance level, satisfaction (path coefficient is 0.123, p=0.053) fails to reach statistical significance. However, it has a significant impact on behavior intention (path coefficient is 0.11, p=0.046), design experience (path coefficient is 0.173), and design experience (path coefficient is 0.173). The direct effect of p=0.001) and design quality (path coefficient 0.169, p=0.002) was significant. This indicates that material improvement can significantly improve the design experience and quality, thereby indirectly affecting the behavioral intention of participants.

The direct effect of design experience and design quality on satisfaction and behavior intention is also very significant. The path coefficient of design experience to satisfaction was 0.155 (p=0.007), and that of behavior intention was 0.17 (p=0.002). The path coefficient of design quality to satisfaction was 0.156 (p=0.004), and that of behavior intention was 0.127 (p=0.02). These results suggest that good design experience and quality can significantly improve participants' satisfaction and behavioral intention.

In general, the direct effects of various innovation factors in different aspects have different focuses, and these data provide valuable empirical evidence for improving design and innovation strategies.

Mediating effect

Secondly, the intermediary effect is analyzed.

Table 8 Path coefficients of mediated effects

	Mediating effect	Standard deviation	T-Value	p-Value
P I -> D E -> S	0.021	0.012	1.82	0.069
P I -> D E -> B I	0.023	0.011	2.056	0.04
P I -> D Q -> S	0.02	0.012	1.648	0.099
P I -> D Q -> B I	0.016	0.01	1.538	0.124
P F -> D E -> S	0.035	0.016	2.225	0.026
P F -> D E -> B I	0.038	0.016	2.336	0.02
P F -> D Q -> S	0.04	0.017	2.317	0.021
P F -> D Q -> B I	0.032	0.016	1.997	0.046
T I -> D E -> S	0.025	0.013	1.937	0.053
T I -> D E -> B I	0.027	0.013	2.048	0.041
T I -> D Q -> S	0.02	0.012	1.689	0.091
T I -> D Q -> B I	0.016	0.01	1.619	0.105
M I -> D E -> S	0.027	0.013	2.02	0.043
M I -> D E -> B I	0.029	0.013	2.32	0.02
M I -> D Q -> S	0.026	0.013	2.083	0.037
M I -> D Q -> B I	0.022	0.012	1.733	0.083

The analysis of mediating effects explores complex relationships between variables, focusing on the roles of design experience and design quality. The mediating effect of "pattern innovation" on "satisfaction" through design experience is 0.021 (p=0.069), nearing significance, while the effect on "behavioral intention" is 0.023 (p=0.04), indicating significance. This suggests that part of the effect on behavioral intention is achieved via improved design experience, accounting for 12.7% of the total effect.

For "exhibition form innovation," the mediating effect of design experience on satisfaction is 0.035 (p=0.026), and on behavioral intention, it is 0.038 (p=0.02), both significant. Design quality shows significant mediating effects on both satisfaction (0.04, p=0.021) and behavioral intention (0.032, p=0.046). Design experience contributes to 50% of the total effect on satisfaction and 18.3% on behavioral intention, while design quality contributes 57.1% and 15.4%, respectively.

In "technological innovation," the mediating effect of design experience on satisfaction is 0.025 (p=0.053), and on behavioral intention is 0.027 (p=0.041), showing significance only for behavioral intention. Design quality's effect on satisfaction (0.02,

p=0.091) and behavioral intention (0.016, p=0.105) is not significant, with design experience accounting for 8.2% of the total effect on satisfaction and 12.1% on behavioral intention.

For "material innovation," the mediating effect of design experience on satisfaction is 0.027 (p=0.043) and on behavioral intention is 0.029 (p=0.02), both significant. The mediating effect of design quality on satisfaction is 0.026 (p=0.037), while its effect on behavioral intention (0.022, p=0.083) is not significant. Design experience accounts for 15.3% of the total effect on satisfaction and 18% on behavioral intention, while design quality contributes 14.8% and 13.7%, respectively.

In conclusion, innovation factors impact satisfaction and behavioral intention via design experience and design quality. Understanding these mediating effects highlights the need to consider both direct and indirect effects in the design process to enhance overall outcomes.

Finally, the overall influence relationship between variables is as follows:

Table 9 Overall influence relation values of variables

	gross effect	standard deviation	T-value	p-value
P I -> S	0.082	0.053	1.535	0.125
P I -> B I	0.181	0.05	3.597	0
P I -> D E	0.135	0.049	2.747	0.006
P I -> D Q	0.125	0.056	2.245	0.025
P F -> S	0.07	0.059	1.18	0.238
P F -> B I	0.208	0.054	3.885	0
P F -> D E	0.226	0.054	4.158	0
P F -> D Q	0.254	0.054	4.678	0
T I -> S	0.306	0.055	5.539	0
T I -> B I	0.223	0.057	3.907	0
T I -> D E	0.161	0.056	2.901	0.004
T I -> D Q	0.129	0.056	2.3	0.021
M I -> S	0.176	0.063	2.801	0.005
M I -> B I	0.161	0.053	3.017	0.003
M I -> D E	0.173	0.054	3.192	0.001
M I -> D Q	0.169	0.055	3.061	0.002
D E -> S	0.155	0.057	2.717	0.007
D E -> B I	0.17	0.054	3.13	0.002
D Q -> S	0.156	0.055	2.845	0.004
D Q -> B I	0.127	0.055	2.329	0.02

The total effect of pattern innovation on satisfaction was 0.082 (p=0.125), showing a positive but non-significant influence, while the effect on behavioral intention was 0.181 (p<0.001), indicating a significant positive impact. The effects on design experience and design quality were 0.135 (p=0.006) and 0.125 (p=0.025), respectively, showing significant positive impacts, implying that pattern innovation enhances design experience and quality, influencing behavioral intentions positively.

The total effect of performance form innovation on satisfaction was 0.07 (p=0.238), non-significant, but its effect on behavioral intention was 0.208 (p<0.001), showing a significant positive impact. The effects on design experience and design quality were 0.226 (p<0.001) and 0.254 (p<0.001), indicating strong positive impacts, thus improving behavioral intentions significantly.

For technological innovation, the total effect on satisfaction was 0.306 (p<0.001) and on behavioral intention was 0.223 (p<0.001), both significant. Effects on design experience and design quality were 0.161 (p=0.004) and 0.129 (p=0.021), indicating positive impacts, suggesting that technological innovation improves satisfaction and indirectly promotes behavioral intention.

The total effect of material innovation on satisfaction was 0.176 (p=0.005), and on behavioral intention was 0.161 (p=0.003), both significant. Effects on design experience and design quality were 0.173 (p=0.001) and 0.169 (p=0.002), showing positive impacts, suggesting that material innovation enhances satisfaction and behavioral intentions.

As mediating variables, design experience and design quality had significant total effects on satisfaction (0.155, p=0.007; 0.156, p=0.004) and behavioral intention (0.17, p=0.002; 0.127, p=0.02), showing that both directly improve satisfaction and behavioral intention.

In conclusion, innovation factors affect satisfaction and behavioral intention through direct and indirect effects, providing insight for developing comprehensive innovation strategies to enhance participants' experiences and satisfaction.

Finally, the summary model diagram is as follows:
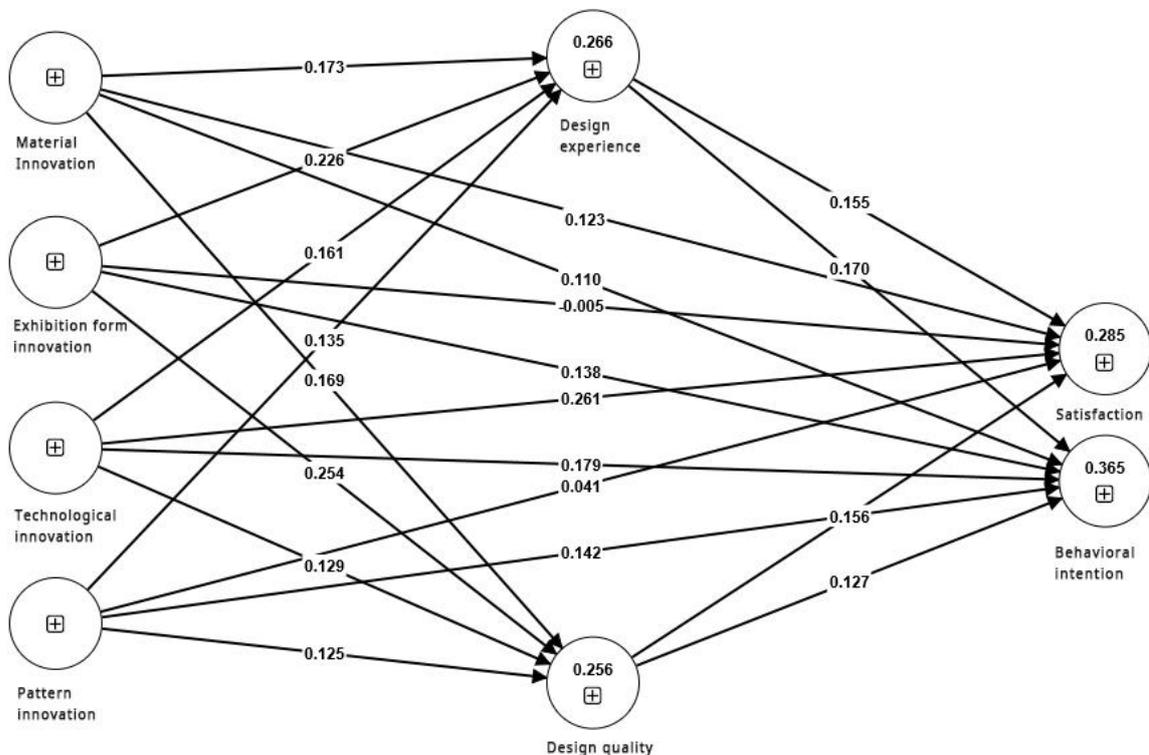
Figure 1 Final validation model diagram
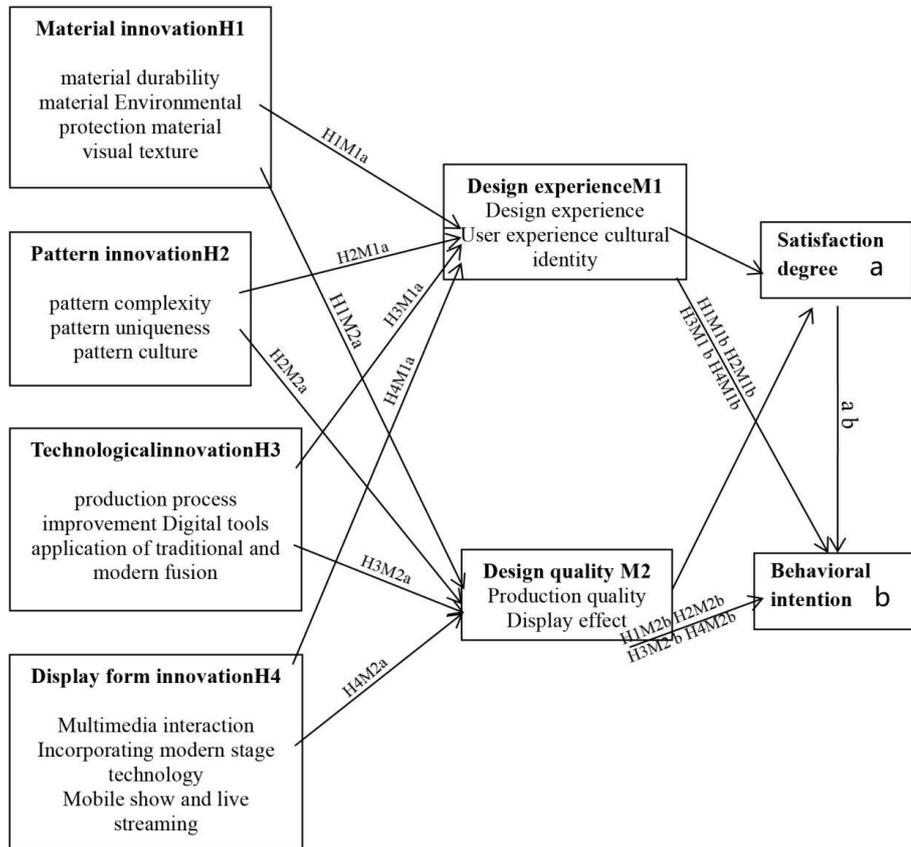
Research Conceptual Framework

Figure 2 Research Conceptual framework

Research Results

The data were collected through interviews and questionnaires with intangible cultural heritage researchers, non-genetic inheritors, craft innovators, and college students in Xiangtan City, Hunan Province. The findings indicate that innovations in materials, patterns, technology, and performance forms significantly positively affect design experience, design quality, user satisfaction, and behavioral intention. Design experience and quality, driven by design thinking, act as mediators. Specifically, innovative materials and technologies enhance user experience, cultural identity, production quality, and visual effects, thereby increasing satisfaction and viewing intent. The structural equation model confirms relationships between design experience, design quality, and user satisfaction. Technological and performance innovations are closely linked to design experience. Utilizing design thinking effectively enhances material, pattern, technology, and performance innovations, ultimately improving user experience and satisfaction.

Section 1: Design Thinking and Its Impact on the Inheritance and Innovation of Shadow Play in Xiangtan

Design thinking is instrumental in prolonging the lifespan of shadow puppetry props by utilizing durable, eco-friendly materials that resonate with contemporary sustainability principles, thereby enhancing cultural identity and user experience. The incorporation of high-quality materials and distinctive pattern designs not only elevates visual appeal but also fosters deeper emotional connections and cultural recognition. However, the complexity of these patterns necessitates a more sophisticated production process, which can be refined through design thinking methodologies. Furthermore, the integration of digital tools and modern technology with traditional craftsmanship introduces innovative visual effects, improves production quality, and enhances accessibility, rendering shadow puppetry more captivating for contemporary audiences.

Design thinking plays a key role in extending the life of shadow puppetry props by incorporating durable, environmentally friendly materials that align with modern sustainability concerns, improving cultural identity and user experience. High-quality materials and unique pattern designs not only enhance visual appeal but also deepen emotional resonance and cultural recognition. The use of complex patterns, however, demands a more refined production process, which can be optimized through design thinking. Additionally, integrating digital tools and modern technology with traditional craftsmanship introduces innovative visual effects, enhances production quality, and increases accessibility, making shadow puppetry more engaging for modern audiences.

Furthermore, multimedia interaction and advanced stage technology boost audience participation and satisfaction, but also necessitate high production standards. Mobile exhibitions and live streaming extend the cultural reach of shadow puppetry but require quality adaptations to suit diverse display environments. The fusion of traditional skills with modern technology is essential for preserving the essence of shadow puppetry while meeting contemporary expectations.

Section 2: Strategies for Contemporary Development Using Design Thinking

To promote the sustainable development of Shadow Play in Xiangtan, design thinking can be employed to enhance user experience and cultural identity. This is achieved through optimizing materials, patterns, techniques, and presentation formats, guided by user research and iterative processes. Selecting durable, environmentally friendly materials and distinctive pattern designs can improve satisfaction and deepen cultural connections. By focusing on design experience and quality, strategies can be developed to meet modern audience needs while maintaining traditional cultural values. These strategies ensure that user satisfaction and behavior intention are aligned with the long-term sustainability of Shadow Play, fostering a balance between innovation and preservation.

Discussion

Sample Demographic Characteristics:

Age distribution: The sample is dominated by young people, with the population aged 18-28 and 29-38 accounting for 67.1%, which has a strong appeal to young people.

Occupational distribution: students are the largest group, accounting for 40.6%; Those engaged in technological innovation accounted for 32.7%, and those engaged in intangible cultural heritage accounted for 24.8%. Only 1.9% had no genetic background, showing a diverse career experience.

Participation in the activity: the proportion of participants in Xiangtan paper shadow activity is as high as 62.7%, indicating that they have a certain understanding of Xiangtan paper shadow art, which provides a solid data basis for studying the influencing factors and effects of paper shadow art.

Reliability analysis: Cronbach's α coefficient of each dimension was more than 0.8, and this data had high reliability and research value.

Validity analysis: the KMO value of the questionnaire was 0.940, and the p value of Bartlett test was lower than 0.001, which was suitable for information extraction. The exploratory factor analysis extracted eight factors that were consistent with their structurally indicative strong construct validity.

Based on the research findings and conclusions, the following recommendations are proposed:

1. Improve the audience's enthusiasm according to the factors that affect the audience's use intention and behavior. If the audience wants to get knowledge, they can take the initiative to understand shadow play in Xiangtan by publishing tasks. For example, they can jointly produce videos with the school to let students learn relevant knowledge of shadow play in Xiangtan in an entertaining way, so as to cultivate and strengthen the audience's habits.

2. Pay attention to the needs of the audience and the root cause of the audience's active publicity. After understanding Xiangtan paper film, the audience propagandas Xiangtan paper film to realize their personal value and form a virtuous cycle. In addition, actively provide the audience with interesting and quality shadow play in Xiangtan content to improve the audience viscosity.

3. As a traditional intangible cultural heritage, shadow play in Xiangtan should avoid information deviation and misleading in the process of dissemination. To provide high-quality and accurate video content for the audience, enhance the audience's experience in the viewing process and subsequent audience satisfaction, and promote the healthy and sustainable development of Xiangtan paper and film communication culture, video producers need to pay attention to it at all times.

4. Viewers expect high-quality content in the video of shadow play in Xiangtan when watching the animation of shadow play in Xiangtan. Including the profound cultural background and educational elements, the appeal of the video display, etc. Perceived interest, as the driving force of user behavior influence, needs to tell real stories, such as the development process of traditional skills, the story of inherited characters or the production process of shadow play in Xiangtan, so as to maintain users 'attention and interest in shadow play in Xiangtan and establish emotional connections.

Research limitations

1. Sample limitation: This study is mainly based on interviews with intangible cultural heritage researchers, non-genetic inheritors, people with experience in folk art innovation and college students. The number of samples is limited, which may not fully represent the views of all audiences.

2. Short observation time: the field observation time is short, which cannot fully 98 cover all the details of the daily work of the inheritors, and may miss some important information.

3.Cultural differences: Audiences from different regions and cultural backgrounds may have different understandings and acceptances of Xiangtan paper films, and the research fails to fully consider these factors.

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