Research on the Cultural Experience of Lion Dance Through Tactile Interactive Devices: A Case Study of Foshan Ancestral Temple

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Abstract. Cultural heritage education is vital for the preservation and promotion of societies' rich history and traditions. This study investigates the significant role of somatosensory interactive technology in cultural heritage education, specifically focusing on the impact of a somatosensory interactive device at the Foshan Ancestral Temple in Guangdong Province, China. By employing the TAM theoretical model and conducting a survey, the research explores how participants' interactions with the interactive device influence their attitudes toward cultural heritage preservation and promotion. The findings highlight the importance of well-designed interactive experiences in enhancing cultural understanding and appreciation. Additionally, the study provides systematic recommendations for service design, aiming to advance cultural heritage education by leveraging interactive technology to create immersive and meaningful experiences for visitors.

Keywords: Cultural tourism; Lion dance culture; Interactive experience; Interactive devices; Service design.

1 Introduction

Cultural heritage education plays a crucial role in preserving and promoting the rich history and traditions of societies. The Foshan Ancestral Temple, located in Guangdong Province, China, holds immense significance as the birthplace of the lion dance, a symbol of Lingnan culture. Despite this cultural heritage's importance, effectively engaging and educating the public about it has become increasingly challenging in the face of rapid societal changes [1].

To tackle this challenge, the Foshan Ancestral Temple implemented a somatosensory interactive device to enhance visitors' understanding and awareness of waking lion traditions. It not only receives strong support from the government but also contributes to the economic development of local businesses (Fig. 1). This study focuses on examining the impact of this interactive device on participants' cultural learning experiences.

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Employing the TAM (Technology Acceptance Model) as a theoretical lens and conducting a survey, this research endeavors to uncover the link between the interactive device's utilization and participants' attitudes toward cultural heritage preservation and promotion. It echoes the sentiment that well-thought-out interactive experiences are instrumental in nurturing cultural comprehension, a concept increasingly recognized in the field of design and service integration [2].

The anticipated findings of this study aim to underscore the pivotal role of somatosensory interactive technology in fostering cultural heritage education. The interactive device at the Foshan Ancestral Temple, through its engaging and immersive experience, has the potential to enrich visitors' understanding and appreciation of the lion dance traditions.

This research endeavors to contribute to the advancement of cultural heritage education by providing systematic recommendations for service design. By effectively utilizing interactive technology, meaningful experiences can be created that not only enhance cultural understanding but also promote the preservation and dissemination of cultural heritage.

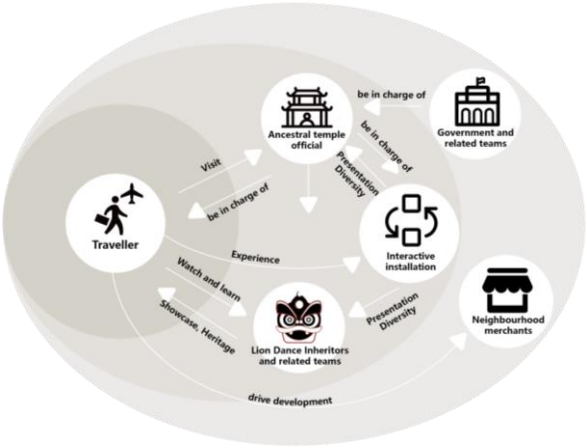

Fig. 1. Foshan Ancestral Temple Stakeholder Map

2 Literature Review

2.1 Development Status of Informationized Cultural Traditional Educational Devices

Since 2021, China has prioritized the digital preservation of intangible cultural heritage, leveraging interactive device art to enhance global cultural understanding. This approach integrates technology with real-world settings to create immersive experiences that deepen knowledge of Chinese culture and history, particularly benefiting cultural exchange in tourism.

Adaptive gamification has emerged as an effective educational strategy [3], personalizing game elements to boost student motivation and learning outcomes in science

education. This study investigates the potential of adaptive gamification in the cultural education of the Lion Dance at the Foshan Ancestral Temple, aiming to develop a tactile, immersive learning experience that fosters a greater appreciation for the cultural heritage.

The development of immersive digital interactive device art requires assistance and guidance from various disciplines, as well as a thorough interpretation of traditional art and the rational application of computer technology. At the same time, a reasonable and aesthetic environment can increase the user's sense of experience [4].Despite of challenges, including production cycles and maintenance issues, there is significant potential for growth. The Foshan Ancestral Temple, central to Lingnan culture, underscores the importance of integrating digital education platforms to bring traditional culture closer to the public through interactive experiences [5].

2.2 Technology Acceptance Model (TAM) Theory

The Technology Acceptance Model (TAM) is a model proposed by Fred D. Davis based on the theory of reasoned action to study users' acceptance of information systems [6]. According to this theory, whether individuals will use a new technology depends primarily on their behavioral intentions, which, in turn, are influenced by their perceived usefulness and ease of use of the new technology [7]. It is widely accepted that TAM consists of three main variables. Perceived usefulness refers to the individual's perception of the extent to which the new technology is beneficial for learning or work. Perceived ease of use refers to the individual's perception of the ease with which the new technology can be learned and used. Perceived interest refers to the individual's perception of whether the new technology offers enjoyable, pleasurable, and interesting experiences.

The TAM model can be applied to assess users' objective evaluations of interactive devices by considering their perceived usefulness, ease of use, and interest, taking into account the influence of users' visual, tactile, and auditory experiences.

3 Research Focus, Methodology and Hypotheses

This study, centered on the "Lion King Battle" interactive installation at the Foshan Ancestral Temple Museum, explores the impact of digital educational models on cultural understanding using the Technology Acceptance Model (TAM). The TAM bridges data between users and the installation, examining perceptions of usefulness, ease of use, and enjoyment to understand behavioral patterns and psychological processes.

This helps predict user adoption and reactions to technology, guiding the design of user-centric technology to enhance satisfaction and experience. The study also focuses on whether cognition of lion dance culture improves post-interaction and employs methods like on-site observations, questionnaires, and data analysis to gather participants' perspectives and inform cultural preservation efforts. A hypothesis is proposed that:

H1: A positive digital interactive experience has a significant impact on enhancing cultural understanding.

4 Data Collection Process

4.1 Steps for Distributing and Collecting Questionnaires

The method adopted in this study is questionnaire survey and observation. For the survey conducted at the Foshan Ancestral Temple, the following steps were taken for the questionnaire survey. Firstly, based on the research objectives, a structured questionnaire was designed [8,9], which included questions related to the Lion Dance culture and participants' feedback after the experience. To ensure the representativeness of the sample, visitors who came to experience the "Lion King Battle" digital educational interactive installation were selected as survey participants, and only visitors whose experience was a first-time experience were surveyed.

After the interviews at the Foshan Ancestral Temple, the following steps were taken to collect the questionnaires. Firstly, the completeness of the collected questionnaires was checked to ensure that all necessary questions were answered. For incomplete questionnaires, we contacted the respondents to supplement or clarify their responses. Subsequently, the data from the questionnaire responses were entered and organized for statistical analysis and interpretation. A total of 61 valid questionnaires were collected.

By employing both questionnaire surveys and observations, we were able to obtain quantitative and qualitative data on respondents' understanding of the Lion Dance culture, providing a more comprehensive understanding of the impact of the "Lion King Battle" digital educational interactive installation on enhancing awareness of the Lion Dance culture. The application of these steps and methods will contribute to a thorough investigation and accurate analysis of the research questions in our paper.

4.2 Grouping and Summarizing Descriptions

After data collection, we divided the questionnaires into two parts: the cultural understanding dimension and the usability, ease of use, and interface design dimensions. Subsequently, we performed summation for the cultural understanding dimension and grouping and summation for the usability, ease of use, and interface design dimensions (referred to as the interaction dimension hereafter) [10].

For each sample in the questionnaire, we computed the total scores for the eleven questions in the usability, ease of use, and interface design dimensions and grouped them. The score range was from 20 to 55. We divided the scores into three groups: 20-33 (low group), 34-44 (medium group), and 45-55 (high group).

5 Data Analysis

This study focuses on whether the "Lion King Battle" interactive installation can enhance users' experience of the Lion Dance culture.

5.1 Reliability and Validity Testing

This study used Likert scales to explore the intrinsic factors and conducted reliability and validity analyses for the questions related to cultural understanding, usefulness, ease of use, and interface design.

Based on 61 valid questionnaires, IBM SPSS Statistics 26 software was used to calculate the overall Cronbach's α coefficient for the 17 measurement items corresponding to users' understanding of the Lion Dance culture and the three latent variables related to it. The calculated Cronbach's α coefficient was 0.942, which is greater than 0.9, indicating excellent internal consistency within the questionnaire. To test the understanding of the Lion Dance culture and the three latent variables after experiencing the interactive installation, the KMO value was 0.864, indicating good validity [11] (Table 2).KMO test is used to characterize the suitability for principal component analysis by the relative size of the simple correlation coefficient and the partial correlation coefficient between the observed variables.0.7<KMO<0.8 indicates that it is suitable for principal component analysis, and KMO>0.8 indicates that it is more suitable for factor analysis, and the relevance of factor analysis is good[12]. In this study, in the dimensions of the Cultural understanding dimension and Interaction dimension, the KMO value of the Cultural understanding dimension was 0.801 and the KMO value of the Interaction dimension was 0.882, indicating that factor analysis can be performed. Bartlett's sphericity test is used to analyze whether the survey data is taken from the multivariate normal distribution population. If the F value of the difference test is significant, it means that the data is taken from the normal distribution population [13]. In this study, the F value of Bartlett's sphericity test was 0.000, its degrees of freedom was 136 and the rough square was 838.500(Table 1), indicating that the data came from the normally distributed population.

Table 1. Reliability and validity analysis

Variable	Number of items	KMO	Cronbach's Alpha
Cultural understanding dimension	6	.801	.840
Interaction dimension	11	.882	.937
Total	17	.864	.942

5.2 Data Analysis

5.2.1 Analysis of Variance

To strengthen the empirical analysis of our study, we employed a single-factor ANOVA model to examine the differences in cultural understanding among participants with varying levels of interaction with the 'Lion King Battle' interactive installation. The mathematical formula for our ANOVA model is as follows:

$$F = \frac{\sum_{i=1}^{k} \left(n_i - 1\right)\left(\overline{y}_{i.} - \overline{y}_{..}\right)^2}{\sum_{i=1}^{k} \sum_{j=1}^{n_i} \left(y_{ij} - \overline{y}_{i.}\right)^2}$$

In the analysis of variance, we used one-way ANOVA, with the cultural understanding dimension as the dependent variable and the interaction dimension as the independent variable.

We employed the ANOVA statistical method to examine the differences between the cultural understanding dimension and the interaction dimension. This analysis helps determine whether there is a significant relationship between the two dimensions, indicating the significance of the relationship between the cultural understanding dimension and the interaction dimension (Table 2). The degree of cultural understanding can affect the accuracy, effectiveness, and authenticity of interactive experiences to some extent. The establishment of a cultural understanding degree relies not only on the creation of a humanistic knowledge module but also on the acceptance of culture through propaganda. Therefore, using cultural understanding degree as the dependent variable can help to study the interactive experience style in different dimensions. Concise and more touching interaction design products can enhance people's cultural acceptance.

Table 2. ANOVA model analysis

	Sum of squares	Degree of freedom	Mean square	F	Significance
Interclass	381.780	2	190.890	23.155	.000
Intra-class	478.154	58	8.244		
Total	859.934	60			

5.2.2 Post-hoc Testing

We divided the samples into three groups: low group (20-33), medium group (34-44), and high group (45-55), and conducted multiple mean comparisons for each group. Through these comparisons, we found significant differences between the high group and the medium group ($p = 0.000 < 0.05$), as well as between the high group and the low group ($p = 0.000 < 0.05$). The results showed a significance value below 0.05.

This indicates that in terms of cultural understanding, users with better digital educational interaction effects in the interactive installation showed a greater improvement

in understanding in the high group. However, the cultural learning effect of low group needs to be improved.

This finding validates our hypothesis that a positive interactive experience has a positive impact on enhancing cultural understanding (Table 3). The vigorous development of interactive educational experience devices in recent years has become one of the main ways to publicize traditional Chinese culture in cultural tourism activities. In this field, researchers have been exploring how to achieve short- term and efficient interactive experience transmission methods, and this study has opened up a good design idea for the effective development of digital educational interactive installation art. It has certain reference value for designing the development of interactive devices from the aspects of device usefulness, device ease-of-use, interactive interface design, etc.

Table 3. Multiple comparisons

					95% Confidence space	
(I) Reciprocal summation	(J) Reciprocal summation	Mean difference (I-J)	Standard error	Significance	Lower limit	Upper limit
20-33	34-44	-2.09524	.92933	.071	-4.3306	.1401
	45-55	-6.69328***	1.03624	.000	-9.1858	-4.2008
34-44	20-33	2.09524	.92933	.071	-.1401	4.3306
	45-55	-4.59804***	.87163	.000	-6.6946	-2.5015
45-55	20-33	6.69328***	1.03624	.000	4.2008	9.1858
	34-44	4.59804***	.87163	.000	2.5015	6.6946

* The significance level of the mean difference was 0.05. *p<0.01, **p<0.01, ***p<0.001.

5.3 Service Design Recommendations

During the observation of visitors' tour experience at the Ancestral Temple, we created the following user journey map (Fig. 2) based on user behaviors. Through this map, we identified pain points and areas for improvement during the visitors' tour process. Based on the user journey map (Fig. 2), there are several pain points identified during the visit to Foshan Ancestral Temple and the experience of lion dance culture. These include a limited variety in the dissemination of lion dance culture, unclear site planning leading to overcrowding when observing others using interactive installations, lack of staff guidance confusing game rules and difficulty in finding accurate instructions, and unresponsive interactive devices affecting the visitor experience.

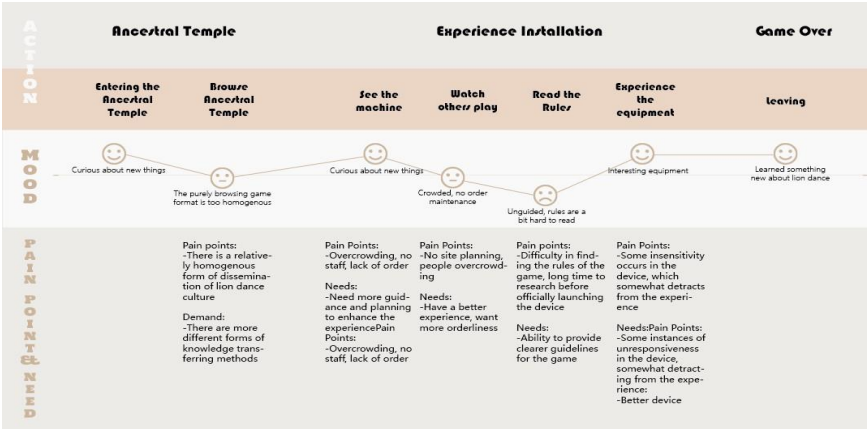

Fig. 2. User Journey Map

Based on the identified pain points and needs, the following suggestions are proposed. First, we propose the integration of more humanized elements into the interactive devices. For instance, by incorporating voice prompts that guide users through the motions of the lion dance, we can provide real-time feedback and instructions that are easily understandable. Additionally, gesture recognition can be further refined to ensure that the system accurately interprets and responds to the users' movements, creating a seamless and intuitive interaction.

To enrich the interactive experience for visitors and to deepen their understanding of lion dance culture, we suggest integrating Augmented Reality (AR) and Virtual Reality (VR) technologies into the service design. Guided tours could be enhanced with AR, where professional guides explain relevant knowledge about lion dance culture, making the interaction more engaging [14]. Moreover, designing interactive exhibition areas that allow visitors to actively participate in aspects of lion dance performances, such as simulating lion dance movements or playing traditional drums, can be greatly enriched with VR and AR technologies. These technologies can provide a realistic and immersive interactive experience, offering visitors a deeper appreciation of the cultural heritage.

Furthermore, well-planned site arrangements should be implemented for digital education, including separate areas for spectators and participants to ensure sufficient space for viewing and participation. Signage and staff should guide visitors along designated paths to prevent overcrowding and confusion. By integrating these advanced technologies, we aim to create a more vivid and educational experience for visitors. Finally, it is recommended to check and maintain the equipment regularly, collect feedback from visitors, and solve and repair any faults in time. Organizations should assess maintenance service costs promptly and find high-priority areas for improvement in service delivery operations to ensure a smooth and enjoyable experience for visitors, particularly high-cost procedures and activities [15].

6 Conclusion

Our study confirms that integrating digital educational interactive devices with traditional cultural experiences significantly enhances visitors' understanding and appreciation of culture, as evidenced by their engagement at the immersive installations of the Foshan Ancestral Temple. Utilizing questionnaires and observations, we've found that a positive interactive experience aids in the effective dissemination of cultural traditions. The insights gained underscore the potential of blending interactive technology with cultural heritage to attract a wider, particularly younger, audience and bridge the past with the present. This integration aligns with societal digitalization and technological progress, enabling cultural sites to preserve and convey knowledge in innovative ways, ensuring their continued relevance. Future research could explore optimal design elements for integrating interactive devices with cultural experiences and assess the long-term impacts on cultural knowledge retention and visitor behavior, aiding sustainable heritage management and education. In conclusion, our research indicates that combining information-based interactive devices with traditional culture offers a dynamic and engaging way to attract diverse audiences and preserve cultural heritage in the digital era. This approach can guide cultural heritage sites toward a vibrant and inclusive future.

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