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Embodied Experience and Visitor Loyalty in Historic Cultural Heritage Buildings: Integrating Structural Equation Modeling and Deep Learning

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Abstract

This study is grounded in the global agenda of achieving the Sustainable Development Goals (SDGs), emphasizing the critical role of historic cultural heritage buildings in fostering cultural continuity and long-term engagement. Centered on the living conservation of architectural heritage, the research explores how immersive and embodied interactions shape visitor loyalty. Structural equation modeling (SEM) demonstrates that environmental restoration and flow experience significantly mediate the relationship between embodied experience and loyalty, while cultural identity further strengthens these pathways. To complement the explanatory analysis, deep learning methods were employed, with the multilayer perceptron (MLP) outperforming the gated recurrent unit (GRU) in terms of predictive accuracy. SHAP analysis revealed that technological mediation and physical interaction are the strongest predictors of loyalty, followed by sensory immersion. By integrating explanatory and predictive perspectives, the study refines the embodied experience framework and offers both theoretical insights and practical guidance for the design and conservation of historic cultural heritage buildings. Ultimately, the findings highlight that embodied experience-driven living heritage conservation not only sustains cultural identity but also makes a meaningful contribution to the realization of global sustainable development.

Keywords: historic cultural buildings; living heritage conservation; embodied experience; visitor loyalty; structural equation modeling; deep learning

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1. Introduction

Historic cultural heritage buildings are not only vital carriers of cultural memory but also serve as spaces for cultural identity and the transmission of social values, playing an indispensable role in advancing global sustainable development [1]. In recent years, the concept of international heritage protection has shifted significantly toward "living heritage protection", which emphasizes the continuity of heritage in contemporary life, promotes community participation, and supports dynamic inheritance while increasingly incorporating urban policy, community co-governance, adaptive reuse, and resilience considerations [2,3]. At the experiential level, research indicates that embodied and immersive experiences enhance cultural understanding and emotional connections, thereby improving communication and educational outcomes [4,5]. In China, cultural and tourism demand has shown sustained growth. In 2024, domestic trips reached 5.615 billion, a year-on-year increase of 14.8%, while related expenditure rose to 5.75 trillion yuan, up 17.1% [6]. This upward trend reflects not only the quantitative expansion of tourism but also the rising demand for cultural experiences and diversified forms of leisure. The annual report of the China Tourism Academy, under the Ministry of Culture and Tourism of China, highlights that the trend of massification and quality improvement requires heritage buildings to respond to new demands through higher-quality experience design [6]. At the same time, domestic and international research on embodied cognition, contextualized narrative, and social co-creation has expanded to scenarios such as heritage sites, museums, and nature walks, thereby offering experience-oriented theoretical support for living heritage protection [7–9].

Despite the deepening of relevant research, there are still shortcomings at the theoretical, methodological, and practical levels. First, at the theoretical level, a large number of studies still focus on cognitive or emotional pathways and pay insufficient attention to the integration of embodied experience system design. However, recent evidence suggests that there are systematic links between embodied and immersive experiences and cultural identity, flow experiences, and aesthetic emotions, and there is an urgent need to form a unified concept and measurement model in the context of heritage [7–9]. Second, at the methodological level, SEM remains the mainstream tool for mechanism testing, but its predictive power is limited when dealing with high-dimensional and nonlinear data. At the same time, machine learning and deep learning are rapidly growing in applications such as tourism prediction, behavior recognition, and field visitor flow analysis, showing potential for predicting loyalty, revisit intention, and recommendation intention. However, the coupling of SEM (explanation) and DL (prediction) in heritage tourism scenarios remains underexplored [10–12]. Finally, at the practical level, there is still a lack of replicable empirical pathways for integrating embodied experiences into heritage space creation, interpretation, and community participation and transforming them into measurable outcomes of satisfaction, identification, and loyalty [2,6].

Based on the above shortcomings, this study systematically explores how embodied experience system design affects visitor loyalty in the context of the living protection of historic cultural heritage buildings and achieves dual innovation in theory and methodology. On the one hand, we construct and verify the mechanism model of “embodied experience—restorative perception/flow/cultural identity—loyalty” through structural equation modeling (SEM). On the other hand, we introduce deep learning methods to improve the accuracy and reliability of visitor loyalty predictions, thereby compensating for the limitations of traditional statistical models [13–15]. Ultimately, this study aims to provide empirical support and practical pathways for the living protection of historic cultural heritage buildings, promoting the optimization of tourist experiences and the sustainable development of cultural heritage. Therefore, this study seeks to answer the following core research questions:

(1) What are the core dimensions of embodied experience system design in historic cultural heritage buildings?
(2) How does embodied experience system design influence visitor loyalty through mediating mechanisms such as restorative perception, flow experience, and cultural identity?
(3) How can structural equation modeling (SEM) be used to construct and verify a model of the mechanism of embodied experience system design on visitor loyalty?
(4) How can deep learning methods be employed to predict visitor loyalty and identify the key indicators of embodied experience?

2. Literature Review

2.1. Embodied Experience

Embodied experience refers to the integration of multisensory, physical, spatial, social, cultural, and technological elements to create deep, participatory experiences in heritage buildings [16]. In the context of living heritage conservation, this approach emphasizes interaction, immersion, and co-creation rather than static observation, promoting cultural continuity, community participation, and sustainable engagement [17–19]. Embodied experience provides both cognitive and affective foundations that shape visitor satisfaction, emotional connection, and loyalty [20,21].

To operationalize embodied experience, this study adopts a six-dimensional framework: sensory immersion, physical interaction, spatial embodiment, situational engagement and social interaction, cultural cognition and emotional connection, and technological mediation. Each dimension contributes uniquely to visitor experience and loyalty outcomes.

- Sensory Immersion refers to the use of multimodal cues—visual, auditory, tactile, olfactory, and gustatory—to enhance presence, attention, and memory, thereby strengthening emotional engagement [22,23].
- Physical Interaction captures direct bodily engagement with heritage objects or installations, transforming visitors from passive observers to active participants, which enhances control, efficacy, and emotional value [24].
- Spatial Embodiment emphasizes coherent spatial narratives and environmental organization, enabling visitors to experience a sense of place, historical continuity, and emotional flow [25].
- Situational Engagement and Social Interaction highlights co-creation through interactions with guides, community members, or other visitors, fostering belonging, cultural co-production, and willingness to recommend [20].
- Cultural Cognition and Emotional Connection reflects visitors' understanding of heritage meaning, identity recognition, and emotional attachment, linking individual experiences to collective memory and loyalty behaviors [26].
- Technological Mediation involves the use of VR/AR, digital twins, or interactive systems to enhance accessibility, immersion, and comprehension without replacing the authenticity of heritage [27].

These six dimensions converge into a second-order construct, "embodied experience system design", which forms the basis for mechanism testing through SEM and predictive modeling using deep learning.

2.2. Visitors' Loyalty

Visitor loyalty is a structural determinant of sustainability in heritage-building tourism. Repeat visitation and predictable revenue streams underwrite conservation, maintenance, and interpretation, while word-of-mouth diffusion enlarges engaged publics at lower marginal cost [28]. Loyal visitors also demonstrate stewardship—greater compliance with protection norms, participation in cultural practices, and advocacy for preservation—thereby consolidating the social and economic foundations for long-term, intergenerational heritage transmission [29].

The construct of visitors' loyalty is closely intertwined with the framework of embodied experience, in which embodied experience dimensions serve as antecedents that shape loyalty outcomes. Embodied experience—operationalized through sensory immersion, physical interaction, spatial embodiment, situational engagement, cultural cognition, and technological mediation—provides the experiential foundation that drives emotional resonance, meaning-making, and behavioral commitment. When visitors engage in embodied and multi-sensory interactions, they develop deeper cognitive-affective connections to heritage buildings, thereby reinforcing revisit and recommendation intentions. For instance, sensory and spatial immersion enhance perceptual richness and a sense of place, while social interaction and cultural cognition strengthen identity recognition and value commitment. These processes collectively transform transient experiences into enduring attachments, which manifest in loyal behaviors [20,21]. Thus, embodied experience functions as a critical explanatory mechanism, linking experiential variables (independent) to loyalty outcomes (dependent), and offering a robust theoretical and empirical foundation for examining how experience quality translates into sustainable tourist loyalty.

The framework of embodied experience system design highlights the role of sensory immersion, physical interaction, spatial embodiment, situational engagement, cultural cognition, and technological mediation in shaping visitor experiences. These dimensions foster cognitive-affective bonds with heritage buildings, enabling meaning-making and identity construction that extend beyond temporary visits [23]. For example, sensory and spatial immersion enhance perceptual richness and a sense of place, while cultural cognition and social interaction strengthen cultural identity and attachment [20,26]. Such processes transform short-term enjoyment into long-term commitment, thereby reinforcing both revisit intentions and positive word-of-mouth recommendations. This indicates that embodied experience serves as a critical mechanism that links experiential quality to loyalty outcomes in heritage contexts.

H_1: *Embodied experience positively influences visitors' loyalty.*

2.3. The Mediating Role of Environmental Restoration Perception

Environmental restoration perception refers to the subjective experience of psychological restoration and attention restoration that visitors obtain through interaction with natural and cultural environments during their visit [30]. Research indicates that the natural landscapes and built environments of heritage buildings can provide visitors with positive effects such as stress reduction, cognitive restoration, emotional repair, and improved mental health [31]). In cultural heritage tourism, visitors achieve attention restoration through elements such as "sense of distance", "attractiveness", "degree", and "fit", thereby enhancing satisfaction and revisit intention [32]. Additionally, emotional connections play a significant role in enhancing visitor satisfaction and recommendation intentions [33].

Within the framework of embodied experience, environmental recovery perception is not only a perceptual response at the environmental level, but also a product of the combined effects of multisensory participation, spatial narrative, and cultural interaction. Embodied experience guides visitors into a state of psychological recovery and deep engagement through immersive interaction between the body and space [34]. This type of embodied experience based on environmental restoration can strengthen visitors' positive emotional experiences, thereby enhancing overall satisfaction [35]. Therefore, environmental restoration perception plays a mediating role in the process of embodied experience, influencing visitor loyalty.

H_2: *Environmental restoration perception mediates the relationship between embodied experience and visitor loyalty.*

2.4. The Mediating Role of Flow Experience

Flow experience refers to the psychological state of high concentration, immersion, and pleasure exhibited by individuals during specific activities [36]. Its prerequisites include clear goals, immediate feedback, and a balance between skill and challenge; its characteristics include the fusion of behavior and consciousness, focus on the present moment, and a sense of control; and its outcomes include the dissolution of self-awareness and an altered sense of time [37]. In the context of cultural heritage tourism, visitors gain flow experiences through historical and cultural environments, thereby triggering positive emotions and deep cultural connections [38].

Embodied experience system design provides tourists with the conditions for entering a flow experience through multi-dimensional sensory stimulation and interactive environments. For example, historical narrative spaces and immersive cultural scenes can enhance visitors' focus and desire to explore, enabling them to achieve deep immersion on both the sensory and cognitive levels. In addition, empirical research has shown that in cultural and creative tourism, embodied participation significantly enhances visitors' cognitive and emotional responses and further stimulates memorable experiences [39]. Flow experiences not only enhance visitors' enjoyment and satisfaction, but also further promote their loyalty behaviors, including their willingness to revisit and recommend the destination. Therefore, flow experiences play a mediating role in the impact of embodied experience on visitor loyalty.

H_3: *Flow experiences mediate the relationship between embodied experience and visitor loyalty.*

2.5. The Moderating Role of Cultural Identity

Cultural identity refers to an individual's sense of belonging and value recognition toward a specific cultural group, reflecting the emotional connection and meaning construction between the individual and the culture [40]. In tourism research, cultural identity not only influences tourists' acceptance and understanding of destination culture but also shapes their psychological experiences and behavioral responses during the tourism process [41]. Existing research has shown that cultural identity can enhance tourists' positive emotional responses and cultural value perceptions, thereby improving the overall quality of experience and satisfaction [42]. Therefore, cultural identity is considered a key psychological mechanism in heritage tourism experiences.

In embodied experience system design, cultural identity plays a regulatory role by strengthening tourists' meaningful resonance in spatial narratives, interactive practices, and cultural connections. Research shows that when visitors have a higher sense of identity with the destination culture, they are more likely to enter a state of deep engagement through immersive experiences, resulting in stronger satisfaction and loyalty [43]. In particular, in the multisensory and interactive design of heritage buildings, cultural identity can amplify the positive effects of environmental restoration and flow experiences [44]. For example, in immersive heritage exhibitions, visitors with high cultural identity are more likely to transform their experiences into positive emotions and cultural value perceptions, thereby strengthening their willingness to revisit and recommend the destination [45]. Therefore, cultural identity not only enhances the psychological recovery and immersion effects of embodied experience on visitors but also further consolidates the path to loyalty formation.

H_4: *Cultural identity plays a moderating role in the effect of embodied experience on visitor loyalty.*

For clarity in empirical testing, the overall hypotheses (H2, H3, H4) are further specified into sub-hypotheses (e.g., H2a/H2b, H3a/H3b, H4a/H4b) to capture the distinct mediating and moderating pathways illustrated in Figure 1. In summary, embodied experience—comprising six dimensions: sensory immersion, physical interaction, spatial embodiment, situational engagement, cultural cognition, and technological mediation—provides a comprehensive framework for understanding visitor outcomes in heritage buildings. Prior studies suggest that embodied experiences foster loyalty through cognitive-affective engagement, with environmental restoration and flow experience as potential mediators, and cultural identity as a moderator. Building on these insights, this study proposes an integrative model linking embodied experience to visitor loyalty, complemented by deep learning methods to enhance prediction and identify key experience indicators. The conceptual framework and hypothesized relationships are shown in Figure 1, providing the foundation for empirical testing.

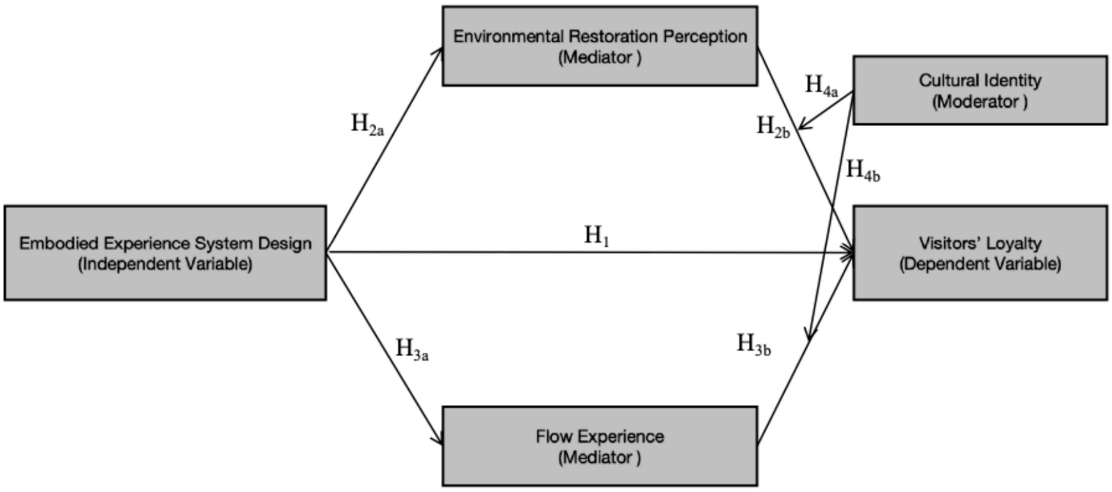

Figure 1. The model for this study.

3. Materials and Methods

3.1. Study Area

This study selects Yingzhou West Lake in Fuyang, Anhui Province, China, as the research site. Known as the "second West Lake" after Hangzhou, it integrates historic architecture, cultural heritage, natural landscapes, and urban park functions, making it a typical case of living heritage preservation. The site preserves a rich collection of traditional pavilions, temples, arch bridges, and garden structures, which embody the region's architectural aesthetics and cultural symbolism. From the perspective of embodied experience system design, these built forms provide sensory immersion through the reflection of pavilions on water and seasonal scenery, and offer opportunities for physical interaction via boating, strolling, and engagement with traditional crafts. Its spatial layout of bridges, islands, and architectural nodes enhances spatial embodiment, while festivals, performances, and community activities promote situational engagement and social interaction. Furthermore, the site carries profound historical narratives and literary traditions, anchored in its architectural heritage, which foster cultural cognition and emotional connection among visitors. In recent years, the introduction of digital exhibitions and smart guidance systems has provided new modes of technological mediation, enriching accessibility and interpretive depth. These characteristics not only highlight Yingzhou West Lake's significance as a cultural landscape but also underscore the research value of its historic architecture as a medium for understanding how embodied experience dimensions shape visitor loyalty in living heritage contexts.

3.2. Research Method

This chapter presents the research design and methodology employed to examine how embodied experience influences visitor loyalty in historic cultural heritage buildings. Innovative aspects of this study include the integration of six-dimensional embodied experience measurement with mediating variables (environmental restoration perception and flow experience) and a moderating variable (cultural identity), the combination of explanatory SEM with predictive deep learning models (MLP and GRU) to enable both causal inference and predictive analysis, and the operationalization of a multi-dimensional, context-specific measurement framework that goes beyond traditional single-dimension approaches in heritage tourism research. These design choices distinguish this study from prior research and provide a robust methodological basis for investigating the translation of embodied experiences into visitor loyalty.

3.2.1. Questionnaire Design

The research instrument was developed based on the conceptual framework of embodied experience system design, encompassing six first-order dimensions: sensory immersion, physical interaction, spatial embodiment, situational engagement, cultural cognition, and technological mediation (see Table 1). In addition, mediating variables (environmental restoration perception and flow experience), a moderating variable (cultural identity), and the outcome variable (visitor loyalty) were incorporated. Measurement items were adapted from validated scales in tourism, environmental psychology, and heritage studies, with modifications to fit the specific context of Yingzhou West Lake. The literature cited in this chapter serves to justify the selection and adaptation of items, ensuring their relevance and validity for the study context rather than providing a comprehensive review of prior research, which is covered in Chapter 2.

Table 1. Embodied Experience Scale.

Elements	Items	References
Sensory Immersion	1. The landscape and atmosphere of the building provided me with a strong sense of visual immersion. 2. I could vividly perceive the building's atmosphere through sounds, smells, or tactile sensations. 3. Multi-sensory experiences enhanced my memory and understanding of the building's uniqueness.	[23]
Physical Interaction	1. I actively participated in activities or interactive elements of the building. 2. Physical interaction with building elements gave me a stronger sense of presence. 3. My bodily engagement deepened my understanding of the heritage building.	[24,46]
Spatial Embodiment	1. The spatial layout of the building enabled me to clearly understand its cultural context. 2. While moving through the building, I experienced coherence between scenes and narratives. 3. The spatial and environmental design enhanced my sense of place.	[21])
Social and Situational Engagement	1. During my visit, I engaged in meaningful interactions with other visitors or community members. 2. Participating in cultural or role-playing activities enhanced my sense of involvement. 3. Shared experiences with others fostered a stronger sense of belonging.	[20,47]

Table 1. *Cont.*

Elements	Items	References
Cultural-Cognitive and Affective Connection	1. The visit enhanced my understanding of the building's history and cultural value. 2. I felt an emotional connection and identification with the heritage culture. 3. The experience strengthened my respect for and commitment to this cultural heritage.	[19,26]
Technological Mediation	1. Digital or multimedia technologies improved my understanding of the heritage building. 2. Technology-based interactions increased my level of engagement during the visit. 3. The use of technology enhanced my immersion and interest in the heritage building.	[27]

Specifically, the 10-item environmental restoration perception scale was employed to measure four dimensions: "coherence" (two items), "leaving" (three items), "compatibility" (two items), and "charisma" (three items) [48,49]. Flow experience was measured using a 6-item scale that included three dimensions: "clarity of purpose" (two items), "sense of control" (two items), and "loss of self-awareness" (two items) [50]. Cultural identity was assessed using a 7-item scale [37], while visitor loyalty was measured with a 2-item scale, which is revisit intention and willingness to recommend [51].

For the demographic variables, we included number of visits, gender, age, education, income, and place of residence as control variables, as these factors have previously been shown to affect visitor loyalty [38]. All measurement items were assessed using a five-point Likert scale ranging from "strongly disagree" to "strongly agree". A pilot test was conducted with 60 visitors at Yingzhou West Lake to refine item clarity and ensure internal consistency.

3.2.2. Data Collection

The study site is Yingzhou West Lake, a renowned urban heritage park with a rich historical and cultural background, making it an ideal case for examining embodied experiences within the context of living heritage. Data were collected in 2024 through on-site visitor questionnaires, with survey periods covering both peak seasons (summer and public holidays) and off-peak periods (weekdays, early spring, and late autumn) to ensure sample diversity. A stratified random sampling strategy was employed to capture different visitor groups, including tourists, residents, and cultural participants. After data cleaning and screening, a total of 622 valid questionnaires were retained for analysis, which is sufficient for conducting Structural Equation Modeling (SEM) and predictive modeling.

Based on the demographic test results, visitor loyalty varies across different groups. In terms of visiting times, first-time visitors account for 45%, and their loyalty is significantly higher than that of repeat visitors. Regarding age, the 25–30 age group makes up 35.4%, but visitors over 50 years old demonstrate higher loyalty levels. Regarding residence, 66.5% of respondents are residents of Fuyang, whose loyalty is significantly higher than that of non-local visitors. By contrast, gender (46% male and 54% female) shows no significant difference. Similarly, education level, with undergraduates comprising 53.4% of the sample, and income level, with the majority earning RMB 2001–5000 per month, are not significantly related to loyalty. Overall, visitor loyalty is primarily influenced by visitation frequency, age, and place of residence, whereas gender, education, and income have no significant effect.

3.2.3. Data Analysis: Structural Equation Modeling

Data analysis was conducted using Structural Equation Modeling (SEM) with AMOS 28.0. Confirmatory factor analysis (CFA) was employed to assess the reliability and validity of the constructs, including Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and discriminant validity. Model fit indices (χ^2/df, RMSEA, CFI, TLI, SRMR) were evaluated to ensure robustness. Hypothesis testing was performed to examine: (1) the direct effects of embodied experience system design on visitor loyalty, (2) the mediating roles of environmental restoration perception and flow experience, and (3) the moderating effect of cultural identity.

3.2.4. Deep Learning Prediction

To complement the causal mechanism testing conducted through SEM, this study further applied deep learning methods to evaluate the predictive capacity of embodied experience system design on visitor loyalty. Only the six embodied experience dimensions—sensory immersion, physical interaction, spatial embodiment, situational engagement, cultural cognition, and technological mediation—were included as input features, while visitor loyalty, operationalized through revisit and recommendation intentions, served as the output variable. Mediating (environmental restoration perception and flow experience) and moderating (cultural identity) variables were excluded to avoid post-treatment bias, ensuring that deep learning was solely used for predictive purposes while SEM remained the primary tool for mechanism testing.

The predictive models were implemented using Python 3.9 with TensorFlow 2.15 and Keras 2.15, with supplementary experiments in PyTorch 2.2.0 for robustness verification. An 80/20 training–testing split and five-fold cross-validation were applied to enhance generalizability. Model performance was assessed using root mean squared error (RMSE) and coefficient of determination (R^2), while SHAP (SHapley Additive exPlanations) values were employed to interpret the relative importance of each embodied experience dimension.

The MLP model consisted of three hidden layers with 128, 64, and 32 neurons using ReLU activation, and a linear output layer for continuous prediction. The model was optimized with the Adam optimizer (learning rate 0.001) and mean squared error loss. To prevent overfitting, dropout (rate = 0.2) and early stopping (patience = 20 epochs) were applied. Hyperparameters, including hidden layer sizes, learning rates, and batch sizes (32, 64, 128), were tuned via grid search. The GRU model was also trained for comparison with a single recurrent layer of 64 units and similar optimization settings, with its predictive performance to be discussed in the results section. Both models were trained for up to 200 epochs with a batch size of 64.

Overfitting was monitored by tracking both training and validation losses across epochs. Overfitting was identified when the validation loss began to increase while the training loss continued to decrease, and the difference between training and validation MSE was used as a quantitative indicator. Early stopping and dropout effectively mitigated excessive overfitting, ensuring stable predictive performance.

4. Results

4.1. Reliability Analysis

As shown in Table 2, all constructs demonstrated good reliability. The Cronbach's α values were 0.919 for embodied experience (18 items), 0.942 for environmental restoration perception (10 items), 0.913 for flow experience (6 items), 0.948 for cultural identity (7 items), and 0.890 for visitor loyalty (1 item). Since all coefficients exceeded the threshold of 0.70, the measurement scales can be considered highly reliable and suitable for further analysis.

Table 2. Reliability analysis.

Dimension	Item Count	Cronbach α
Embodied Experience	EE-SI 1-3 [1], EE-PI 1-3 [2], EE-SE 1-3 [3], EE-SESI 1-3 [4], EE-CCEC 1-3 [5], EE-TM 1-3 [6]	0.919
Environmental Restoration Perception	ERP 1-10	0.942
Flow Experience	FE 1-6	0.913
Cultural Identity	CI 1-7	0.948
Visitors' Loyalty	VL 1,2	0.890

[1] Embodied Experience-Sensory Immersion (EE-SI), [2] Embodied Experience-Physical Interaction (EE-PI), [3] Embodied Experience-Spatial Embodiment (EE-SE), [4] Embodied Experience-Situational Engagement and Social Interaction (EE-SESI), [5] Embodied Experience-Cultural Cognition and Emotional Connection (EE-CCEC), [6] Embodied Experience-Technological Mediation (EE-TM).

4.2. Validation Factor Analysis

Confirmatory factor analysis (CFA) results indicate that the model demonstrates an excellent fit (see Table 3). The CMIN/DF value was 1.319, well within the acceptable range of 1–3. Other fit indices all exceeded the recommended thresholds: GFI = 0.917, AGFI = 0.905, NFI = 0.941, IFI = 0.985, TLI = 0.984, and CFI = 0.985. In addition, RMR (0.023) and RMSEA (0.026) were below the cut-off values of 0.05 and 0.08, respectively. These results confirm that the measurement model possesses strong construct validity and is suitable for further hypothesis testing.

Table 3. Results of confirmatory factor analysis.

Model Fit Indicators	Statistical Value	Standard Value
CMIN/DF	1.319	1–3
RMR	0.023	0.05
GFI	0.917	>=0.9
AGFI	0.905	>=0.9
NFI	0.941	>=0.9
IFI	0.985	>=0.9
TLI	0.984	>=0.9
CFI	0.985	>=0.9
RMSEA	0.026	<=0.08

4.3. Mediating Effects of Environmental Restoration Perception and Flow Experience

The results of the structural equation modeling confirm the hypothesized relationships (see Table 4). Embodied experience system design exerted a significant positive effect on visitors' loyalty (β = 0.333, t = 5.563, $p < 0.001$), thus supporting H1 and answering RQ3. Moreover, embodied experience significantly predicted environmental restoration perception (β = 0.181, t = 3.641, $p < 0.001$) and flow experience (β = 0.256, t = 5.038, $p < 0.001$).

Both mediators further enhanced loyalty, with environmental restoration perception (β = 0.183, t = 3.269, $p = 0.001$) supporting H2a–H2b, and flow experience (β = 0.243, t = 4.069, $p < 0.001$) supporting H3a–H3b. These findings indicate that embodied experience affects loyalty not only directly but also indirectly through psychological mechanisms, thereby addressing RQ2. Overall, the model demonstrates that embodied experience system design enhances loyalty through both direct and mediated pathways.

Table 4. Mediating Effects of Environmental Restoration Perception and Flow Experience.

Latent Variable		Observed Variables	Standardization Factor	t	*p*
Environmental Restoration Perception	<---	Embodied Experience	0.181	3.641	***
Flow Experience	<---	Embodied Experience	0.256	5.038	***
Visitors' Loyalty	<---	Embodied Experience	0.333	5.563	***
Visitors' Loyalty	<---	Environmental Restoration Perception	0.183	3.269	0.001
Visitors' Loyalty	<---	Flow Experience	0.243	4.069	***

*** indicates significance at the 0.001 level.

As shown in Table 5, all hypothesized mediation effects were significant. Embodied experience influenced visitors' loyalty through environmental restoration perception (EE→ER→VL, β = 0.028, $p = 0.003$; H2b) and flow experience (EE→FE→VL, β = 0.052, $p = 0.001$; H3b). It also indirectly affected flow experience via environmental restoration perception (EE→ER→FE, β = 0.030, $p = 0.006$; H2a). Moreover, environmental restoration perception further shaped visitors' loyalty through flow experience (ER→FE→VL, β = 0.167, $p = 0.001$), showing the strongest mediating effect. Together, these results support H2a, H2b, H3a, and H3b, confirming the key mediating roles of environmental restoration perception and flow experience.

Table 5. Mediation Path Analysis Results (Bootstrap Test).

Mediation Path	Efficacy Value	Bias-Corrected 95%CI		
		Lower	Upper	*p*
EE-ER-VL	0.028	0.01	0.056	0.003
EE-FE-VL	0.052	0.023	0.099	0.001
EE-ER-FE	0.03	0.009	0.065	0.006
ER-FE-VL	0.167	0.091	0.254	0.001

4.4. Moderating Effect of Cultural Identity

The regression results indicate that environmental restoration perception exerts a significant positive effect on visitors' loyalty (B = 0.608, $p < 0.001$), while cultural identity also shows a significant effect (B = 0.157, $p < 0.001$). More importantly, the interaction between environmental restoration perception and cultural identity is positively significant (B = 0.075, $p = 0.019$), suggesting that cultural identity strengthens the relationship between environmental restoration perception and visitors' loyalty. Cultural identity exerts a positive moderating effect on the relationship between environmental restoration perception and visitor loyalty, such that the higher the level of cultural identity, the stronger the impact of environmental restoration perception on loyalty. (see Table 6 and Figure 2). Thus, hypothesis H4a is supported.

The regression results indicate that flow experience has a significant positive effect on visitors' loyalty (B = 0.447, $p < 0.001$). Cultural identity also shows a significant positive effect (B = 0.158, $p = 0.005$). Crucially, the interaction term between flow experience and cultural identity is statistically significant (B = 0.207, $p = 0.027$), demonstrating that cultural identity positively moderates the relationship between flow experience and visitors' loyalty. This suggests that visitors with higher cultural identity are more likely to translate their flow experience into stronger loyalty. Similarly, cultural identity positively moderates the relationship between flow experience and visitor loyalty, indicating that higher cultural identity enhances the extent to which flow experience translates into loyalty. Hence, hypothesis H4b is supported (see Table 7 and Figure 3).

Table 6. Moderating Effect of Cultural Identity on Environmental Restoration Perception and Visitors 'Loyalty.

	Model 1				
	B	**Standard Error**	*t*	*p*	*β*
Constant	3.182	0.025	129.234	0.000 **	-
Environmental Restoration Perception	0.608	0.036	17.026	0.000 **	0.585
Cultural Identity	0.157	0.023	6.780	0.000 **	0.233
Environmental Restoration Perception * Cultural Identity	0.075	0.032	2.355	0.019 *	0.080
R^2			0.439		
Moderating of R^2			0.435		
F			F (3,482) = 125.489, p = 0.000		

* Indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

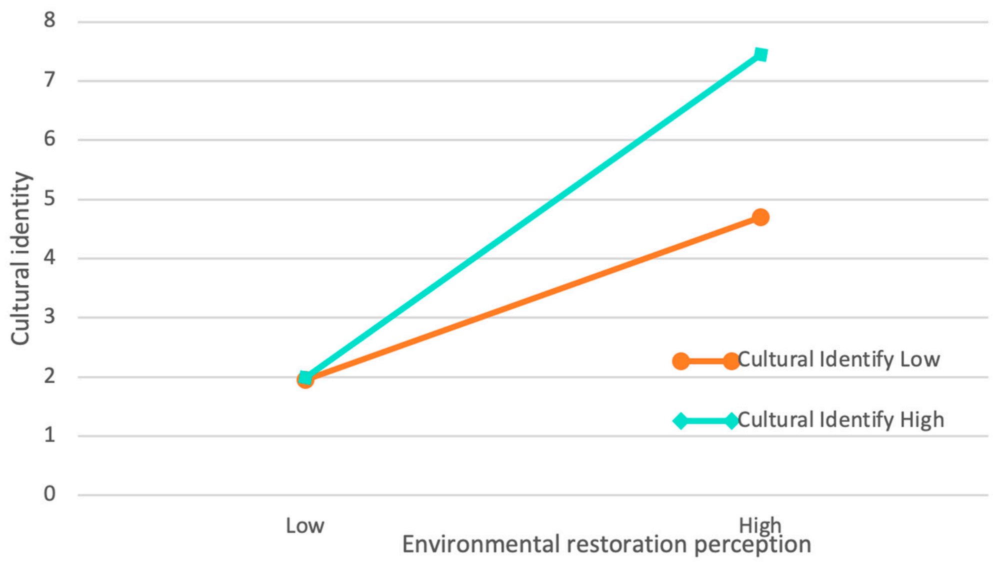

Figure 2. The modulation effect diagram between environmental restoration perception and cultural identity.

Table 7. Moderating Effect of Cultural Identity on Flow Experience and Visitors' Loyalty.

	Model 2				
	B	**Standard Error**	*t*	*p*	*β*
Constant	3.542	0.038	92.953	0.000 **	-
Flow Experience	0.447	0.066	6.753	0.000 **	0.350
Cultural Identity (fy)	0.158	0.057	2.799	0.005 **	0.145
Flow Experience * Cultural Identity (fy)	0.207	0.093	2.223	0.027 *	0.113
R^2			0.178		
Moderating of R^2			0.171		
F			F (3,318) = 23.027, p = 0.000		

* Indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

The findings reveal that environmental restoration perception and flow experience serve as key mediators through which embodied experience influences visitor loyalty. Moreover, cultural identity significantly moderates both the pathway from environmental restoration perception to visitor loyalty and the path from flow experience to visitor loyalty. This integrated model highlights the interplay between mediation and moderation, providing a comprehensive explanation of the underlying mechanisms of visitor loyalty formation and paving the way for subsequent deep learning analysis.

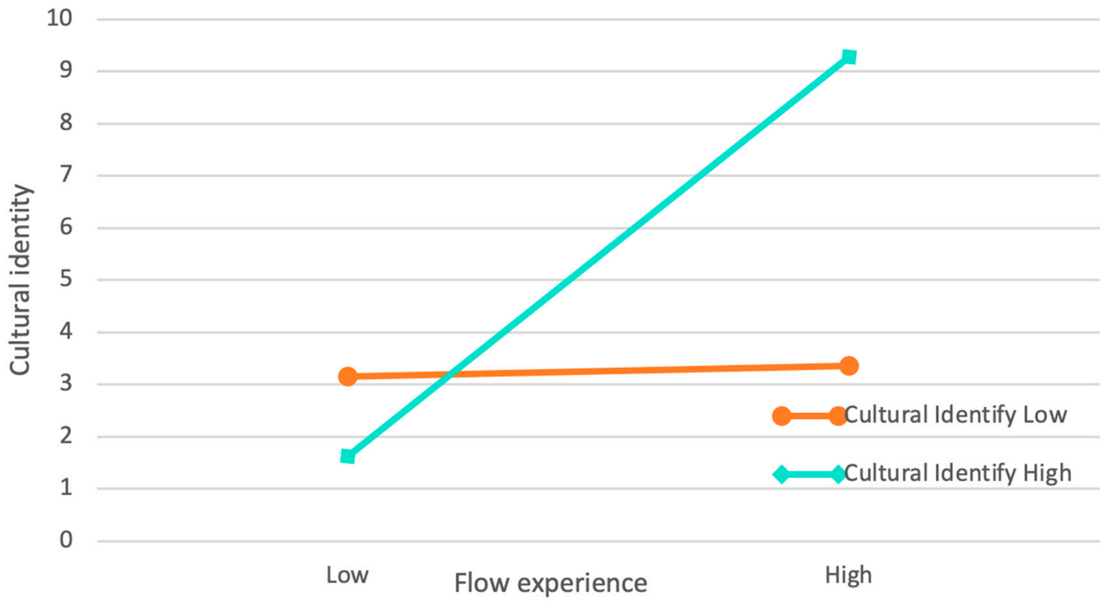

Figure 3. The modulation effect diagram between flow experience and cultural identity.

4.5. Results of Deep Learning Prediction

The primary objective of this study is to systematically explore and evaluate the applicability and effectiveness of deep learning models in predicting the key target variable, visitor loyalty (VL1, VL2), based on the provided dataset. To achieve this aim, the analysis was conducted in accordance with the established research design, employing two models—Multilayer Perceptron (MLP) and Recurrent Neural Network (RNN, implemented as GRU). A rigorous and structured analytical procedure was adopted to ensure the development of a predictive framework that is both optimal in performance and robust in its results.

4.5.1. Model Performance Comparison

Table 8 presents the comparative performance of the tuned MLP and GRU models. The MLP outperforms the GRU, achieving lower RMSE (0.8310) and MAE (0.6472) values. Although its R^2 is very low (0.0027), indicating that it explains almost none of the variance in visitor loyalty, it still slightly outperforms a mean-based prediction, suggesting limited but detectable nonlinear relationships among the input features.

Table 8. Performance Comparison of Various Models.

Model	RMSE	R^2	MAE
MLP_Tuned	0.8310	0.0027	0.6472
GRU_Tuned	1.0488	−0.5999	0.7807

In contrast, the GRU model shows markedly inferior performance, with higher RMSE (1.0488), MAE (0.7807), and a negative R^2 (−0.5999), indicating that its predictions are even less accurate than using the mean value as a baseline. This can be attributed to the cross-sectional nature of the dataset, which lacks temporal or sequential dependencies necessary for the recurrent architecture of GRU to capture meaningful patterns. Additionally, the relatively small sample size and sensitivity to hyperparameter settings further limit GRU's generalization capacity.

Overall, these results indicate that the simpler MLP architecture provides a more robust and generalizable predictive model for visitor loyalty in this study. The low R^2 of the MLP highlights the inherent complexity of predicting loyalty using only the six embodied experience dimensions, as visitor behavior is also influenced by additional psychological, cultural, and social factors not captured in the dataset. Nevertheless, the MLP demonstrates detectable nonlinear relationships and offers a foundation for identifying key predictive features through feature importance analyses in subsequent sections.

4.5.2. Model Training and Convergence Performance

Figures 4 and 5 illustrate the training loss curves of the tuned MLP and GRU models, respectively. Both models exhibit desirable convergence characteristics, with training and validation losses decreasing rapidly and stabilizing as the number of epochs increases. Notably, the validation loss closely follows the training loss and eventually settles at a relatively low level, indicating the absence of overfitting and confirming that the models successfully captured the underlying patterns in the data. The stable and efficient training process provides a solid foundation for reliable predictive performance in subsequent analyses.

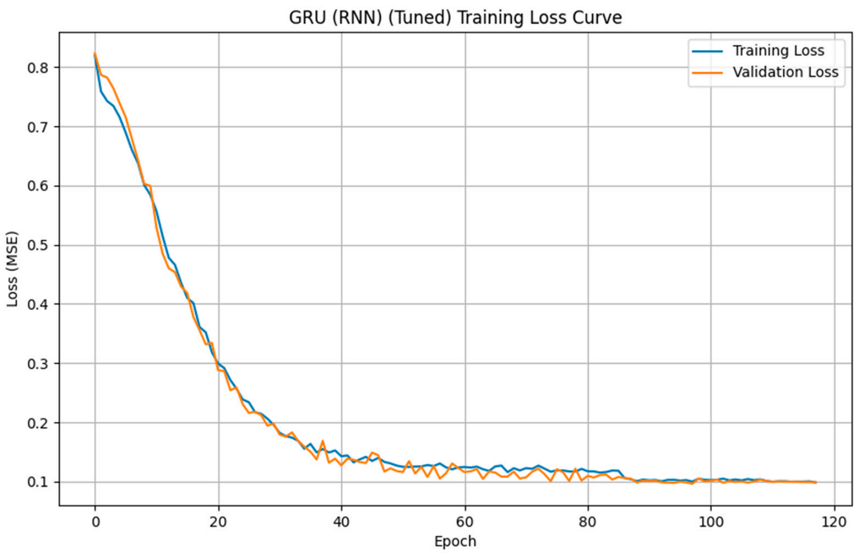

Figure 4. Training Loss Curve of the GRU Model.

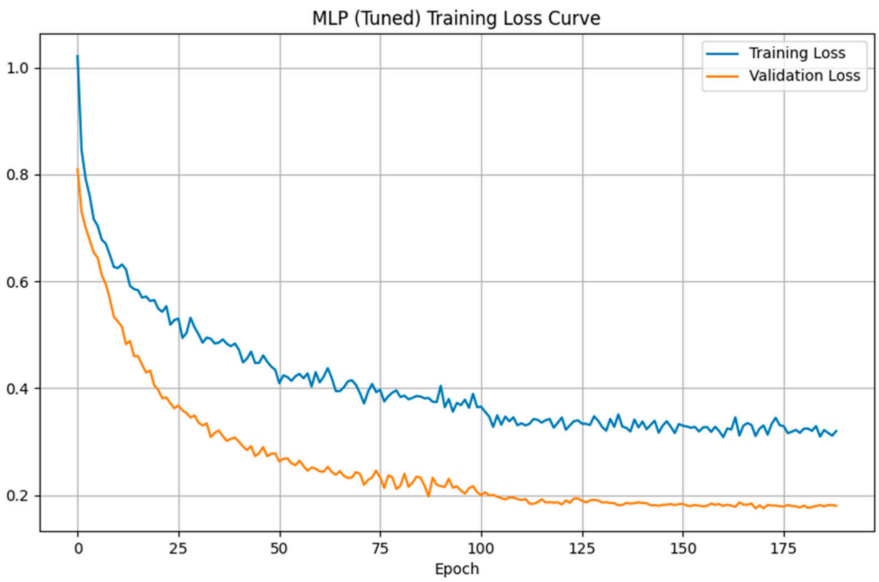

Figure 5. Training Loss Curve of the MLP Model.

4.5.3. Predictive Accuracy of Models

In addition to RMSE and R^2, MAE was reported to provide further insight into predictive accuracy. Scatter plots of predicted versus actual values (Figures 6 and 7) show that although the models capture the overall trend, some dispersion reflects inherent variability in visitor loyalty. Qualitative inspection suggests that sensory immersion (EE-SI) and physical interaction (EE-PI) consistently influence predicted loyalty scores, highlighting trends that may not be fully captured by quantitative metrics alone. This combination of quantitative and qualitative interpretation offers a richer understanding of model performance in the context of complex, real-world behavioral data. The scatter plots reveal that most data points are distributed closely around the diagonal reference line, indicating that the models successfully captured the overall trend and direction of the data. Although some dispersion of data points was observed, reflecting the inherent variability and noise in real-world datasets, the concentration of points near the diagonal line confirms the robustness of the predictive outcomes. These results suggest that both models possess valid predictive capability for visitor loyalty, with differences in precision further clarified in the subsequent quantitative performance evaluation.

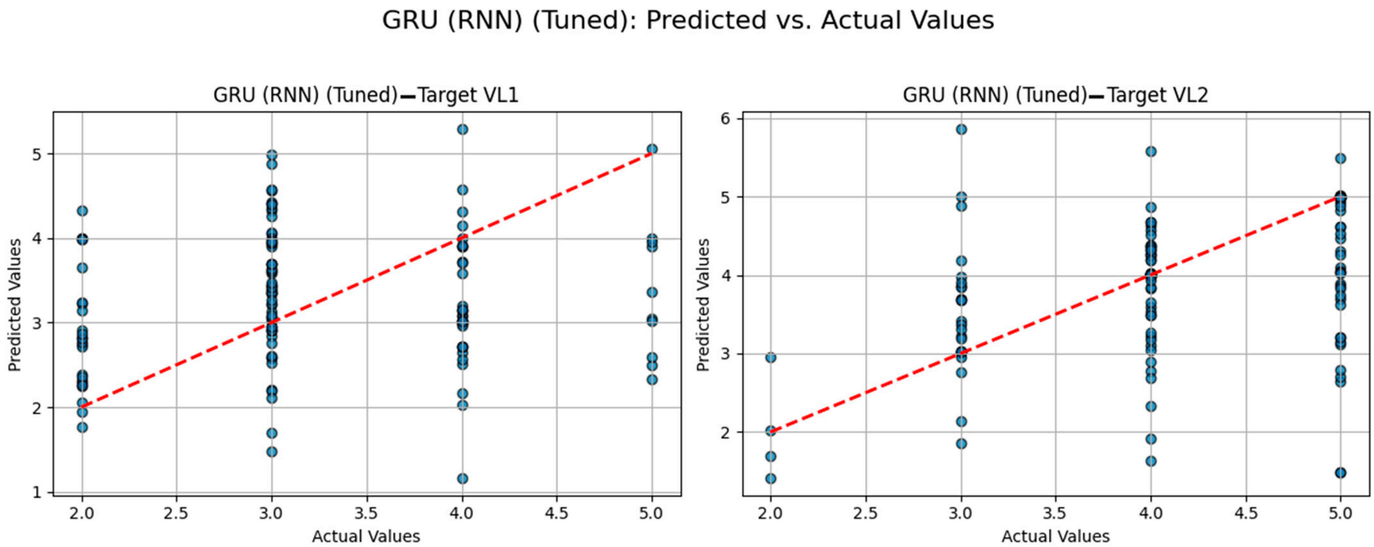

Figure 6. Scatter plot of predicted vs. actual visitor loyalty values using the GRU model.

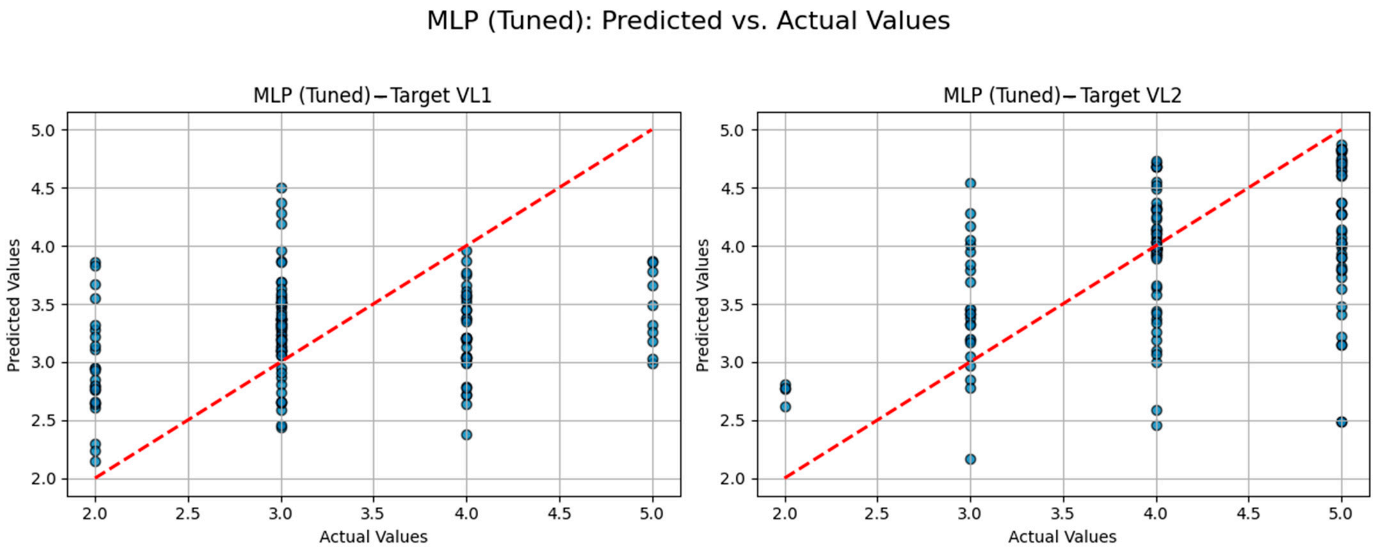

Figure 7. Scatter plot of predicted vs. actual visitor loyalty values using the MLP model.

4.5.4. Key Predictors of Visitor Loyalty

An important outcome of the deep learning analysis lies in the identification of the most influential predictors of visitor loyalty. As shown in Figure 8, feature importance derived from the optimal MLP model highlights that items such as EE-TM-2, EE-TM-1, and EE-PI-1 exert the strongest impact on predictive outcomes. These dimensions represent the core drivers shaping visitor loyalty, underscoring their central role in the embodied experience framework.

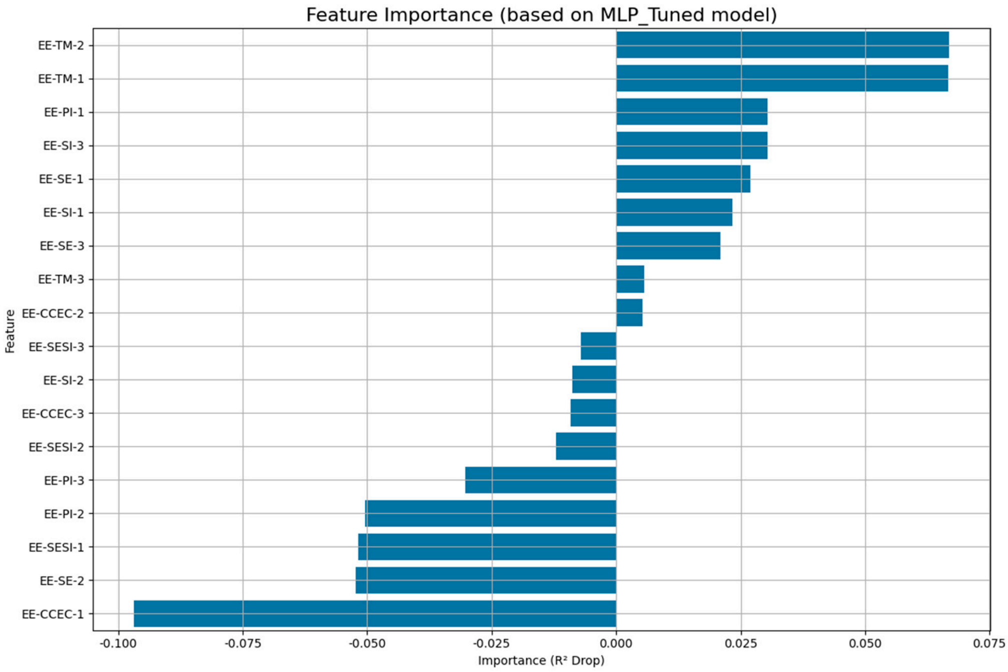

Figure 8. Feature importance ranking for predictors of visitor loyalty based on the MLP model.

In contrast, other indicators such as EE-SI-2 and EE-SESI-2 contributed less substantially to the model's predictive performance. This ranking not only validates the robustness of the model but also provides critical insights for practical applications and theoretical advancement. By pinpointing the features with the greatest predictive power, the analysis offers clear guidance for prioritizing design and management strategies that enhance visitor loyalty in heritage tourism contexts.

In summary, by rigorously following the established research design, both MLP and RNN models were effectively constructed and optimized, leading to several insightful outcomes. First, the training processes were efficient and stable, ensuring reliable learning and strong generalization performance. Second, the models accurately captured the underlying variation in the target variable, demonstrating a clear predictive capacity. Finally, the analysis quantified the relative importance of individual predictors, offering valuable insights into the key factors shaping visitor loyalty. Overall, the findings not only fulfill the intended objectives but also provide a solid and dependable foundation for future research and practical applications.

5. Discussion

This study provides new empirical evidence on how embodied experience influences visitor loyalty in urban heritage parks by integrating structural equation modeling (SEM) and deep learning prediction. The findings highlight both the explanatory mechanisms and predictive capabilities of the proposed framework, offering theoretical and practical implications for heritage tourism research.

5.1. Mediating Roles of Environmental Restoration and Flow Experience

The results confirm that environmental restoration perception and flow experience serve as significant mediators in the relationship between embodied experience and visitor loyalty. These findings suggest that immersive design elements not only enhance visitors' psychological restoration and engagement but also contribute to the sustainability of living heritage conservation. Specifically, when visitors feel physically restored and psychologically immersed, they are more likely to form repeated connections with the heritage building, which in turn generates a cycle of cultural transmission and community participation [13]. In the context of living heritage, such embodied experiences do not merely provide temporary satisfaction; rather, they reinforce the dynamic continuity between the tangible environment and intangible cultural practices [35]. This indicates that heritage buildings designed to stimulate sensory, affective, and interactive engagement are more capable of sustaining cultural vitality while fostering visitor loyalty. By situating these processes within the embodied experience framework, the study extends prior research on restorative environments and demonstrates that psychological well-being is intricately linked to the active safeguarding and revitalization of heritage in everyday life.

5.2. Cultural Identity's Role in Strengthening Visitor Loyalty

The moderating analysis further reveals that cultural identity strengthens the impact of both environmental restoration and flow experience on visitor loyalty. Visitors with stronger cultural attachment exhibited higher loyalty when restorative and immersive experiences were perceived positively [52]. This finding highlights that cultural resonance is not only an individual psychological factor but also a key mechanism for sustaining living heritage. In heritage tourism contexts, cultural identity functions as a bridge between embodied experiences and heritage continuity: when visitors recognize their own cultural values in the environment, restorative and immersive experiences are transformed into a deeper sense of belonging and responsibility [53]. This process extends beyond short-term satisfaction, fostering long-term engagement that supports the safeguarding and revitalization of living traditions [37]. Accordingly, identity-based connections amplify the effectiveness of embodied design strategies by ensuring that heritage buildings are not merely preserved as static monuments but are actively lived, experienced, and transmitted across generations.

5.3. Predictive Insights from Deep Learning

Beyond explanatory modeling, the application of MLP and GRU models demonstrates the predictive potential of embodied experience indicators. The superior performance of the MLP model indicates that nonlinear machine learning approaches can effectively capture complex interactions among experiential, psychological, and cultural factors. Moreover, the feature importance analysis identifies tactile–materiality and physical interaction dimensions as the strongest predictors of loyalty, offering actionable insights for park design and management.

The SHAP analysis of embodied experience dimensions reveals how various forms of embodied interaction impact visitor loyalty. Among the six identified dimensions—sensory immersion (EE-SI), physical interaction (EE-PI), spatial embodiment (EE-SE), situational engagement and social interaction (EE-SESI), cultural cognition and emotional connection (EE-CCEC), and technological mediation (EE-TM)—the results reveal clear hierarchical contributions [22,23].

Specifically, technological mediation (EE-TM) and physical interaction (EE-PI) emerge as the strongest predictors of visitor loyalty, followed closely by sensory immersion (EE-SI). This suggests that immersive technologies and opportunities for direct bodily engagement are central in reinforcing loyalty behaviors, as they allow visitors to experience cultural heritage in ways that feel both authentic and participatory [27]. These findings align with the principles of living heritage conservation, where maintaining the materiality of a space and fostering embodied engagement are crucial to sustaining cultural continuity.

Conversely, spatial embodiment (EE-SE) and situational engagement/social interaction (EE-SESI) exert more moderate effects, indicating that while spatial orientation and group dynamics enrich the experience, they are less decisive in shaping long-term loyalty. Cultural cognition and emotional connection (EE-CCEC), although less prominent in predictive strength, plays a subtle yet complementary role by reinforcing cultural identity—a factor shown in the moderating analysis to amplify the pathways from restorative perception and flow experience to loyalty [26].

By integrating SHAP interpretability with the embodied experience framework, this study demonstrates not only which features drive predictive accuracy but also how they align with the theoretical underpinnings of cultural heritage preservation. This dual perspective underscores the necessity of designing heritage environments that combine material authenticity, embodied participation, and identity-based resonance, thereby ensuring both predictive robustness and practical relevance for sustainable heritage management.

Based on the predictive results of the deep learning models, technological mediation (EE-TM) and physical interaction (EE-PI) emerged as the most influential factors driving visitor loyalty, providing actionable insights for the management and policy of heritage parks. From a cultural perspective, the incorporation of immersive technologies and interactive design can enhance visitors' engagement and cultural understanding, supporting the preservation and transmission of living heritage. Socially, facilitating embodied participation and group interactions may strengthen community involvement and identity-based connections. Economically, strategies that enhance repeat visits and word-of-mouth recommendations can contribute to sustainable tourism development and long-term revenue generation. These findings offer data-driven guidance for park managers, enabling interventions that balance cultural, social, and economic objectives effectively.

Nevertheless, this study has several methodological limitations. First, the data were collected from a single urban heritage park, and the cross-sectional design limits the ability to capture changes in visitor loyalty over time, which may constrain the generalizability of the findings to other cultural or geographical contexts. Second, the predictive models were restricted by the available feature set, with only six embodied experience dimensions, resulting in the MLP model explaining very little variance and the GRU model performing poorly due to the lack of sequential information. Future research could address these limitations by employing longitudinal or multi-site datasets, incorporating additional psychological, cultural, and social variables, and exploring alternative deep learning architectures or multimodal data integration to enhance predictive performance and applicability across diverse heritage contexts.

6. Conclusions

This study systematically examined the role of embodied experience in shaping visitor loyalty within urban heritage parks, integrating explanatory and predictive perspectives. The results of structural equation modeling (SEM) confirmed that embodied experience exerts a positive influence on loyalty, with environmental restoration perception and flow experience acting as significant mediators. Moreover, cultural identity moderated these pathways, strengthening the impact of restorative and immersive experiences on loyalty among visitors with stronger cultural attachment. These findings reveal the intertwined psychological and cultural mechanisms through which heritage environments sustain long-term visitor engagement.

Beyond explanatory modeling, the study extended the analysis with deep learning techniques. The comparative results of the multilayer perceptron (MLP) and gated recurrent unit (GRU) models demonstrated that nonlinear machine learning methods effectively capture the complex interactions among experiential, psychological, and cultural variables. The superior predictive accuracy of the MLP model, supported by SHAP analysis, further highlighted the relative importance of technological mediation and physical interaction as the strongest predictors of visitor loyalty, underscoring the significance of immersive engagement in contemporary heritage contexts.

Theoretically, this research advances the embodied experience framework by embedding it within the broader agenda of living heritage conservation, emphasizing the combined roles of material authenticity, embodied participation, and cultural resonance. Practically, the findings offer actionable guidance for park and heritage management: prioritizing technological mediation, enhancing opportunities for physical interaction, and reinforcing cultural identity can effectively foster visitor loyalty.

In line with the proposed hypotheses, the study confirmed that embodied experience positively influences loyalty (H_1), with environmental restoration perception and flow experience serving as mediators (H_2 and H_3), and cultural identity moderating these effects (H_4). The integration of SEM and deep learning illustrates the value of combining explanatory and predictive approaches in heritage-tourism research. By linking psychological processes, cultural identity, and advanced modeling, this study provides both theoretical enrichment and robust tools for the sustainable management of urban heritage parks. Ultimately, the findings inform strategies for the living conservation of heritage buildings—particularly through technological mediation, physical interaction, and sensory immersion—ensuring the safeguarding of authenticity, the reinforcement of cultural continuity, and alignment with long-term sustainability goals and the SDGs.

Building on these insights, several practical recommendations can be drawn. First, enhancing multisensory and embodied engagement should remain central to heritage design, as tactile materiality and physical interaction most strongly predict loyalty [54]. Second, immersive technologies such as AR and VR should be employed with careful attention to authenticity, augmenting rather than replacing the tangible presence of heritage. Third, cultural identity should be embedded in interpretive narratives, using storytelling that strengthens visitors' identification with cultural values and history [55]. Fourth, participatory co-creation involving local communities can reinforce cultural continuity and intergenerational engagement [56]. Finally, adaptive reuse strategies should balance innovation with conservation, integrating immersive and participatory features to keep heritage relevant while preserving its cultural essence [57].

By merging explanatory findings with applied recommendations, this study not only clarifies the mechanisms shaping visitor loyalty but also highlights innovative pathways—namely the integration of embodied experience, cultural identity, and deep learning methods—for advancing heritage conservation research. These contributions position the study within the frontier of heritage-tourism scholarship, offering both theoretical novelty and practical value.

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References

1. Zhou, Z.; Syamsunur, D.; Fan, X.; Li, J. A Preliminary Investigation on the Relationship Between the Sustainable Construction Field and the Sustainable Development Goals: A Proposed Research Framework. In Proceedings of the E3S Web of Conferences, Yogyakarta, Indonesia, 7–8 August 2025; p. 03014.
2. Haselberger, M.; Krist, G. Applied Conservation Practice Within a Living Heritage Site. *Stud. Conserv.* **2022**, *67*, 96–104. [CrossRef]
3. Min, W. A scientometric review of cultural heritage management and sustainable development through evolutionary perspectives. *npj Herit. Sci.* **2025**, *13*, 215. [CrossRef]
4. Liang, L.; Elliot, S. A systematic review of augmented reality tourism research: What is now and what is next? *Tour. Hosp. Res.* **2020**, *21*, 146735842094191. [CrossRef]
5. Pinto, I.; Huertas, A. A comparative study of VR and AR heritage applications on visitor emotional experiences: A case study from a peripheral Spanish destination. *Virtual Real.* **2025**, *29*, 36. [CrossRef]
6. Academy, C.T. *Annual Report on China's Domestic Tourism Development 2024*; China Tourism Academy: Beijing, China, 2025.
7. Chen, W.; Li, T.; Zhang, Y. Embodied cognition model for museum gamification cultural heritage communication a grounded theory study. *npj Herit. Sci.* **2025**, *13*, 239. [CrossRef]
8. Lin, X.; Wang, Y.; Zhan, Z.; Wang, Q.; Xiang, D.; Li, H. Effects of VR technical interaction and acceptance on rural cultural identity: The mediating role of embodied cognition and flow experience. *Telemat. Inform. Rep.* **2024**, *16*, 100170. [CrossRef]
9. Yang, W.; Chen, Q.; Huang, X.; Xie, M.; Guo, Q. How do aesthetics and tourist involvement influence cultural identity in heritage tourism? The mediating role of mental experience. *Front. Psychol.* **2022**, *13*, 990030. [CrossRef]
10. Sancho Núñez, J.C.; Gómez-Pulido, J.A.; Ramírez, R. Machine learning applied to tourism: A systematic review. *Wiley Interdiscip. Rev. Data Min. Knowl. Discov.* **2024**, *14*, e1549. [CrossRef]
11. Zhang, J.; Gao, M. The application of deep learning in economic analysis and marketing strategy formulation in the tourism industry. *PLoS ONE* **2025**, *20*, e0321992. [CrossRef]
12. Şeker, F. Evolution of Machine Learning in Tourism: A Comprehensive Review of Seminal Research. *J. Artif. Intell. Data Sci.* **2023**, *3*, 54–79.
13. Wu, K.; Guo, Y.; Han, X. The relationship research between restorative perception, local attachment and environmental responsible behavior of urban park recreationists. *Heliyon* **2024**, *10*, e35214. [CrossRef]
14. López-Naranjo, A.L.; Puente-Riofrio, M.I.; Carrasco-Salazar, V.A.; Erazo-Rodríguez, J.D.; Buñay-Guisñan, P.A. Artificial intelligence in the tourism business: A systematic review. *Front. Artif. Intell.* **2025**, *8*, 1599391. [CrossRef]
15. Jimenez-García, D.; Espinoza Heredia, O.; Cruz Lizana, E.; Cruz-Tarrillo, J.J.; Millones-Liza, D.Y. Destination Image and Brand Value as Predictors of Tourist Behavior: Happiness as a Mediating Link. *Adm. Sci.* **2025**, *15*, 176. [CrossRef]
16. Song, H.; Chen, J.; Li, P. Decoding the cultural heritage tourism landscape and visitor crowding behavior from the multidimensional embodied perspective: Insights from Chinese classical gardens. *Tour. Manag.* **2025**, *110*, 105180. [CrossRef]
17. Smith, L. Uses of Heritage. In *Uses Herit*; Routledge: New York, NY, USA, 2006; pp. 1–351. [CrossRef]
18. Waterton, E.; Watson, S. *The Palgrave Handbook of Contemporary Heritage Research*; Springer: New York, NY, USA, 2015; pp. 1–560.
19. Timothy, D. *Cultural Heritage and Tourism: An Introduction*; Channel View Publications: Bristol, UK, 2011.
20. Falk, J.; Dierking, L. *The Museum Experience Revisited*; Routledge: New York, NY, USA, 2016.
21. Packer, J. Conceptualizing the Visitor Experience: A Review of Literature and Development of a Multifaceted Model. *Visit. Stud.* **2016**, *19*, 128–143. [CrossRef]
22. Pine, B.J.; Gilmore, J.H. *The Experience Economy*; Harvard Business Review Press: Brighton, MA, USA, 2011.
23. Agapito, D.; Mendes, J.; Pinto, P. Exploring the conceptualization of the sensory dimension of tourist experiences. *J. Destin. Mark. Manag.* **2013**, *2*, 62–73. [CrossRef]
24. Csordas, T.J. Embodiment as a Paradigm for Anthropology. *Ethos* **1990**, *18*, 5–47. [CrossRef]
25. Seamon, D.; Sowers, J. Place and Placelessness, Edward Relph. *Key Texts Hum. Geogr.* **2008**, *43*, 51. [CrossRef]
26. Poria, Y.; Reichel, A.; Cohen, R. World Heritage Site—Is It an Effective Brand Name?:A Case Study of a Religious Heritage Site. *J. Travel Res.* **2011**, *50*, 482–495. [CrossRef]
27. Tom Dieck, M.C.; Jung, T. Value of Augmented Reality at Cultural Heritage Sites: A Stakeholder Approach. *J. Destin. Mark. Manag.* **2017**, *6*, 110–117. [CrossRef]
28. Ramkissoon, H.; Smith, L.D.G.; Weiler, B. Testing the dimensionality of place attachment and its relationships with place satisfaction and pro-environmental behaviours: A structural equation modelling approach. *Tour. Manag.* **2013**, *36*, 552–566. [CrossRef]
29. Maulina, A.; Sukoco, I.; Hermanto, B.; Kostini, N. Tourists' revisit intention and electronic word-of-mouth at adaptive reuse building in Batavia Jakarta Heritage. *Sustainability* **2023**, *15*, 14227. [CrossRef]
30. Yang, F.; Huang, A.; Huang, J. Influence of sensory experiences on tourists' emotions, destination memories, and loyalty. *Soc. Behav. Personal. Int. J.* **2021**, *49*, 1–13. [CrossRef]

31. Hartig, T.; Evans, G.W.; Jamner, L.D.; Davis, D.S.; Gärling, T. Tracking restoration in natural and urban field settings. *J. Environ. Psychol.* **2003**, *23*, 109–123. [CrossRef]
32. Scopelliti, M.; Carrus, G.; Bonaiuto, M. Is it really nature that restores people? A comparison with historical sites with high restorative potential. *Front. Psychol.* **2019**, *9*, 2742. [CrossRef]
33. Packer, J.; Bond, N. Museums as restorative environments. *Curator Mus. J.* **2010**, *53*, 421–436. [CrossRef]
34. Wang, Z.; Wang, M.; Wang, Y.; Huang, T.; Chen, J.; Liu, T. The Effect of Enclosure Layout on Wind Environment in Chinese Classic Landscape Gardens: A Case Study of Beijing's Summer Palace Ruins Garden. *Buildings* **2024**, *14*, 280. [CrossRef]
35. Pilotti, L. Cultural economy for the environmental preservation of the landscape as a key resource in historic territories. *Agriculture* **2018**, *8*, 161. [CrossRef]
36. Moneta, G.B.; Csikszentmihalyi, M. The effect of perceived challenges and skills on the quality of subjective experience. *J. Personal.* **1996**, *64*, 275–310. [CrossRef] [PubMed]
37. Zhang, S.-N.; Li, Y.-Q.; Liu, C.-H.; Ruan, W.-Q. How does authenticity enhance flow experience through perceived value and involvement: The moderating roles of innovation and cultural identity. *J. Travel Tour. Mark.* **2019**, *36*, 710–728. [CrossRef]
38. Kim, M.; Thapa, B. Perceived value and flow experience: Application in a nature-based tourism context. *J. Destin. Mark. Manag.* **2018**, *8*, 373–384. [CrossRef]
39. Yin, Z.; Huang, A.; Wang, J. Memorable Tourism Experiences' Formation Mechanism in Cultural Creative Tourism: From the Perspective of Embodied Cognition. *Sustainability* **2023**, *15*, 4055. [CrossRef]
40. Scannell, L.; Gifford, R. Defining place attachment: A tripartite organizing framework. *J. Environ. Psychol.* **2010**, *30*, 1–10. [CrossRef]
41. Hou, J.-S.; Lin, C.-H.; Morais, D.B. Antecedents of attachment to a cultural tourism destination: The case of Hakka and non-Hakka Taiwanese visitors to Pei-Pu, Taiwan. *J. Travel Res.* **2005**, *44*, 221–233. [CrossRef]
42. Pardo-García, C.; Coll-Serrano, V.; Rausell-Köster, P.; Pérez Bustamante-Yábar, D. Cultural attitudes and tourist destination prescription. *Ann. Tour. Res.* **2018**, *71*, 59–61. [CrossRef]
43. Su, M.M.; Wall, G. Community participation in tourism at a world heritage site: Mutianyu Great Wall, Beijing, China. *Int. J. Tour. Res.* **2014**, *16*, 146–156. [CrossRef]
44. He, X.; Cheng, J.; Swanson, S.R.; Su, L.; Hu, D. The effect of destination employee service quality on tourist environmentally responsible behavior: A moderated mediation model incorporating environmental commitment, destination social responsibility and motive attributions. *Tour. Manag.* **2022**, *90*, 104470. [CrossRef]
45. Ramkissoon, H.; Mavondo, F.T. The satisfaction–place attachment relationship: Potential mediators and moderators. *J. Bus. Res.* **2015**, *68*, 2593–2602. [CrossRef]
46. Tussyadiah, I.P. Toward a Theoretical Foundation for Experience Design in Tourism. *J. Travel Res.* **2014**, *53*, 543–564. [CrossRef]
47. Binkhorst, E.; den Dekker, T. Agenda for Co-Creation Tourism Experience Research. *J. Hosp. Mark. Manag.* **2009**, *18*, 311–327. [CrossRef]
48. Brown, T.A.; Moore, M.T. Confirmatory factor analysis. *Handb. Struct. Equ. Model.* **2012**, *361*, 379.
49. Hartig, T.; Böök, A.; Garvill, J.; Olsson, T.; Gärling, T. Environmental influences on psychological restoration. *Scand. J. Psychol.* **1996**, *37*, 378–393. [CrossRef] [PubMed]
50. Xie, M.; Mao, Y.; Yang, R. Flow experience and city identity in the restorative environment: A conceptual model and nature-based intervention. *Front. Public Health* **2022**, *10*, 1011890. [CrossRef]
51. Wang, L.; Li, X. The five influencing factors of tourist loyalty: A meta-analysis. *PLoS ONE* **2023**, *18*, e0283963. [CrossRef]
52. Jimber del Rio, J.A.; Hernández-Rojas, R.D.; Vergara-Romero, A.; Dancausa Millán, M.G.D. Loyalty in heritage tourism: The case of Córdoba and its four world heritage sites. *Int. J. Environ. Res. Public Health* **2020**, *17*, 8950. [CrossRef]
53. Fu, Y.; Luo, J.M. An empirical study on cultural identity measurement and its influence mechanism among heritage tourists. *Front. Psychol.* **2023**, *13*, 8718. [CrossRef]
54. Zhao, L.; Qi, J.; Wang, J. Exploring the Impact of Immersive Projection Art on Visitor Behavior and Engagement. *J. Soc. Sci. Humanit.* **2025**, *7*, 145–152. [CrossRef] [PubMed]
55. Eck, T.; Zhang, Y.; An, S. A Study on the Effect of Authenticity on Heritage Tourists' Mindful Tourism Experience: The Case of the Forbidden City. *Sustainability* **2023**, *15*, 7756. [CrossRef]
56. Xiang, C.; Rosni, N.A.B.; Ab Ghafar, N. A Landscape Narrative Model for Visitor Satisfaction Prediction in the Living Preservation of Urban Historic Parks: A Machine-Learning Approach. *Sustainability* **2025**, *17*, 5545. [CrossRef]
57. Vafaie, F.; Remøy, H.; Gruis, V. Adaptive reuse of heritage buildings; a systematic literature review of success factors. *Habitat Int.* **2023**, *142*, 102926. [CrossRef]