Analyze the Gamification Application User Target Group and Formulate Design Strategies for Cultural Tourism: Case Study of Huizhou

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Abstract

In the era of digital tourism, integrating gamified interactive entertainment with traditional tourism has enhanced the cultural tourism experience. This study explores tourists' diverse needs for cultural tourism gamification in Huizhou through precise user research, aiming to attract and maintain user participation and provide a scientific basis for developing such applications. The research objectives are to understand users' needs and expectations for Huizhou's cultural tourism gamified applications and to clarify target user groups for formulating targeted gamification strategies. Based on user-centered design principles, researchers interviewed and observed tourists in tourist attractions (N = 30) and distributed and collected valid questionnaires (N = 514). The study used the MDA framework to conduct qualitative and quantitative analyses of tourists' concerns, experiences, functional needs, and artistic style preferences. Results indicate that target users are mainly digital native self-guided tourists, with 81.12% showing high interest in gamified cultural tourism applications, compared to 28.69% of non-digital natives. Tourists expect apps to provide useful information features to enhance their travel experience, particularly by providing detailed and informative explanations of attractions. Additionally, they are concerned with the application's ease of use and privacy protection. Aesthetically, Chinese line-drawing cartoon styles and travel visual experiences are favored. The proposed gamification strategy balances education, entertainment, and practicality to improve user engagement and experience. These findings offer crucial insights for developers and provide precise guidance for market positioning and product design strategies.

Keywords: Cultural Tourism, Gamification Application, Design Strategies, User-Centered Design, MDA Gamification Design

Introduction

Gamification refers to integrating gamification elements into non-game environments to effectively stimulate users' positive experiences and intrinsic motivation, thereby affecting their behavior (Deterding, 2012). With the development of digital media technology, gamified applications are being increasingly used in the tourism industry, especially in the field of cultural tourism, and their impact is significant (Pasca et al., 2020; Xu et al., 2016; Xu et al., 2013). Gamified applications effectively improve tourist engagement by setting challenges and tasks, providing rewards and incentive mechanisms, and creating personalized experiences (Eisingerich et al., 2019; Lu et al., 2020; Xi & Hamari, 2020). At the same time, gamification elements satisfy the needs for user autonomy, competence, and belonging while enhancing the individual's internal motivation (Wee & Choong, 2019). Gamification design improves tourists' travel experiences by providing interesting and motivational digital media content (van Nuenen & Scarles, 2021), allowing them to obtain richer and more diverse experiences through functions such as personalized tours, in-depth explanations, and interactions (Coghlan & Carter, 2020; Pendit et al., 2015). Gamification also increases tourism's educational and learning effects, promoting tourists' in-depth understanding of cultural content through game tasks and challenges (Argyriou et al., 2020; Khan et al., 2020; Luimula & Trygg, 2016). At the same time, gamification promotes social interaction and cooperation among tourists by introducing competitive elements and teamwork tasks, enhancing their sense of participation and belonging

through the tourism experience (Leclercq et al., 2018). The multifaceted role of gamified applications in cultural tourism enriches tourists' experiences and provides new impetus and direction for developing the tourism industry. However, the effective implementation of gamification relies on a key prerequisite: the user's active willingness to participate. Researchers need to understand and stimulate tourists' motivation to encourage thorough participation deeply to realize the full potential of gamified applications.

This research focuses on the Huizhou Region and aims to understand the behaviors, needs, and preferences of tourists in the area when using cultural tourism gamified applications. The research adopts User-Centered Design (UCD) principles as a theoretical framework, emphasizing putting users' needs and experiences first in the design process. In tourism, the UCD principle has been proven to be effective in improving user satisfaction and engagement. Especially with the rapid development of digital and mobile technologies, the importance of this principle has become increasingly significant (Poux et al., 2020; Williams et al., 2017). Compared with traditional function-oriented design, UCD focuses more on meeting user requirements in terms of their experience.

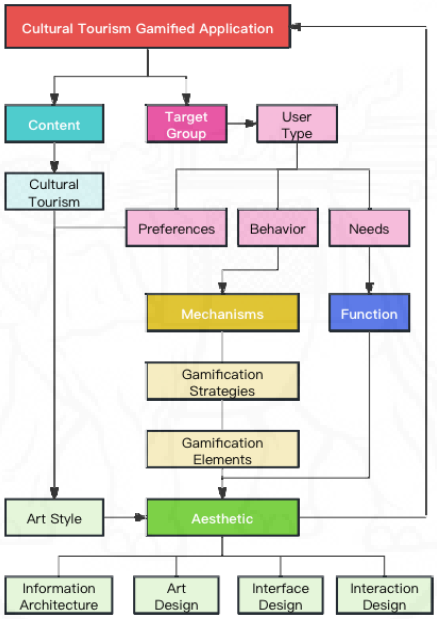

Figure 1 Cultural Tourism Gamified Application Design Model Based on the MDA Framework.

Source: Produced by Author.

In the MDA (Mechanics, Dynamics, and Aesthetics) gamification design framework, effectively meeting the diverse needs of different user groups is a key consideration (Kim, 2015). Ensuring that the design meets user needs involves thoroughly evaluating mechanics, dynamics, and aesthetics (Figure 1). The first thing to focus on when implementing gamification in cultural tourism is mechanism design. It requires in-depth user research to capture the preferences and needs of the target group accurately. Based on these insights, game rules can be designed to encourage engagement and participation. Secondly, the analysis and optimization of game dynamics are crucial. It involves evaluating and adjusting how users interact with game mechanics to increase their engagement and satisfaction. Finally, aesthetic design should fully consider emotional experience and cultural relevance. Designers must ensure that visual elements harmonize with the user's emotional needs and cultural background. Careful design and adjustment of these three aspects are key to creating an engaging game experience that meets user needs.

The core objectives of the research focus on two main directions. Firstly, the research aims to deeply understand users' specific functional requirements and aesthetic preferences regarding Huizhou cultural tourism gamified applications. Achieving this goal will ensure that these applications meet user needs and expectations accurately. Secondly, the research is dedicated to identifying and classifying different types of users to develop more effective and targeted gamification strategies and mechanisms. By accomplishing these objectives, the research aims to provide practical insights and specific suggestions to assist developers in designing cultural tourism gamified applications that attract and satisfy users more effectively, thereby enhancing digital services for cultural tourism.

The research proposes two hypotheses: H1) Young individuals who frequently use mobile applications for practical purposes in their daily lives are likely to exhibit increased interest in and adoption of gamified cultural tourism applications, H2) There are differences among users regarding their functional requirements and aesthetic preferences for gamified cultural tourism applications.

Methods and Materials

The research employs a mixed-methods approach, integrating quantitative and qualitative research strengths to comprehensively understand user needs. This methodology is widely recognized for providing a more holistic view and deeper insights (Venkatesh et al., 2013). The research methods and sampling procedures have been approved by the Human Research Ethics Committee of Silpakorn University. All research activities have been conducted with informed consent from the participants.

Research Tools and Materials

The research tools include tourist interviews, travel behavior observations, and questionnaires. Experts thoroughly reviewed and assessed these tools to guarantee the quality and validity of the research. All research instruments scored over 0.94 in the reliability assessment of data collection, demonstrating the trustworthiness and accuracy of the data collected. Detailed descriptions of the research tools and materials are provided below:

Interview Tools: Semi-structured interviews were conducted with tourists to gather in-depth insights into their original tourism experiences, opinions, and acceptance of cultural tourism gamified applications.

Observation Tools: Mobile phone cameras were used to unobtrusively observe and record tourists' behavior patterns, interaction methods, and responses to tourism resources in real-world settings.

Questionnaire: A comprehensive questionnaire consisting of single-choice, multiple-choice, ranking, and Likert scale questions was designed to assess various aspects of tourists' travel behavior, functional needs, and aesthetic preferences for gamified applications.

The materials used included interview recordings, video recordings of tourists' travel behavior at scenic spots, questionnaire data, and related statistical analysis reports.

Research Methods

The qualitative research components comprised face-to-face interviews and on-site observations. The researchers interviewed 30 tourists (Figure 2) with differing ages, genders, and cultural backgrounds, focusing on their original tourism experiences, opinions, and acceptance of cultural tourism gamified applications to ensure the data collected were diverse and representative. The interviews covered topics such as tourists' overall satisfaction with attractions, their evaluation of specific services and facilities, and opinions and suggestions on applying gamification to cultural tourism. Specifically, the differences in travel experiences between groups and independent tourists were compared to explore the impact of different travel modes on tourist experiences and needs.

Figure 2 Tourist Interviews.

Source: Produced by Author.

Understanding tourists' behavior and preferences in real-world settings provides important insights into their responses to gamified applications (Kawulich, 2005). The researchers recorded the travel behavior of 30 tourists in the West Lake Scenic Area in Huizhou through video. Visitors' tour routes, types of activities (e.g., taking photos, reading information boards, participating in guided tours), social interactions among tourists, ways of interacting with attractions (e.g., touching artifacts, using interactive screens), and the devices they use (e.g., smartphones, camera). In addition, we also paid attention to whether tourists downloaded and used tourism applications currently developed in scenic spots, the frequency of use, and the use of specific functions.

A comprehensive questionnaire was designed for quantitative data collection and analysis. The questionnaire contains the following main contents: 1) Basic information of the respondents, 2) Tourism behavior characteristics of the respondents, 3) Key factors affecting tourists' use of cultural tourism gamification applications, 4) Respondents' opinions on cultural tourism applications in Huizhou Acceptance and functional requirements for cultural gamification applications, 5) Respondents' aesthetic preferences for cultural tourism gamification applications.

Data Collection

The study employed diverse data collection methods. First, researchers recorded direct tourist feedback through interviews using recording devices, then transcribed the recordings into text for in-depth analysis. Additionally, researchers used mobile phone cameras to unobtrusively observe and record the travel behavior patterns of these tourists in the scenic areas. To ensure the representativeness and reliability of the qualitative data, this study used a purposive sampling strategy to select interview participants (Malterud et al., 2016). This approach allows for in-depth exploration of specific phenomena and ensures that the sample includes diverse perspectives. This study used the following specific criteria to select participants: 1) The age of participants from different age groups to reflect the attitudes and experiences of different generations towards cultural tourism and gamification applications, 2) Diversity of occupational background: including individuals from different occupational backgrounds, such as students, white-collar workers, freelancers, and retirees. This helps to understand the impact of occupational background on tourism behavior and acceptance of gamification applications, 3) Travel experience: Participants should be non-local tourists visiting Huizhou for the first time. This standard ensures that fresh and unique tourism experience data is collected, excluding biases that may be brought about by local residents.

The sampling process involved working with local tourism offices and cultural attractions in Huizhou to identify and recruit participants who met the above criteria. Invitations to participate in the study were sent to tourists visiting the West Lake Scenic Area in Huizhou, and a total of 30 participants were ultimately selected.

The questionnaire survey was conducted online and on paper to meet the needs of different situations and target groups. Researchers collaborating with scenic area staff distributed 550 questionnaires across four scenic areas: West Lake, Dongpo Shrine, Shuidong Street, and Hejiang Tower in Huizhou from April 23 to 25, 2023. We successfully recovered 516 questionnaires, with 514 being valid, achieving an effective response rate of 93.45%, ensuring the representativeness of the scenic spots dataset and its adequacy (Figure 3).

Figure 3 Tourists Completing the Questionnaire.

Source: Produced by Author.

Results

The Impact of Differences in Tourism Models on the Acceptance of a Cultural Tourism Application

The experiences of group and self-guided tourists differ significantly in their exploration methods and depth of cultural interaction, impacting their acceptance and use of cultural tourism applications. Group tourists rely on tour guides or professional docents for comprehensive guidance, resulting in less frequent use of apps. This model has limitations such as fixed itineraries, restricted personal freedom, and shallow cultural experiences due to predetermined travel agency plans, limiting opportunities for personalized exploration and in-depth cultural understanding.

Research observations indicate that group tourists, typically older and come in groups of 6 to 14 people, follow the tour guide closely while chatting or admiring the scenery. Professional commentators at attractions generally provide more accurate cultural information than group tour guides, but the quality varies. The explanations of tour guides and docents are often mixed with commercial promotions, which increases the psychological pressure of tourists.

In contrast, self-guided tourists show diverse behaviors. Some join tour groups for free guidance, but most use traditional signs, information boards, and digital media at attractions (Figure 3). Although some attempt to use travel apps, they primarily use them for interpretive information rather than in-depth exploration. Many quickly abandon attempts to explore further, and those who use digital explanations often only browse without engaging deeply. Self-guided tourists' understanding of destination culture is often superficial and requires more depth.

Additionally, the findings of this study reveal that although some tourists engage in spontaneous cultural discussions during their visits, these often lack depth and structure, possibly due to their limited understanding of the local cultural and historical context. From the self-guided tour perspective, tourists' understanding of the destination culture is often superficial and needs more depth and breadth.

Feedback indicates that cultural tourism applications are underutilized. Group tourists rely more on guides, while self-guided tourists use traditional signage and digital media provided by attractions. Two main reasons for this are the need for certain IT literacy and digital skills to use these applications, and the need for more user-friendly and intuitive design to avoid confusion or inconvenience. Additionally, digital content often provides only simple information, lacking the depth needed for thorough cultural exploration.

Tourists' Needs and Expectations for the Huizhou Cultural Tourism Gamified Application

According to the interview data, most respondents planned to stay in Huizhou for 1 to 2 days. Their favorite attractions are West Lake, Luofu Mountain, and Dongpo Shrine. Among the interview sample for this study, fourteen respondents explicitly stated they had accessed and utilized tourism applications provided by the attractions (Figure 4). Eight group tour participants believed there was no need for such applications within the group of tourists who had not used them. In comparison, another six group tour participants felt the applications did not significantly enhance the tourism experience. The study revealed a notable dissatisfaction with the current tourism applications, even among tourists who use them. This phenomenon can be attributed to two main reasons: the design of the application content did not surpass traditional methods of information provision but merely replicated information visible on-site, failing to meet tourists' needs for a deeper cultural experience; secondly, the user interface design was not intuitive enough, leading to operational difficulties during use.

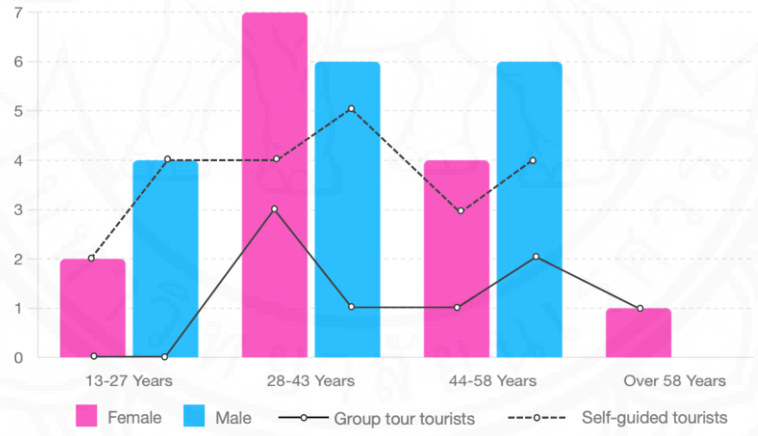

Figure 4 Basic Information of the Interviewed Visitors.

Source: Produced by Author.

Table 1 Basic Information on the Respondents

Item	Options	No. of Selections	Percentage of Total
Gender	Male	264	51.36%
	Female	250	48.64%
Age	Under 13 Years	12	2.33%
	13-27 Years	172	33.46%
	28-43 Years	208	40.47%
	44-58 Years	75	14.59%
	Over 58 Years Old	47	9.14%

Table 1 (Cont.)

Item	Options	No. of Selections	Percentage of Total
Education Status	High School and Below	121	23.54%
	Junior College	127	24.71%
	Bachelor Degree	187	36.38%
	Master Degree	64	12.45%
	Doctoral Degree or Above	15	2.92%
Travel Mode	Group Tour	116	22.57%
	Self-guided Travel	398	77.43%
App Usage	Never Used	174	33.85%
	Have Used	340	66.15%

*N = 514

Questionnaire data (Table 1) show that male participants slightly outnumber female participants in this study, with an overall age distribution trend leaning toward the younger generation. The 13-27 age group (Generation Z) and the 28-43 age group (Generation Y) account for 73.93% of the respondents. The proportion of individuals under 13 and over 58 is low. Many surveyed individuals have received higher education, predominately associate and bachelor's degrees. There are approximately 3.4 times more self-guided tourists than group tour tourists. 66.15% of the respondents have used travel-related applications to improve their travel experience. Considering all these data, the demographic composition of respondents shows a slight bias in gender distribution and age groups. However, these differences do not affect the integrity of the survey results.

This study evaluates the participants' concerns, focal points, experiential needs, functional requirements, and aesthetic preferences regarding gamified applications in cultural tourism. The survey results show that the primary motivation for tourists to participate in cultural tourism activities is to learn and experience historical and cultural knowledge (Table 2). However, there is a large gap between this motivation and the actual situation. The data shows that 29.1% of the respondents have limited knowledge of the tourist attractions they have traveled to (Figure 5). The findings indicate that applying gamification to integrate cultural tourism experiences with cultural learning outcomes presents challenges and opportunities. When utilizing gamified applications, their main concerns include excessive storage consumption on mobile devices, high data usage, and personal data privacy protection. Tourists expect to enhance their travel experience through gamified applications while desiring related rewards and entertainment. Regarding functional requirements, the most valued features are cultural information on attractions, travel route planning, and detailed navigation within scenic areas.

Table 2 Questionnaire Results on User Preferences and Concerns Toward the Huizhou Cultural Tourism Gamified Application

Question Type	Survey Question	Data Results
Ranking	Purpose of Travel	The top three purposes of cultural tourism activities identified by respondents are learning and experiencing historical and cultural knowledge and related information (4.39), broadening horizons (3.13), and relaxation (2.13).
	Apprehensions	The top three concerns of respondents using gamified applications are excessive use of phone storage (2.93), high data consumption (2.18), and personal data privacy protection (2.07).
	Experience Needs	The top three experience needs of respondents using gamified applications are enhancing the tourism experience (3.56), gamified rewards (2.34), and entertainment (2.19).

Table 2 (Cont.)

Question Type	Survey Question	Data Results
Ranking	Functional Needs	The top three functionalities of gamified applications, as identified by respondents, are cultural information on attractions (3.84), travel route planning (3.17), and detailed navigation of scenic areas (2.48).
Multiple Choice	Art Style	The top three functionalities of gamified applications, as identified by respondents, are Chinese line drawing cartoons (55.84%), minimalist style (28.21%), and illustration style (25.49%).
	Color Scheme	E (38.33%), B (31.52%), A (27.04%)

*N = 514

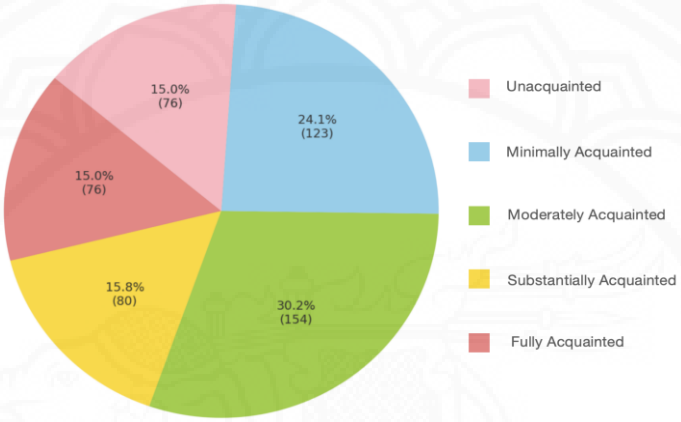

Figure 5 Respondents' Knowledge of the Scenic Spots Visited (N = 514).

Source: Produced by Author.

In terms of art style, the Chinese line drawing cartoon is the most popular (Figure 6). As for color schemes, scheme E is the most popular. The Chinese line drawing cartoon style complements cultural tourism attractions in temperament and visual appeal, aligning with the traditional aesthetic preferences of the Chinese people and offering significant advantages from both the technical and economic perspectives. This style demands less graphic rendering, ensuring a smooth experience on most mobile devices without the need for high-end hardware. As for color, scheme E is the most popular. These colors are closely related to the visual experiences encountered during travel (Figure 6). For example, black originates from the lines in ink paintings. Ochre red reflects the color of ancient wooden structures. Blue-gray evokes the color of stone walls, while green represents the common vegetation encountered during travel.

Figure 6 The Chinese Line Drawing Cartoon Style.

Source: Produced by Author.

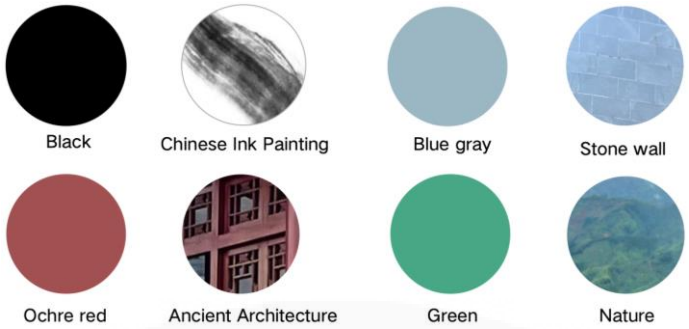

Figure 7 Respondents' Preferred Colors (Option E).

Source: Produced by Author.

Target User

The research findings indicate that the target user group for gamified applications in cultural tourism consists predominantly of digital natives among self-guided tourists. Digital natives, who have grown up amidst the transformation brought about by the internet, smartphones, and digital media, exhibit a stronger preference for enriched digital and game-based travel experiences (Skinner et al., 2018). This trend is evidenced by the survey results (Table 3), with a notable 81.12% of digital native respondents demonstrating significant interest in gamified applications for cultural tourism, awarding high ratings of 4 or 5 points. In contrast, only 28.69% of respondents from the non-digital native group provided similar ratings.

Table 3 Respondents' Acceptance of Cultural Tourism Gamified Applications by Age Group

Item	Distribution of Responses					Total
	1	2	3	4	5	
Digital Natives (Age ≤ 43)	7	19	48	144	174	393
Non-digital Natives (Age ≥ 44)	33	26	28	19	16	122

*N = 514

Moreover, the research also reveals that, compared to group tour participants, the demand for gamified applications in cultural tourism is more pronounced among self-guided tourists. An impressive 81.12% of self-guided tour respondents showed significant interest in gamified applications for cultural tourism, assigning them high ratings of 4 or 5 points, whereas only 22.41% of respondents from the group tour cohort offered equivalent ratings (Table 4).

Table 4 Response Distribution Among Group Tour and Self-guided Tourists

Item	Distribution of Responses					Total
	1	2	3	4	5	
Group Tour Tourists	31	32	27	19	7	116
Self-guided Tourists	9	13	49	144	183	398

*N = 514

User Category Division and Corresponding Gamification Strategies

The researchers first conducted an interest assessment through questionnaire analysis, asking participants to rate their interest in various aspects of cultural tourism (such as historical information, interactive activities, and practical travel planning tools). Second, in-depth insights are gained through interview data, which provides qualitative data on user motivations and preferences. Participants discuss their ideal cultural tourism experience and the most valuable features in travel apps and share detailed travel experiences, highlighting what they think

are the most valuable features. Through the collection and analysis of the above data, the researchers divided the target users into three categories according to different demand orientations: cultural learners, entertainment seekers, and travel explorers.

Cultural learners focus on acquiring knowledge and understanding cultural information at tourist attractions. The application design should incorporate interactive elements around culture and history, such as virtual tours, historical knowledge quizzes, and cultural activity simulations. These mechanics provide in-depth knowledge and stimulate users' interest in learning. Dynamic systems should be designed to allow users to unlock new cultural content and historical stories during their exploration, promoting continuous learning and exploration. Such as completing knowledge tests will influence their progress in unlocking new content. Enhancing the cultural experience through high-quality images, audio, and video materials provides an immersive learning environment, helping users better understand and appreciate the cultural sites they visit.

Entertainment seekers prefer gamified experiences with rewards and immediate feedback. The application design should include gamification elements such as point systems, reward badges, and leaderboards to motivate users to learn cultural knowledge through game interactions. These mechanics aim to increase user engagement and a sense of achievement. Dynamic systems involving competitions, challenges, and cooperative tasks should encourage users to participate and interact with other users actively. User performance will determine their rankings on leaderboards and the number of rewards they receive, fostering competition and enthusiasm for participation. Providing a visually appealing game interface and interactive design enhances the entertainment experience, enabling users to learn cultural knowledge while enjoying the fun of gaming.

Tourist explorers prioritize the practicality of information, integrating actual travel tools with on-the-ground experiences. The application design should integrate practical travel tools such as navigation systems, itinerary planners, and real-time information queries to support users with convenient and practical assistance during their travels. These mechanics aim to enhance the application's usability and the convenience of the user experience. Dynamic itinerary suggestions and real-time updates should be designed to provide personalized travel recommendations based on the user's current location and points of interest. Users' real-time feedback and behavior data will be used to adjust and optimize travel planning. A clear and user-friendly interface ensures ease of operation, enhancing the application experience for users during their travels.

Moreover, a gamification strategy based on the MAD framework is proposed to balance gamification applications' educational, entertainment, and practicality (Table 5). The ideal cultural tourism game application should provide rich cultural and historical knowledge to enhance the user's learning experience while increasing their engagement and entertainment experience through the mechanics and interactive elements. In addition, practicality is also an aspect that must be considered, especially for users whose main purpose is sightseeing.

Table 5 User Types and Gamification Strategies

User Type	Cultural Learner	Entertainment Seeker	Tourist Explorer
User Needs	Focuses on the educational aspect of the gamified digital tool. Desires to understand the cultural information of tourist spots to increase their knowledge.	Focuses on the entertainment and activity aspects of the gamified digital tool. Prefers game mechanisms that provide immediate feedback and rewards.	Focuses on the close integration and informational value of the gamified digital tools with actual tourist spots.

Table 5 (Cont.)

User Type	Cultural Learner	Entertainment Seeker	Tourist Explorer
Gamification Strategies	Incorporates their cultural knowledge of tourist spots into game tasks, facilitated through storytelling or NPC (Non-player Character) guidance.	Achievement and reward mechanisms, along with immediate feedback systems.	Features high utility functions (e.g., site introduction, guided tours, route planning) and tasks and challenges relating to geographical location.

*N = 514

Discussion

Cultural tourism gamified applications involve the integration of gamification elements into original applications. This strategy aims to engage users by providing a pleasant and interactive experience while motivating them to participate. The core goal is to meet the intrinsic needs of cultural tourists by providing enhanced cultural interaction and deepening participation, thereby significantly improving the overall tourism experience. Previous research has systematically investigated the impact of gamification on users' intrinsic needs (Xi & Hamari, 2019). These research findings provide a solid foundation for a deep understanding of the role and utility of gamification in diverse application contexts. However, the research starts from the application design perspective and focuses on integrating gamification elements with tourists' specific functional needs and aesthetic preferences in cultural tourism. This approach provides a more attractive and satisfying design for developing applications with external needs, offering new perspectives and strategies for cultural tourism applications.

The findings highlight the importance of addressing visitor concerns regarding storage space, data usage and privacy protection as key to increasing user satisfaction and trust in gamified applications. Designers should prioritize solving these issues to ensure application convenience and security. In addition, tourists' preference for Chinese line drawing cartoon style and travel visual experience emphasizes the importance of incorporating cultural relevance and aesthetic appeal into the design of gamification applications.

This study supports the applicability of the MDA framework in designing effective gamified cultural tourism applications. The goal of cultural tourism gamification application is not only limited to entertainment value but also focuses on enhancing tourists' cultural tourism experience through gamification. For example, the main goal of the "Turku Castle in Your Hands" application developed by the Turku University of Applied Sciences is to encourage visitors to interactively experience the architecture and exhibits of the Turku Castle (Luimula & Trygg, 2016). The application offers different types of users a choice between tour and game modes, utilizing Augmented Reality (AR) technology and smart mobile device (phones and tablets) cameras to scan real-world objects. In normal tour mode, users can obtain additional information about the scanned objects; in game mode, users must obtain this information by completing various tasks and mini-games. Well-designed game mechanics, engaging dynamics, and appealing aesthetics can significantly increase user engagement by balancing educational, entertainment, and practical elements. Therefore, this study demonstrates its uniqueness in practical application and goal setting, especially in integrating gamification strategies with enhanced cultural tourism experiences.

The results of this study are consistent with and extend previous research on the role of gamification in tourism. For example, Eisingerich et al. (2019) highlighted the impact of gamification on improving user engagement and intrinsic motivation. Our research confirms these findings and, by demonstrating cultural tourism users' specific needs and preferences, provides design strategies that developers can implement to create more engaging and

satisfying gamification experiences.

Although this paper explores the external needs and expectations of users of cultural tourism gamified applications through empirical research, some limitations were revealed during the research process, which deserves to be considered in future research. This study focuses on the specific geographical area of Huizhou. Different regions possess unique cultural tourism resources and characteristics, which may limit the generalizability of the research results. Future research should expand the geographical scope to include areas with diverse cultural backgrounds and tourism resources. This expansion will help verify and extend the findings, ensuring the results have broader applicability.

The sample size in this study is limited, particularly in the interview and observation sections. The sample selection must effectively differentiate between local, out-of-town, and international tourists. This limitation is crucial from a diversity perspective, as a homogenous sample may affect the representativeness of the study's conclusions. Future research should aim to increase the diversity of the sample, ensuring coverage of tourist groups from various geographical and cultural backgrounds. This approach will provide a more comprehensive understanding of the needs and expectations of different tourist groups. Moreover, the study employed targeted sampling without stratified sampling based on different scenic spots. This method may result in insufficient representation of data across various scenic areas, impacting the comprehensiveness and accuracy of the results. Future research should consider using stratified sampling techniques, sampling according to the characteristics of different scenic spots and the composition of tourists. This approach will improve the representativeness of the data and enhance the reliability of the research conclusions.

Conclusion and Suggestions

This research involves an in-depth analysis of tourists' needs and preferences toward gamified cultural tourism applications in Huizhou using interviews, behavioral observations, and questionnaires. The research revealed obvious differences in the willingness and demand for cultural tourism gamified applications among tourists with different travel modes and ages. The target user group for the application (digital native self-guide tourists) was identified and subdivided into types such as cultural learners, entertainment seekers, and sightseeing enthusiasts. Since each type of user has different needs and preferences, corresponding gamification strategies were proposed to meet the specific requirements of each tourism group. The key to designing a Huizhou cultural tourism gamified application is integrating the region's unique cultural elements and landscape features with an educational and entertaining immersive tourism experience. This includes a comprehensive introduction to cultural attractions to enhance users' understanding and appreciation of Huizhou culture and innovation in game mechanics, interactive elements, and storytelling to adapt to the preferences of different user groups. In this way, gamified applications can balance education and entertainment, effectively conveying the deep value of regional culture while stimulating visitor interest and participation.

The following suggestions are drawn from the specific design of Huizhou cultural tourism gamified applications: 1) The application should integrate highly practical functions, such as providing comprehensive cultural information on scenic spots, intelligent travel route planning, and accurate scenic spot navigation systems to ensure the user gains maximum convenience and value, 2) In terms of development and platform selection, the principles of lightweight and convenience should be adhered to, and the size and performance of the application optimized to achieve a user-free experience. At the same time, data protection for users should be strengthened to ensure

privacy and security, 3) In terms of gamification mechanisms, cultural knowledge can be cleverly integrated into game tasks by including narrative elements, tasks, and challenges relating to geographical location to improve user participation and interaction, and 4) In terms of visual design, the traditional Chinese line drawing style should be mainly used, and priority given to extracting relevant colors matching from tourists' travel experiences to enhance the visual appeal and cultural resonance of the application and balance the travel experience with education and entertainment.

This study primarily focuses on the Huizhou region. Given the unique cultural background and history of this region, the results of this study may be significantly influenced by these factors and may not be replicable in other regions. Therefore, future research should include comparative studies across different cultural contexts to validate the broader applicability of this study's findings.

This research holds significant academic and practical importance for the design of cultural tourism gamified applications. By deeply exploring tourists' needs and preferences, it provides a solid empirical foundation for developing more attractive cultural tourism gamified applications that better meet user needs. The research results enhance the understanding of different user groups' requirements and offer valuable guidance for optimizing gamified application designs and improving the quality of tourists' cultural tourism experiences.

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