GAMIFICATION-BASED DIGITAL TOOL FOR HUIZHOU CULTURAL TOURISM

By
Mr. Fankai NIE

A Thesis Submitted in Partial Fulfillment of the Requirements
for Doctor of Philosophy Design
Silpakorn University
Academic Year 2024

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Mr.Fankai NIE

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต
สาขาวิชาการออกแบบ แบบ 1.1
มหาวิทยาลัยศิลปากร
ปีการศึกษา 2567

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Title	Gamification-based digital tool for Huizhou cultural tourism
By	Mr. Fankai NIE
Field of Study	Design
Advisor	Assistant Professor Dr. Atithep Chaetnalao

Faculty of Decorative Arts, Silpakorn University in Partial Fulfillment of the Requirements for the Doctor of Philosophy

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This study explores developing a gamified digital tool to enhance the cultural tourism experience. The primary research objectives include: 1) To explore the concept of gamification and the use of gamified digital tools in enhancing the tourism experience in Huizhou's cultural tourism. 2) To propose guidelines for the design of digital tools for cultural tourism gamification. 3) To develop and evaluate a Huizhou cultural tourism gamified digital tool.

This study adopted a mixed methodology, combining qualitative and quantitative research methods. First, the researchers collected opinions from 10 experts, 15 tourists, and 10 scenic spot staff through interviews and analyzed 514 questionnaires for tourists. These data were used to explore gamification design, the travel behavior of the target group, needs, and design preferences. The researchers then developed and tested a prototype of a gamified digital tool.

The results demonstrated that gamified digital tools significantly stimulated user participation, increased the desire to explore attractions, and enhanced cognition and memory of cultural content. The experimental group using the prototype scored an average of 49.33, notably higher than the control group's 27.17 ($p < 0.05$). Participant feedback and behavioral data further validated the effectiveness and appeal of gamified tools in cultural tourism.

The findings suggest that aligning gamified digital tool design with the target user group's travel behaviors, needs, and preferences dramatically enhances their effectiveness. However, it is essential to balance gamification elements, as overly complex tasks may detract from the overall travel experience by consuming too much user time.

ACKNOWLEDGEMENTS

First and foremost, I extend my sincere gratitude to my advisor, Asst. Prof. Dr. Atithep Chaetnalao. His exemplary academic rigor, meticulous approach to scholarship, profound knowledge, and noble conduct have been a beacon for me in my studies, research, and daily life. Asst. Prof. Dr. Atithep Chaetnalao has provided immense support, assistance, and encouragement, from which I have greatly benefited. His meticulous guidance has been crucial in my Ph.D. Dissertation. He always patiently and attentively addressed my queries and offered invaluable advice for my study. The time spent with him is filled with inspiring moments. I am deeply grateful to my mentor and will forever cherish these memories.

I also wish to thank the review committee members and the Doctor of Philosophy Design in the Faculty of Decorative Arts, Silpakorn University, for their generosity in sharing their knowledge, insights, and encouragement. Your reviews and suggestions have significantly enhanced the quality of my thesis.

I sincerely thank my family, especially my parents and relatives. Your unwavering support and trust have been the driving force behind my endeavors. I appreciate your understanding and encouragement throughout my academic journey.

Furthermore, I am grateful to my classmates and friends. Your friendship and collaboration have helped me overcome challenges in my academic and personal life. We have grown, encouraged each other, and shared knowledge and experiences.

At this special moment, I extend my deepest thanks to everyone who has supported and accompanied me. Completing this doctoral thesis would not have been possible without your help and support. Thank you all!

Fankai NIE

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1.1 BACKGROUND AND SIGNIFICANCE OF THE PROBLEM

1.1.1 CONTEXT AND SIGNIFICANCE OF THE PROBLEM: THE INTEGRATION OF CULTURE AND TOURISM PROMOTED BY POLICY DOCUMENTS

As China's economy advances, the demand for a better quality of life among its people is growing. The cultural tourism industry has become a significant means of enhancing the country's soft cultural power. In the context of economic experience, tourists' expectations for cultural tourism have shifted from superficial travel experiences to profound cultural engagements. Therefore, creating interactive digital cultural tourism experiences that are engaging and immersive at tourist destinations is key to promoting the deep integration of culture and tourism.

Since the Guidance on Promoting the Integrated Development of Culture and Tourism (China, 2009) proposed the development of tourism using cultural resources, the deep integration of culture and tourism under new circumstances has been highly valued. The institutional reform plan of the State Council in 2018 announced the establishment of the Ministry of Culture and Tourism, adhering to the policy orientation of promoting tourism through culture and showcasing culture through tourism. In 2019, the General Office of the State Council issued a document on the Opinions on Further Unleashing the Potential of Cultural Tourism Consumption (China, 2019), proposing to empower cultural tourism with the digital culture industry and promote the innovative application of new information technologies such as "Internet+," VR, AR, 5G, etc., in the field of cultural tourism. In 2020, the Ministry of Culture and Tourism proposed accelerating the construction of smart tourism attractions, actively building digital museums and exhibition halls, continuing to deepen "Internet+ tourism," and promoting high-quality development of the tourism industry, thus advancing the high-quality development of a major tourism country (China, 2020).

1.1.2 DIGITAL TECHNOLOGY EXPANDS NEW IDEAS FOR THE DEVELOPMENT OF INTERNET+ TOURISM

With the advancement of information technology, traditional tourism modes can no longer meet the needs of modern society. As a result, many tourist destinations seek to improve the tourism experience through the Internet and mobile clients, promoting a deep cultural experience. Most travel apps on the App Store involve comprehensive service, providing all-around convenient services for tourists, such as scenic spot tickets, hotels, and guides, as well as audio and text introductions on scenic spots. There is a severe homogenization in overall visuals and functionality, and online platforms are not effectively connected with offline tourist destinations, lacking personalized and engaging cultural tourism experiences to some extent. In recent years, the Palace Museum has produced a series of supporting apps, such as the Palace Museum Exhibition, Palace Museum Daily, Han Xi Zai's Night Banquet, and Forbidden City. These apps, in digital form, showcase the cultural relics of the Forbidden City and provide a rich experience of traditional art and court culture: "A Day in the Life of the Emperor" combines elements of popular role-playing, puzzle-solving, and collection games, allowing users to understand the emperor's day through different tasks. Interactive maps enable users to visit more than 30 Forbidden City buildings, including the Qianqing Palace, the Imperial Garden, and the Changyin Pavilion. These auxiliary applications from the Forbidden City have been well-received by the public and provide new ideas for the innovative "Internet+ tourism" model. Can we use gamification to improve and optimize the tourism experience to meet the diverse needs of cultural tourism under new circumstances?

1.1.3 GAMIFICATION ENHANCES THE TOURISM EXPERIENCE

At the 2011 GDC conference, a new concept was announced: gamification. In short, gamification is the application of game thinking and mechanics in other areas to guide user interaction and usage. It involves adopting game design elements and mechanics in non-game contexts to engage users actively. In the tourism sector, this means changing the travel mode of scenic spots through gamification while allowing tourists to interact with scenic spots in a game-like manner, thereby enhancing the cultural tourism experience.

This background highlights the significance of integrating culture and tourism, particularly in the context of China's economic advancement and policy support for cultural tourism. With increasing expectations for profound cultural engagement among tourists, there is a growing need to develop interactive and immersive digital cultural tourism experiences. The Chinese government's policy documents emphasize the importance of leveraging digital technologies to promote the deep integration of culture and tourism. Given the existing challenges in traditional tourism modes, including the homogenization of digital tourism apps and the lack of personalized and engaging experiences, this research seeks to explore the potential of gamification in improving the cultural tourism experience. Gamification, defined as the application of game design elements in non-game contexts, has the potential to transform tourist interactions with cultural sites, creating a more engaging and enriching experience.

1.2 RESEARCH OBJECTIVES

1.2.1 To explore the concept of gamification and the use of gamified digital tools in enhancing the tourism experience in Huizhou's cultural tourism.

1.2.2 To propose guidelines for the design of digital tools for cultural tourism gamification.

1.2.3 To develop and evaluate a Huizhou cultural tourism gamified digital tool.

1.3 RESEARCH QUESTIONS

1.3.1 Can gamification enhance user willingness to utilize digital tools for cultural tourism?

1.3.2 Can gamified digital tools enhance tourists' travel experiences?

1.3.3 Can gamified digital tools in cultural tourism effectively improve tourist experiences?

1.4 SIGNIFICANCE OF THE RESEARCH

By studying gamification design theories and methods, this research explores how to combine gamified digital tools with the Huizhou cultural tourism experience. Its goal is to develop design strategies for gamified tourism experiences and give practical advice on making digital tools for cultural tourism in Huizhou. The study

aims to determine what users want and encourage active participation by designing gamification methods to improve the tourism experience at cultural tourist attractions in Huizhou. The goal of this approach is to make users happy while visiting attractions, making them more likely to stick with and remember gamified digital tools for Huizhou cultural tourism in the long term. This would facilitate convenience for tourists, increase the enjoyment of tourism activities, and better disseminate local culture.

1.5 RESEARCH CONCEPTUAL FRAMEWORK

Figure 1

Conceptual Framework

Source: Created by the author

This research proposes an integrative conceptual framework to explore the application of gamified digital tools in cultural tourism. The framework regards

cultural tourism as the foundational platform for practice (Figure 1). Digital tools serve as the intervening medium, enhancing visitor engagement and experiential value by incorporating gamification strategies such as task-driven activities, point-based incentives, and narrative experiences. User experience, as the perception of the interaction, plays a critical role within this framework (Figure 1). It is an evaluative measure of how effectively gamification strategies and digital tools are integrated to enhance engagement. The cultural tourism environment enriches the context for applying gamified elements, providing vivid content and storylines, and facilitating gamification strategies' deep integration and innovative implementation. Gamification technology, in turn, drives a significant increase in user engagement by enhancing the interactivity and appeal of digital tools. Digital tools build a convenient bridge for interaction between tourists and cultural tourism through their informational services, directly influencing the overall user experience.

1.6 RESEARCH HYPOTHESES

The research aims to examine the impact of gamification elements in digital tools for Huizhou cultural tourism, with the expectation that they will function through the following mechanisms:

1.6.1 Gamification strategies will positively influence user motivation to use Huizhou cultural tourism digital tools, enhancing their willingness to engage.

1.6.2 Gamified digital tools for cultural tourism will increase user participation in tourism activities.

1.6.3 Gamified digital tools for cultural tourism will effectively deepen users' perception and memory of cultural knowledge about attractions.

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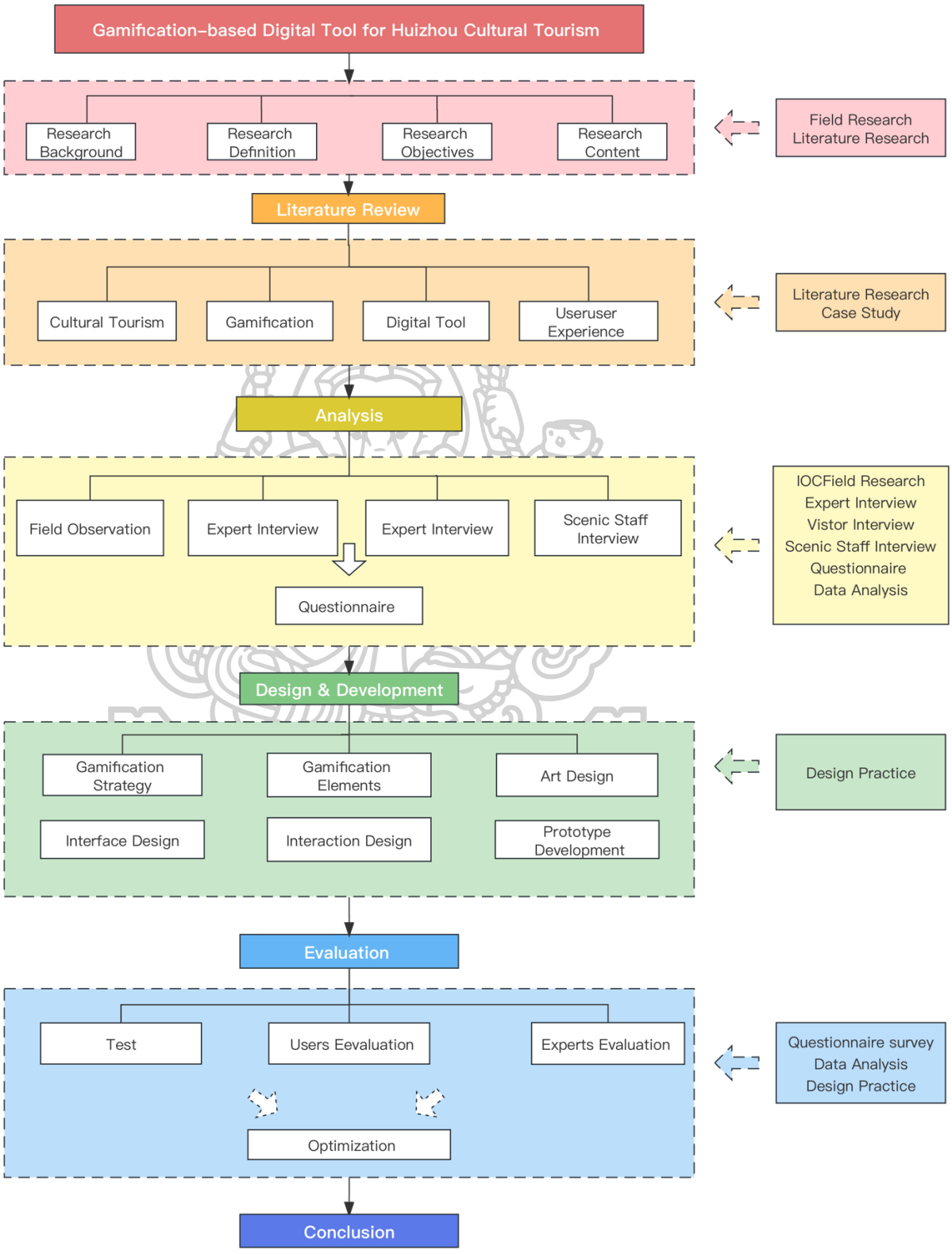
1.8 RESEARCH FRAMEWORK

The research aims to design a gamified digital tool for mobile devices tailored to Huizhou's cultural tourism. It intends to enhance the convenience of tourists during their travels by incorporating relevant cultural tourism information services and to increase the enjoyment of tourism activities through gamified elements (tasks, points, badges), thereby strengthening cultural dissemination.

Figure 2

The Research Framework



Source: Created by the author

As shown in Figure 2, the domestic and international gamification cases in cultural tourism are examined to understand the existing gamified solutions' classification, functions, and applications. By visiting Huizhou's cultural tourism sites and interviewing the staff, the current state and digital service levels of Huizhou's cultural tourism sites were assessed. Subsequently, interviews and surveys were conducted with experts, site staff, and tourists to analyze the user needs and objectives for a gamified digital tool in Huizhou's cultural tourism. After determining the product's features, style, and technical standards, a prototype of the gamified digital tool was completed and released for user testing and use. Finally, based on the feedback and recommendations from test users and experts, the prototype was optimized to establish a conclusive model.

1.9 PRELIMINARY AGREEMENT

1.9.1 The researcher reviewed the literature and case studies on gamified digital tools in the cultural tourism sectors of China and abroad.

1.9.2 Based on the cultural tourism resources of Huizhou's scenic areas, the development of a gamified digital tool that enhances the visitor experience and interest is proposed.

1.9.3 The researcher, guided by expert ratings and recommendations, has designed a survey to study the acceptability of the gamified digital tool for cultural tourism in Huizhou among tourists.

1.9.4 The survey respondents must be tourists participating in Huizhou's cultural tourism.

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1.10.1.2 Study relevant cases.

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1.10.7 CONCLUSION

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1.10.7.2 Discuss the limitations encountered during the study.

1.10.7.3 Propose recommendations based on the findings and limitations.

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1.11 DEFINITIONS USED IN THE RESEARCH

1.11.1 CULTURAL TOURISM

Cultural tourism refers to travel activities primarily motivated by the exploration and experience of a destination's cultural attributes. This process encompasses the recognition and appreciation of local arts, heritage, and other cultural expressions. Specifically, cultural tourism may include visits to historical sites, viewing art exhibitions, participating in festivals or ceremonies, experiencing traditional crafts, and tasting local cuisine. These experiences provide entertainment and leisure opportunities and, more importantly, promote deep understanding and respect for a particular region or people's history, traditions, beliefs, and lifestyles. Cultural tourism is not just a journey; it is an interactive and educational process

aimed at deepening cultural exchange and understanding while also playing a crucial role in protecting and transmitting cultural heritage.

Huizhou City, located in Guangdong Province, has a long history of more than 1,400 years and is a national historical and cultural city in China. The city has rich historical and cultural resources, including numerous historical sites and cultural landmarks, which have attracted many historical celebrities, among whom the most famous is Su Shi. a renowned writer, calligrapher, and painter in the Northern Song Dynasty and one of the important figures in Chinese cultural history. During his stay in Huizhou, he visited many local attractions. He also created many poems depicting Huizhou's scenery and folk customs, which became important documents for later generations to understand Huizhou's history and culture. Su Shi is the central cultural icon in Huizhou's cultural tourism strategy, and the attractions related to him are important cultural tourism resources.

1.11.2 GAMIFICATION

Gamification involves integrating game elements into non-game settings, with the core purpose of enhancing individual engagement and intrinsic motivation for specific activities. This strategy is widely used to stimulate user enthusiasm, optimize the user experience, promote the formation of specific behavioral patterns, enhance the effectiveness of educational activities, and increase the attractiveness of participation in tasks or activities. Gamification practices typically include the introduction of progress-tracking mechanisms, achievement systems, point incentives, competitive rankings, virtual rewards, narrative frameworks, and role-playing elements. These components trigger users' intrinsic motivational factors and enhance engagement through extrinsic reward mechanisms. This comprehensive application aims to create an environment with high interactivity and engagement, thereby fostering deeper participation and interaction among users.

1.11.3 CULTURAL TOURISM DIGITAL TOOLS

Cultural tourism digital tools refer to functional software systems designed specifically for cultural tourism, with the primary goal of enriching tourists' experiences and providing in-depth knowledge and interactive experiences of cultural

heritage, historical landmarks, artworks, and traditional customs. These tools include, but are not limited to, mobile applications, augmented reality (AR) experiences, virtual reality (VR) tours, interactive maps, digital guide systems, social media platforms, and other various online resources. Their design aims to provide tourists with more detailed information and educational resources while visiting cultural sites and attractions, thereby enhancing the quality of the tourist experience.

1.11.4 USER EXPERIENCE

User experience refers to their sensations and reactions while interacting with digital tools. This experience encompasses all aspects of the user's interaction cycle, including their perceptions of functionality, usability, efficiency, satisfaction of expectations, and overall value judgment of the product before and after use.

CHAPTER 2
LITERATURE REVIEW

The scope of the literature search was determined based on the posed questions and research objectives. The researcher utilized the Web of Science database to conduct a literature search with predetermined keywords, examining the number of articles and trends in academic research. The literature search was concluded on May 26, 2023, with the bibliometric results presented in Table 1.

Table 1

Publications in the Last Ten Years on Research in Related Fields

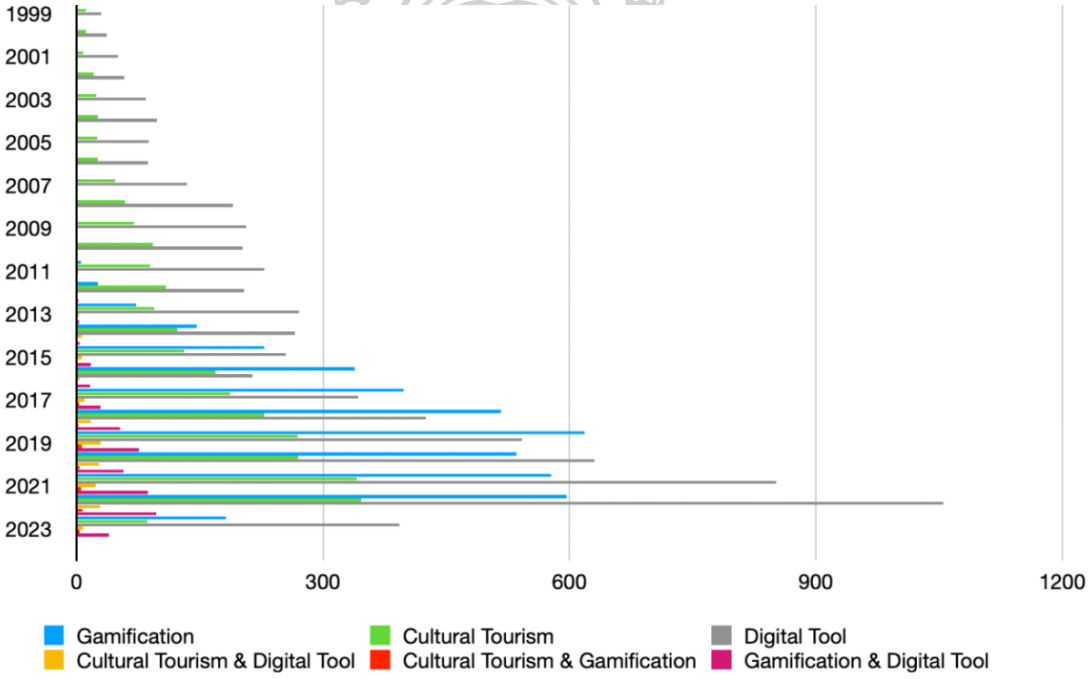
Search Words	Total Articles	Research Areas	Article Count	Percentage
Gamification	4240	Computer Science	2061	48.61%
		Educational	1711	40.35%
		Engineering	916	21.60%
		Business Economics	452	10.66%
		Arts Humanities	87	2.05%
Cultural Tourism	2945	Social Sciences	1345	45.67%
		Business Economic	941	31.95%
		Arts Humanities	594	20.17%
		Environmental	544	18.47%
		Sciences Geography	410	13.92%
Digital Tool	7959	Engineering	4462	58.75%
		Instrumentation	3268	43.03%
		Computer Science	2652	34.92%
		Metallurgy	1014	13.35%
		Arts Humanities	122	1.61%
Cultural Tourism and Gamification	34	Computer Science	14	43.75%
		Arts Humanities	12	37.50%
		Business Economics	8	25.00%
		Communication	3	9.38%
		Chemistry	2	6.25%
Cultural Tourism and Digital Tool	69	Social Sciences	64	37.87%
		Business Economics	61	36.10%
		Arts Humanities	59	34.91%
		Computer Science	40	23.67%
		Information Science	37	21.89%
Gamification and Digital Tool	480	Educational	264	55.00%
		Computer Science	176	36.67%
		Engineering	72	15.00%
		Arts Humanities	13	2.71%

Note: The data were obtained by searching the Web of Science database using the keywords specified by the author.

The literature search using predetermined keywords for articles published in the last decade (Figure 3) indicates that the number of papers published in the field of cultural tourism has been steadily increasing. In contrast, publications in gamification and digital tools have risen rapidly since 2013, becoming hot research topics in recent years. However, the number of related articles is relatively small when conducting a composite search with keywords such as cultural tourism, gamification, and digital tools. These findings suggest that research on gamified digital tools in cultural tourism is still lacking, with limited empirical validation.

Figure 3

Publications in the Last Ten Years of Research in Related Fields



Source: Compiled by the author based on the keyword search results from the Web of Science (1999–2023)

In cultural tourism, the core goal for tourists is to pursue a profound cultural experience. The application of digital tools makes acquiring related information more convenient and provides a quantifiable way of participation. This convenience and quantifiability are further enhanced by gamification elements, effectively increasing user engagement. Therefore, applying gamification strategies combined with digital tools in cultural tourism promises to create a unique and highly participatory travel

experience. Given the limitations of existing research literature, in-depth study in this area holds significant academic and practical value.

2.1 CULTURAL TOURISM

2.1.1 DEFINITION OF CULTURAL TOURISM

Tourism is when individuals leave their residences to visit or relax in another location. In the early stages of tourism development, it was primarily seen as a leisure and entertainment activity, with the main goal being the pursuit of novelty and relaxation. As the tourism industry has evolved and tourism products have become more homogenized, a deeper understanding of tourism has emerged. Tourists have developed more personalized demands for their travel activities (Cohen, 1979), leading to the creation of different types of tourism products, such as cultural tourism, which is primarily aimed at understanding and experiencing the culture of a destination; nature tourism, which focuses on experiencing natural landscapes and wildlife; adventure tourism, which involves activities like mountain climbing, skiing, and rafting; leisure tourism, which is for relaxation and entertainment; and health tourism, which is aimed at wellness and treatment, among others.

The concept of cultural tourism was first introduced by the American scholar MacCannell in the 1970s, who noted that "culture covers all aspects of tourism, through which people can understand each other's thoughts and emotions." Initially, tourism activities mainly involved visiting historical sites, museums, and art galleries or participating in folk activities were defined as cultural tourism (Reisinger, 1994). Over time, tourism resources such as architecture, entertainment, customs, religion, and lifestyle also became important cultural tourism components (Gunn, 2014). The current authoritative definition of cultural tourism in academia is provided by the World Tourism Organization (UNWTO). The UNWTO offers a broad definition of cultural tourism as contact with the way of life, history, heritage, art, and philosophy of the people in the tourist destination. It includes visiting cultural sites and experiencing and understanding the people's lives, culture, history, and heritage. At the same time, the UNWTO also provides a narrow definition, namely, "movements of people for cultural motivations such as study tours, performing arts and cultural tours, visits to historical sites, a study of nature, folklore and art, religious pilgrimages,

festival, and other cultural events travel." Thus, the concept of cultural tourism has gradually expanded and now includes not only tangible cultural heritage (such as architecture and artworks) but also intangible cultural heritage (such as customs, traditions, and lifestyles), as well as emerging fields such as "creative cities" and "creative industries."

Relevant research in China categorizes cultural tourism into the following three types:

1) Cultural tourism is a type of tourism with a broad inclusiveness, encompassing historical and cultural tourism, architectural, garden culture, religious culture, folk culture, and culinary culture tourism (Ma & Shu, 1999).

2) Cultural tourism is a new tourism product. It primarily aims to learn, research, and investigate the culture of the tourist destination's region, such as historical and folk cultural tourism (Meng & Cui, 2001).

3) Cultural tourism is a different kind of travel experience, driven by the interest in seeking a deep cultural experience because any tourism is an experience of a new culture (Wu, 2006).

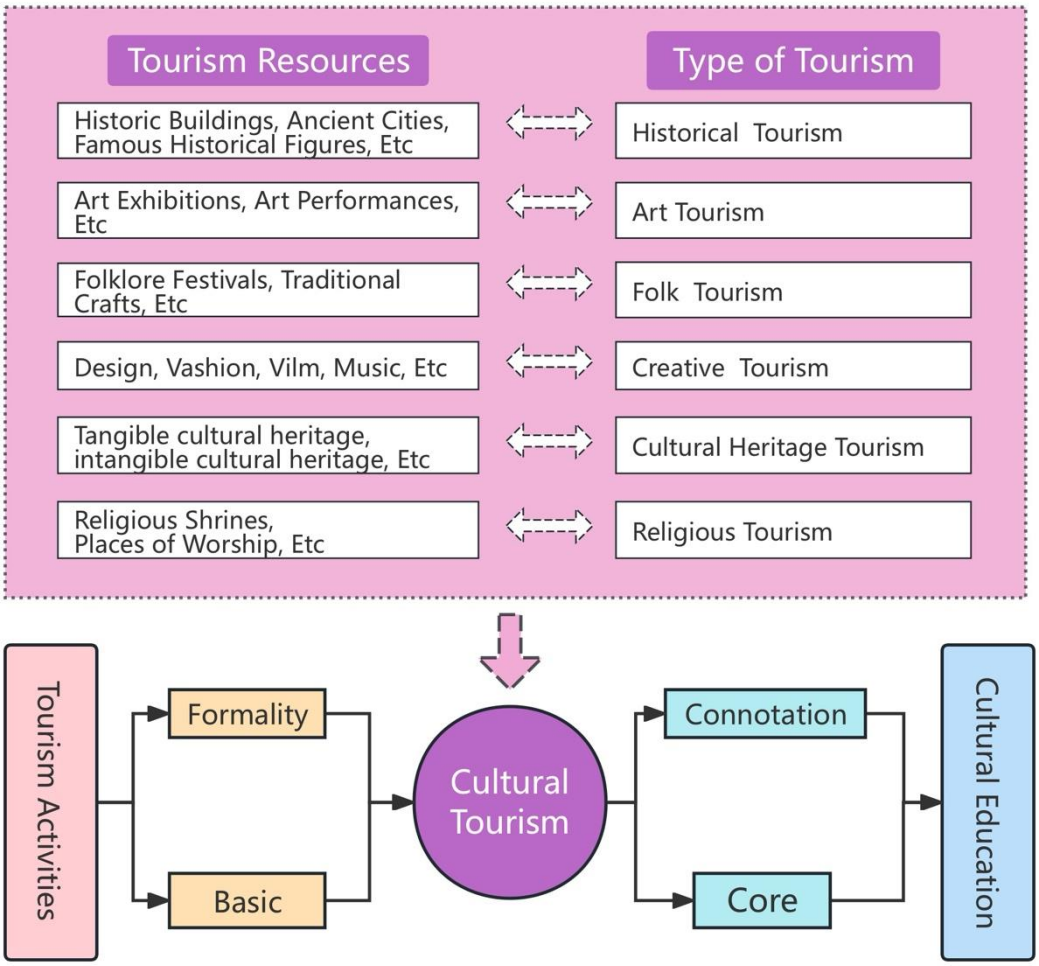
In summary, the research defines cultural tourism as a type of tourism activity based on cultural resources.

2.1.2 TYPES OF CULTURAL TOURISM

The foundation and core of cultural tourism are its resources providing the basis for developing the cultural tourism industry and source of its attractiveness. There is a progressive process in understanding cultural tourism resources. Initially, the focus was on cultural relics and heritage sites with historical and cultural value, and then it became gradually recognized that cultural tourism resources also included many active resources (Dai, 2010). Hence, the connotation of cultural tourism resources is quite rich. It includes static cultural tourism resources such as historical and cultural tourism resources, religious cultural tourism resources, and ethnic folklore cultural tourism resources, as well as dynamic cultural tourism resources such as regional historical and cultural festivals and various artistic performances. Based on the categories of cultural tourism resources, cultural tourism can be subdivided into the following types (Figure 4):

Figure 4

The Cultural Tourism Concept Model



Source: Created by the author

1) Historical Cultural Tourism

This type of tourism primarily focuses on exploring the historical relics and cultural heritage of a destination, such as historical buildings, ancient cities, museums, and monuments.

2) Artistic Cultural Tourism

Art tourism mainly refers to visiting art exhibitions, art festivals, art museums, and galleries, participating in art workshops, and watching performances.

3) Folklore Cultural Tourism

Folklore cultural tourism focuses on local traditions and customs, including folk festivals, specialty foods, traditional crafts, rural tourism, and customs and habits.

4) Creative Cultural Tourism

This type of tourism concerns participating in and experiencing the manifestations of innovation and creativity, covering aspects of design, fashion, film, music, and more.

5) Cultural Heritage Tourism

Heritage tourism mainly relates to visiting and understanding World Cultural Heritage and Intangible Cultural Heritage, including those sites recognized by UNESCO.

6) Religious Cultural Tourism: Religious tourism, also known as pilgrimage tourism, typically involves visiting religious holy places, churches, temples, or other religious sites.

2.1.3 THE SIGNIFICANCE OF CULTURAL TOURISM

According to the World Tourism Organization (UNWTO), approximately 40% of all global tourism activities involve cultural elements, with cultural tourists increasing at an annual rate of 15% (UNWTO, 2016). The role and importance of cultural tourism are multifaceted and profound, holding immense value for tourists, residents, communities, cities, and even the whole of society.

1) Promoting Cultural Education and Dissemination

The most distinctive feature of cultural tourism compared to other types of tourism is the deep experience of the culture in the tourist destination. It provides tourists with unique opportunities to deeply learn and understand history, art, and culture through personal experience and practice (Knapp, 1994). This form of education is more intuitive, vivid, and likely to inspire interest and curiosity, making learning more profound and lasting.

By personally encountering and understanding different cultural customs, traditions, and lifestyles, tourists can directly experience cultural diversity. This form of cultural exchange can promote understanding and friendship between peoples,

reduce divisions caused by cultural differences, and thus help build a more inclusive and diverse global society.

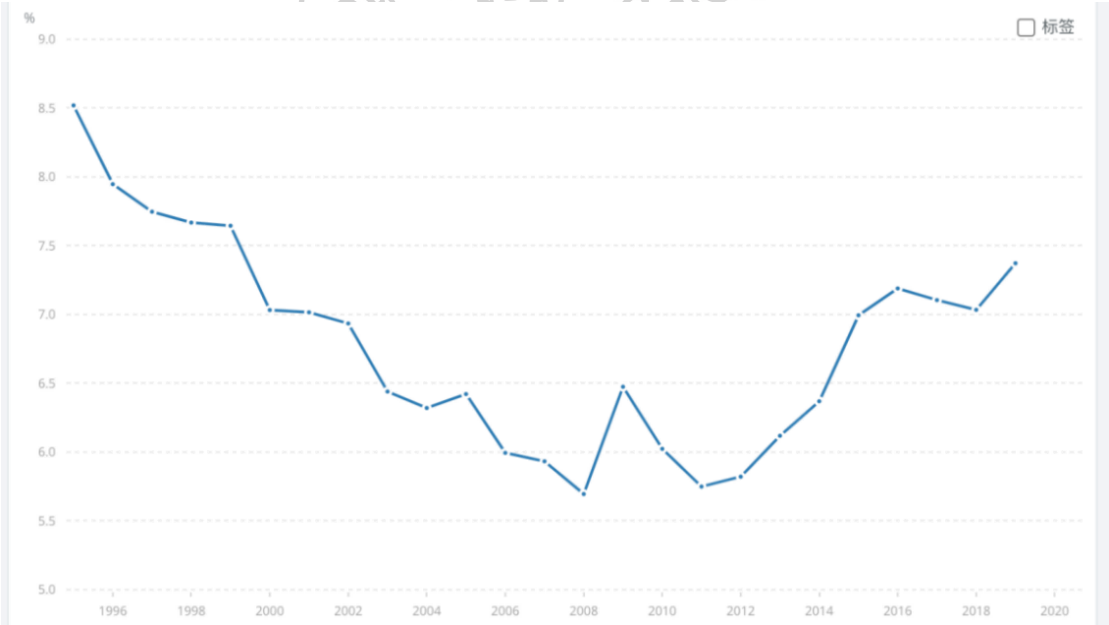
2) Promoting the Protection of Cultural Heritage

The revenue from tourism can be invested in preserving and protecting historical buildings, artworks, and other forms of cultural heritage (McKercher & Du Cros, 2002). By raising public awareness and interest in protecting cultural heritage, cultural tourism can enhance societal recognition toward the importance of preserving cultural heritage.

3) Promoting Economic Development

Figure 5

International Tourism Income Accounts for a Proportion of the Total Foreign Exchange Income of Each Country



Note: The figure shows the approximate percentage of average international tourism r eceipts as a proportion of total foreign exchange earnings for various countries, based on data collected and analyzed by the World Bank from 1996 to 2019. https://data.wor ldbank.org/indicator/ST.INT.RCPT.XP.ZS?end=2020&start=1995.

Tourism creates many job opportunities and drives related industries, such as catering, accommodation, handicrafts, and transportation. In addition, cultural tourism

attracts a significant amount of foreign investment, making it highly socially and economically beneficial. The World Bank's statistical data on more than 200 countries and regions worldwide estimate that international tourism revenue accounts for an average of 7.4% of each country's export earnings (Figure 5).

4) Enhancing Urban Appeal

Cultural tourism helps shape and enhance a city's image, increasing its global recognition and popularity on a global scale (Rabbiosi, 2015). It also gives cities a greater advantage in attracting foreign investment, talent, and other resources.

Beyond the impacts mentioned above, cultural tourism also offers opportunities for leisure and entertainment. Tourists can relax and have fun while visiting historical buildings, art exhibitions, and cultural events, enriching their lives.

2.1.4 CULTURAL TOURISM RESOURCES IN HUIZHOU

Located in Guangdong Province, Huizhou is one of the central cities in the Pearl River Delta region and an important city on the east coast of the Guangdong-Hong Kong-Macao Greater Bay Area. Huizhou covers a total area of 11,347 square kilometers and has four districts and three counties under its jurisdiction. Huizhou City's history, traceable back to the Sui Dynasty, spans over 1,400 years. This extensive history has allowed Huizhou to amass a rich cultural heritage, making it a national historical and cultural city. On the other hand, as a city surrounded by mountains and sea, Huizhou also enjoys beautiful natural scenery. Its unique geographical location endows Huizhou with unique and diverse tourism resources, attracting tourists from all over the country and even the world. Therefore, rich historical and cultural accumulation and beautiful natural landscapes give Huizhou a unique advantage in tourism. Currently, there are 40 national-level A-level tourist attractions in Huizhou City, including 12 tourist attractions with cultural tourism attributes (Table 2) and 47 cultural relics protection units above the provincial level.

Table 2

Classification of National A-Class Cultural Tourism Attractions in Huizhou

Cultural Tourism Attraction	Level
Huizhou West Lake	5A
Luofu Mountain	5A
General Ye Ting Memorial Park	4A
Dongping Kiln Ceramic Culture Park	3A
Gaotanzhongdong Red Tourist Area	3A
Huizhou Science and Technology Museum	3A
Guangdong Aerospace Agricultural Science and Technology Ecological Park	3A
Hakka Po Scenic Area	3A
R&F Wandong Ancient Village Tourist Scenic Spot	3A
Shangdong Yao Township Customs Tourist Scenic Spot	3A
Nanbao Yubao Cultural Industry Park	2A
Former Residence of Deng Chengxiu, Former Residence of Deng Zhongyuan	2A

Source: Created by the author

2.1.5 HUIZHOU CULTURAL TOURISM DEVELOPMENT AND VISION

In recent years, Huizhou has made remarkable achievements in tourism development. Especially in the booming global tourism industry, Huizhou's tourism industry occupies an important position in the local economy. In 2019, Huizhou's total tourism revenue reached US$8,260.87 million, accounting for 13.57% of the city's GDP, more than double the national average (Tables 3 and 4). The number of tourists received throughout the year reached 65.41 million, equivalent to more than 11 times the city's resident population.

However, Huizhou's tourism industry has been greatly affected due to the severe impact of the new crown pneumonia epidemic from 2020 to 2022. However, as the Chinese government fully liberalized epidemic control in December 2022, Huizhou's tourism industry quickly returned to pre-epidemic levels. Take the May Day holiday in 2023 as an example (for five days). Huizhou received 3.0821 million tourists, an increase of 140.8% over 2022 and 6.3% over 2019. Huizhou West Lake scenic area received 550,000 tourists, and Luofu Mountain scenic area received

80,000. Tourism revenue reached US$201.49 million, an increase of 143.8% over 2022 and a 5.1% increase over 2019.

Table 3

Economic Development of China's Tourism Industry in the Last Five Years

Time	GDP of China (T USD)	Tourism Revenue to GDP Ratio	Total Tourism Revenue (M USD)	International Tourism Revenue (T USD)	Domestic tourist arrivals (M)	Inbound Tourist Arrivals (M)
2018	13.89	6.49%	0.9020	0.1271	5539	141.20
2019	14.28	6.73%	0.9613	0.1313	6006	145.31
2020	14.69	2.20%	0.3231	–	2879	–
2021	17.73	2.25%	0.4525	–	3246	–
2022	17.99	1.69%	0.3041	–	2530	–

Source: Created by the author with data from the National Bureau of Statistics of China

Table 4

Economic Development of China's Tourism Industry in the Last Five Years

Time	GDP of Huizhou (M USD)	Tourism Revenue to GDP Ratio	Total Tourism Revenue (M USD)	International Tourism Revenue (M USD)	Domestic Tourist Arrivals (M)	Inbound Tourist Arrivals (M)
2018	63747.59	11.89%	7580.47	1045.29	66.39	2.53
2019	60854.86	13.57%	8260.87	1069.84	62.79	2.61
2020	61185.36	6.13%	3750.43	31.77	22.11	0.09
2021	77168.37	4.41%	3404.65	26.51	28.03	0.07
2022	80302.70	3.11%	2500.41	60.41	23.86	0.05

Source: Created by the author with data from the National Bureau of Statistics of China

With the active promotion of the Huizhou Municipal Government, the development vision of Huizhou's cultural tourism has become clearer and more ambitious. According to the Outline of the Fourteenth Five-Year Plan for Huizhou's

National Economic and Social Development (Government, 2021), 2021 to 2025 will be critical for developing Huizhou's cultural tourism. The focus is on accelerating the development of protective tourism in historical and cultural cities, promoting the protection and utilization of historical blocks, and maintaining and continuing the features of Huizhou's historical and cultural cities.

From a strategic point of view, Huizhou City will be committed to building a cultural tourism zone "around the West Lake" (Figure 6), further protecting and enhancing the West Lake, the most representative cultural tourism scenic spot in Huizhou. The government will increase investment to repair and restore the ancient buildings, cultural sites, and historical blocks around West Lake and add cultural display and experience facilities to enhance the tourist experience. At the same time, it will pay attention to the interaction with residents, promote the inheritance and innovation of traditional culture, and create a cultural tourism brand with unique charm and appeal.

Figure 6

The Huizhou West Lake and Surrounding Cultural Tourism Areas

Source: Drawn by the author from google maps satellite imagery

In addition to developing and protecting scenic spots, Huizhou City will accelerate the digitalization of cultural tourism public services. By building a smart tourism platform and providing convenient digital services, Huizhou City aims to

enhance tourists' experience and satisfaction. At the same time, it will strengthen the excavation and utilization of Huizhou's historical culture, use digital technology to protect and display Huizhou's historical and cultural resources digitally, and present tourists with more three-dimensional and rich cultural tourism content.

2.1.6 SUMMARY

Cultural tourism is a tourism activity whose main purpose is to understand and experience the cultural elements of a destination. It has formed various types according to different tourism resources, including historical and cultural tourism, art and cultural tourism, folk cultural tourism, creative cultural tourism, cultural heritage tourism, and religious and cultural tourism. Therefore, cultural tourism has an important position and extensive influence in tourism and has positive significance for tourists, communities, cities, and the whole society. With the increase in people's emphasis on and demand for cultural tourism, further research and the promotion of cultural tourism have become important tasks for the academic community.

Huizhou City has a rich historical and cultural heritage and a beautiful natural landscape, so it has a significant competitive advantage in tourism. According to the development plan, Huizhou City will actively accelerate the development of protective tourism in historical and cultural cities in the future and use digital technology as a support to enhance the ability of local cultural tourism public services. It will use digital technology to protect and display Huizhou's historical and cultural resources, presenting tourists with more three-dimensional and rich cultural tourism content. This development trend provides a broader practical application value for this research.

2.2 CULTURAL TOURISM DIGITAL TOOLS

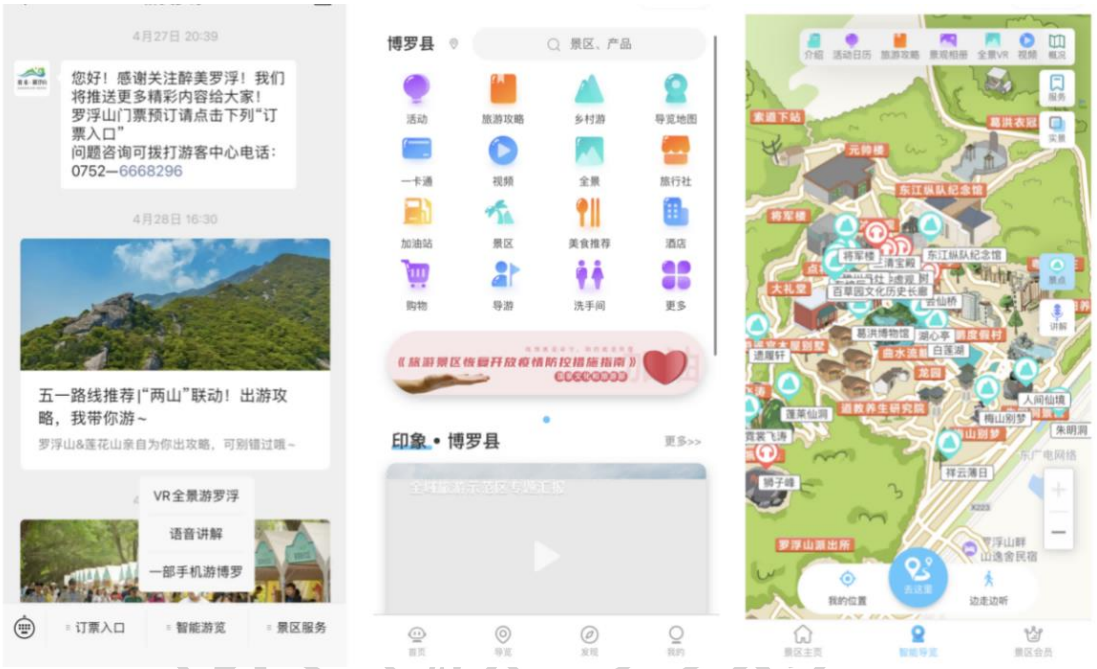
2.2.1 DEFINITION OF CULTURAL TOURISM DIGITAL TOOLS

Digital tools use digital technology to help improve the efficiency of performing specific tasks. The concept of digital tools is relative; it does not refer to any specific thing (software, application) but encompasses any tool that uses digital technology to enhance the efficiency of a task. Similarly, cultural tourism digital tools are a relative concept. The research defines cultural tourism digital tools as

applications and software used on portable, interactive smart mobile devices (smartphones, tablets) that help enhance the cultural tourism experience (Figure 7). These tools integrate and present information, resources, and services related to cultural tourism in a digitalized manner, providing tourists with convenient and personalized cultural tourism experiences.

Figure 7

Luofu Mountain Cultural Tourism WeChat App



Source: Screenshot by the author, March 8, 2023

2.2.2 THE BENEFITS OF DIGITAL TOOLS TO IMPROVE THE TRAVEL EXPERIENCE

Rapid information and communication technology advancements have revolutionized the tourism industry and greatly enhanced tourists' experience (Neuhofer et al., 2014). Li and Zhang (2015) studied tourists' downloads and the use of tourism apps, exploring the factors affecting tourists' attitudes toward their use. F. Xu and L. Huang (2018) researched the willingness to use smart tourism systems in scenic areas, mainly the TAM and TTF research models, to verify the factors affecting tourists' behavior in using the system. Huang et al. (2017) found that smart tourism technologies, such as tourism websites, social media, and smartphones, on the one

hand, promoted exploratory use by tourists, while on the other hand, brought exploitative use, i.e., negative impacts caused by concerns over tourists' safety and privacy. Marques and Borba (2017) discussed the application of digital technology in tourism cities, finding that digital technology could meet the common needs of different stakeholders, resolve conflicts between tourists and residents, and improve cities' material and socio-cultural structure.

From the tourist experience and behavior perspective, information and communication technology has expanded tourism's temporal and spatial boundaries, opening new ways and processes of experience for tourists. By using digital tools for information access and booking, tourism has gradually become self-arranged, providing tourists with convenient information search and problem-solving in foreign environments (Xiang & Gretzel, 2010). Through social sharing, online reviews, and interactive online methods, tourists participate in the design of tourism services, realizing the co-creation of tourism services and products (Sfandla & Björk, 2013). Mobile devices, represented by smartphones, have greater value in information collection, experience enrichment, and construction, mainly reflected in providing convenient services during the tourism process (navigation, booking), communication (sharing tourism experiences), and entertainment (games, music, movies) (Wang et al., 2014).

However, the academic community has gradually recognized the negative impacts of tourism digital tools. Increasing evidence shows that tourists are dissatisfied with the intrusion of technology into daily life (Lay, 2014), and the ubiquity of mobile technology disrupts people's daily lives, blurring the time and space of work and leisure (Augner & Hacker, 2012). From the perspective of tourism experience, prolonged use of mobile devices can distract tourists during the travel process, which could be more conducive to the recovery of the tourist experience (Ayeh, 2018). When individuals become dependent on technology, they become emotionally attached to a particular technology, are more willing to use it, and enjoy interacting with it. However, once tourists' dependence on technology exceeds a certain threshold, it can lead to dependence and addiction to technological tools, resulting in severe negative impacts (Li et al., 2006).

2.2.3 PRINCIPAL FUNCTIONS OF DIGITAL TOOLS IN CULTURAL TOURISM

In responding to tourists' diverse needs and preferences, digital tools in cultural tourism exhibit a broad and rich functionality. Currently, the primary functional characteristics of these tools are as follows:

1) Maps and Navigation

These tools often provide geographical location information and navigation capabilities for cultural tourism attractions. Tourists can utilize map applications or travel guide apps to locate and discover cultural sites and activities of interest quickly and further plan their travel itinerary.

2) Attraction Interpretation

Digital tools offer in-depth explanations of cultural attractions, including but not limited to relevant historical and cultural backgrounds and information about artworks. Tourists can access knowledge of cultural sites anytime and anywhere via mobile applications or audio guide devices, enhancing their understanding and appreciation of culture.

3) Virtual Tours

Through augmented reality (AR) or mixed reality (MR) technologies, digital tools in cultural tourism can provide immersive virtual tour experiences. They can simulate actual site environments and scenarios, allowing tourists to freely explore and experience a virtual space.

4) Activity Management

Tourists can obtain information about local cultural activities through related applications, facilitating participation and planning itineraries.

5) Social Sharing

Tourists can share their travel experiences and insights through platforms. These platforms may be social media applications, online forums, or cultural tourism communities, where tourists can share their cultural travel experiences, exchange views, and offer suggestions.

2.2.4 CHALLENGES OF DIGITAL TOOLS IN CULTURAL TOURISM

The primary developers of digital tools in cultural tourism are concentrated in cultural tourism scenic areas, government departments, and academic research institutions. These entities recognize the importance of digital technology in enhancing the cultural tourism experience and meeting tourist needs and have invested resources in developing relevant tools. Despite the great potential of digital tools for enhancing the cultural tourism experience and meeting tourist demands, they still need to overcome several challenges and issues. One of these is user experience and usability. Although these digital tools offer a wealth of functions and services, users may sometimes encounter complex interfaces, poor user experiences, or difficulties in operation. This may hinder user engagement and reduce the effectiveness and impact of the digital tools (Xu & Huang, 2018). To address this issue, it is necessary to focus on user experience and usability design, simplifying interface operations, and providing clear navigation and guidance to ensure users can easily use and enjoy the convenience of cultural tourism digital tools (Stankov & Gretzel, 2020).

Another issue is content quality. With the rapid development of cultural tourism digital tools, there is a situation where the quality of content could be better, and authenticity is difficult to guarantee. Some applications and platforms have content that could be more varied and engaging, failing to attract tourists' interest, resulting in low usage rates. To meet tourists' demands for high-quality cultural tourism content and services, it is necessary to strengthen the focus and attention on the content design of digital tools (Lai, 2015). As an important medium for conveying cultural tourism information and experiences, the quality and accuracy of content design in digital tools significantly impact tourist satisfaction and the quality of experience. In designing digital tool content, it is important to provide reliable, accurate, and comprehensive cultural tourism information, ensuring the authenticity and authority of the information. At the same time, tourists' interests and needs should be considered. The content should be attractive and engaging through careful planning and presentation to stimulate tourists' interest and desire to explore.

Furthermore, challenges also exist in standards and interoperability. Since the design of cultural tourism digital tools needs to be customized according to the

characteristics of different cultural tourism scenic areas, it is common for tourists to use different digital tools in different scenic areas. There are various applications, platforms, and systems on the market, and the standards, data formats, and interfaces they use are also different, leading to difficulties in data interchange and sharing. This causes inconvenience to tourists and tourism practitioners and limits the integration and interoperability of digital tools. To solve this problem, it is necessary to establish unified standards and specifications to promote the interconnectivity of different digital tools to improve the interchangeability and shareability of data (Sadeghi et al., 2022), thereby providing users with a more convenient and seamless cultural tourism experience.

Privacy and data security are also important issues. User's personal information and behavioral data are also collected and stored using cultural tourism digital tools. This involves privacy protection and data security (Masseno & SANTOS, 2018). Users are concerned about the misuse, leakage, or cyber-attacks of personal information, which can harm user trust and the use of digital tools (Choi et al., 2023). Therefore, it is necessary to establish a sound privacy protection mechanism to ensure users' personal information is properly handled and protected, strengthening data security management, and taking measures to prevent and respond to security risks.

2.2.5 SUMMARY

Synthesizing the preceding content, digital tools in cultural tourism hold immense potential for enhancing the cultural tourism experience and fulfilling the needs of tourists. By digitally integrating and presenting information, resources, and services related to cultural tourism, these tools offer tourists a convenient and personalized cultural tourism experience. As gamified digital tools in cultural tourism, it is essential to prioritize user experience and usability, improve content quality and personalized services, promote the development of standards and interoperability, and strengthen research in privacy protection and data security. Additionally, conducting specific research on the effective assessment of cultural tourism digital tools in application scenarios is advisable, providing more valuable guidance and suggestions for practical application.

2.3 GAMIFICATION

2.3.1 DEFINITION OF GAMIFICATION

Despite its current widespread attention, Nick Pelling first used the term "gamification" in 2002 (Marczewski, 2013), but it was not until after 2011 that it started to garner academic interest. Deterding, Dixon, et al. (2011) were among the first to define gamification as applying game elements in non-game contexts. Subsequently, Werbach (2014) refined this definition, viewing gamification as a process that makes activities more game-like. These early definitions arose from the perspective of service providers or designers and did not fully consider the user's subjective experience.

Huotari and Hamari (2012) were the first to focus on the psychological effects of gamified systems and deepened the definition in subsequent research. Gamification is a design approach to develop systems, services, organizations, or activities that evoke game-like experiences and motivations, influencing user behavior (Huotari & Hamari, 2017). Similarly, Reiners and Wood (2015) saw gamification as a design strategy that changes behavior by providing enjoyable experiences. Some scholars define gamification as using game-like features in technology to enhance user experience and motivation, leading to a change in their behavior (Högberg et al., 2019).

From the above discussion, it is evident that early definitions of gamification placed too much emphasis on the designer's perspective, neglecting the user's subjective experience. In recent years, researchers have begun to re-examine this definition, shifting toward understanding and interpreting gamification from the user experience perspective, focusing on the impact of gamification on user experience. Gamification is seen as a multi-step process, including the induction of motivation, generation of psychological effects, and change in behavior (Koivisto & Hamari, 2019). In practice, gamification designers integrate game elements into systems to stimulate motivation, thereby affecting the user's psychological state and, in turn, changing their behavior. Therefore, the research defines gamification as a design strategy that uses elements derived from game design (gamification elements) in non-game domains to evoke game-like experiences and influence user behavior.

2.3.2 DISTINCTION BETWEEN GAMIFICATION AND GAMES

Although the origins of gamification research can be traced back to games, there are many unique differences between gamification and games. First, they differ conceptually. Juul (2010) provided six basic conditions to form a game: rules, variable and quantifiable outcomes, valorization of outcomes, player effort, player attachment to outcomes, and negotiable consequences. In contrast, McGonigal (2011) described four defining traits of games: clear goals to inspire enthusiasm and focus, rules to provide a fair, competitive environment, voluntary participation to attract and motivate users with pleasant experiences and rewards, and active engagement to allow users to participate and influence the development of the game actively. Gamification, conversely, is the application of game design elements in non-game domains to evoke gamified experiences and influence user behavior. Thus, the concepts of gamification and games are distinct.

Secondly, their objectives differ. Gamification is primarily used to enhance user stickiness in different contexts, while games are mainly for entertainment (Hamari et al., 2016). A gamified application is an entity embedded in a non-game context; it is not a complete game in itself, but its enhancement comes from introducing some game design elements (Deterding, Sicart, et al., 2011). It means the game elements in a gamified application, such as badges or virtual avatars, are unnecessary for its core function. However, without game elements, a game ceases to exist (Eppmann et al., 2018). Therefore, game elements are not the core function in gamified applications, while in games, they are indispensable.

2.3.3 GAMIFICATION ELEMENTS

Gamification elements are the core components of the gamification concept, representing all the components and aspects required to design and understand gamification (Schöbel et al., 2020). Common gamification elements include points, badges, and leaderboards (Codish & Ravid, 2014). However, the potential of gamification extends beyond just "high scores" and "badges" (Wiegand & Stieglitz, 2014). (Hamari et al., 2014) listed ten typical gamification elements: points, badges, leaderboards, levels, narrative, clear goals, feedback, rewards, progress, and

challenges. These typical elements have been widely recognized in subsequent research (Högberg et al., 2019; Kim & Castelli, 2021).

Points measure user performance, such as scores and experience points (Toda et al., 2019). Some researchers view them as manifestations of a reward system (Maican et al., 2016). Points are often used to represent individual progress and performance, thus potentially evoking a sense of self-efficacy and promoting direct competition (Hamari, 2017).

Badges are viewed as visual representations of achievements, forming part of the reward mechanism when users reach specified goals (Zichermann & Cunningham, 2011). They contain symbolic elements (such as the visual and textual cues of the badge), rewards (such as the badge earned), and the specific conditions for obtaining the badge (Hamari, 2017), while badges can be seen as a form of external motivation, such as symbols of social status and identity (Hamari, 2017; Silic & Back, 2017).

Leaderboards display scores sorted by specific success criteria, presented alongside the names of the participants (Groening & Binnewies, 2019). On leaderboards, individuals can showcase their achievements in a timely and ongoing manner and see others' achievements, thereby adjusting their actions accordingly (Zichermann & Cunningham, 2011). Leaderboards can foster a sense of competition among users (Hamari et al., 2014) and satisfy users' needs for competence and autonomy (Sailer et al., 2017).

Levels refer to the tiered game stages that allow users to gain new advantages as they progress, also known as character levels or skill levels (Toda et al., 2019). Over time, users can track their progress through system goals. Levels are often presented visually, such as progress bars, stars, or flags moving toward a specific goal (Klock et al., 2020).

Narratives are how stories are told in games through text, voice, or sensory resources (Toda et al., 2019), also known as themes or storytelling. They are a continuous combination of storylines embedded in the activities and characters of the game. Narrative contexts can be realistic non-game situations or analogies of real situations (Sailer et al., 2017), such as being chased by zombies while running. An interesting and powerful story or narrative fosters a sense of immersion (Goethe, 2019). In current gamification research, functions related to progress and achievement

are most used. In contrast, functions related to immersion (such as narratives and virtual characters) are less utilized (Koivisto & Hamari, 2019).

Clear goals require users to set explicit behavioral targets and recommend certain actions to users (to achieve the expected goals during system use) (Orji et al., 2017). They ensure that users have goals and focus, providing feedback about the process to increase motivation (Goethe, 2019). Without clear goals, users cannot know if their efforts are getting closer to the overall goal or who will win the goal. Clear goals give users autonomy to achieve goals in creative ways.

Feedback pushes relevant information to users (Klock et al., 2020). Gamification offers many elements to satisfy users' needs for feedback, such as points, progress bars, badges, ratings, or leaderboards (Hamari et al., 2014).

Rewards are presented after a behavior to repeat or reinforce that behavior; they can be tangible or intangible (da Rocha Seixas et al., 2016). Rewards transform users' time and effort in the game into quantifiable, comparable, and exchangeable forms (Goh et al., 2017).

Progress allows users to determine their position and process within the system, also known as progress, bars, maps, or steps (Toda et al., 2019). Users can visually see their progress at different levels, such as the number of contributions, experience, or frequency of use of knowledge management systems (Friedrich et al., 2020). Percentages inform users how far they are from completion, allowing them to see their growing capabilities, thus evoking a sense of achievement and increasing their motivation to progress (Eisingerich et al., 2019).

Challenges are units of playable content that set a high goal for users to achieve within time or other constraints in exchange for rewards within the game (Khoshkangini et al., 2021). Challenges can be various situations that need to be handled or resolved, boss battles, or any other action, quiz, or task that requires effort from the user to complete (Klock et al., 2020). They can cultivate users' autonomy (Van Roy & Zaman, 2019) and enhance the pleasurable experience (Mulcahy et al., 2020).

2.3.4 GAMIFICATION IN CULTURAL TOURISM

In the tourism industry, gamification has revealed its potential value throughout the travel experience cycle. These tools provide destination information, enhance user interaction and experience, and promote social sharing, paving new strategies for destination marketing and user engagement (Table 5).

Table 5

The Benefits of Gamification for Cultural Tourism

Usage Scenarios	Benefits	Use Effect	Recommended Literature
Before Travel	Promote marketing Increase brand awareness Generate interest Converting users to visitors	Provide tourism information to potential visitors and lead to generating interest in traveling to the destination. Expand brand marketing and increase brand awareness.	(Çeltek, 2010) (Xu et al., 2016) (CORRÊA & KITANO, 2015) (Dubois & Gibbs, 2018) (Arif et al., 2021)
In-Travel	Entertainment Enhance experience Engagement and interaction Promote cultural understanding	Based on practical features such as LBS games encourage visitors to interact with real tourist attractions on-site. Providing an experiential, fun, and educational travel experience.	(Quiroz-Fabra et al., 2022) (Chan et al., 2020) (Lu et al., 2020) (Xu et al., 2017) (Luimula & Trygg, 2016)
Pre-Travel	Share experiences Enhance memories Repeat visit Secondary dissemination	Encourage the sharing of travel experiences through the game, which serves to evoke memories and invite friends to promote the cultural attractions. Share rewards/coupons in the game to enhance user stickiness.	(Pasca et al., 2020) (Bakhsheshi & Ghaziani, 2019) (Stadler & Bilgram, 2016) (Sigala, 2015) (Xu et al., 2013)

Source: Created by the author

In the pre-travel phase, gamification elevates brand visibility through marketing activities and sparks interest among potential tourists, aiding in converting prospective users into actual visitors. By offering comprehensive destination information, some applications extend the brand's market influence and effectively heighten public brand awareness.

During the journey, gamification, with its entertaining nature, enhances the travel experience. Location-based service (LBS) gaming features encourage real-time interaction between tourists and on-site attractions, offering an experience that is immersive, fun, and educational. This interaction deepens the tourists' cultural understanding and increases engagement and satisfaction levels.

After the trip, gamification encourages users to share their travel experiences through reward-sharing mechanisms, which not only strengthens the memories of the trip but also promotes secondary publicity and repeat visits to the destination. In-game rewards and coupons enhance user retention and motivate users to invite others to participate, amplifying the cultural attractions' impact.

The research aims to delve into how gamified digital tools can enhance the tourist experience. Building upon existing research, the application of gamification strategies can enrich the travel experience by focusing on the following key areas:

1) Enhancing Visitor Engagement

Gamification increases visitor engagement by setting interesting challenges and tasks and offering rewards and incentives while providing personalized and customized experiences. It stimulates interest and participation (Eisingerich et al., 2019; Lu et al., 2020; Xi & Hamari, 2020). Additionally, gamification can increase individual intrinsic motivation. Based on the Self-Determination Theory, Wee and Choong (2019) found that gamification elements could enhance intrinsic motivation for energy-saving behavior by satisfying users' autonomy, competence, and relatedness needs. Xi and Hamari (2019) examined the relationship between three gamification characteristics and the satisfaction of internal needs, finding that immersion-related gamification elements could satisfy users' autonomy needs, while achievement and social-related elements could meet their needs for autonomy, competence, and relatedness.

2) Improving the Tourist Experience

Gamification designs offer engaging and motivating digital media content, making tourists more willing to use digital tools and applications for cultural tourism, leading to more enjoyable and meaningful travel experiences. Tourists can gain a more diverse travel experience through personalized tours, in-depth explanations, and interactive experiences provided by gamified digital tools and applications (Coghlan & Carter, 2020; Mesáro et al., 2016; Pendit et al., 2015). The characteristics of gamification enable tourists to experience the cultural essence of cultural tourism sites more immersively, enhancing their understanding and appreciation of cultural backgrounds, historical stories, and the significance of artworks.

3) Increasing Educational and Learning Effects

Gamification entertainingly promotes learning and education on cultural tourism sites (Khan et al., 2020). Through tasks, challenges, and puzzles in games, tourists can actively participate and gain an in-depth understanding of the cultural content carried by the sites (Luimula & Trygg, 2016). Gamification designs can provide interactive and immersive experiences (Figure 8), allowing tourists to better understand historical scenes, cultural sites, and artworks, enhancing their cognition and knowledge of cultural tourism (Argyriou et al., 2020).

Figure 8

The Rethymno 360° Immersive Video Virtual Tour

Note: The figure demonstrates how AR technology enhances the visitor experience by overlaying digital information onto physical environments (Argyriou et al., 2020).

Gamification entertainingly promotes learning and education about cultural tourism sites (Khan et al., 2020). Through tasks, challenges, and puzzles in games,

tourists can actively participate and gain an in-depth understanding of the cultural content carried by the sites (Luimula & Trygg, 2016). Gamification designs can provide interactive and immersive experiences (Figure 8), allowing tourists to better understand historical scenes, cultural sites, and artworks, enhancing their cognition and knowledge of cultural tourism (Argyriou et al., 2020).

4) Promoting Social Interaction and Cooperation

Gamification encourages tourist interaction and cooperation by introducing competitive elements and team cooperation tasks. For example, gamified mechanisms can shape experiences of competition and cooperation (Leclercq et al., 2018). Tourists can explore and solve problems together, enhancing communication and cooperation. This social interaction enriches the travel experience and strengthens the sense of participation and belonging to cultural tourism sites. Through gamification strategies, tourists can share experiences and create collective memories, enhancing the social value of tourism.

2.3.5 THE BENEFITS OF GAMIFICATION FOR CULTURAL TOURISM DIGITAL TOOLS

In the ecosystem of digital tools for cultural tourism, tourists, tourist attractions, and local tourism authorities play indispensable roles and are the main stakeholders. Tourists, as end-users, gain rich travel experiences and cultural insights through digital tools, including convenient travel information, precise navigation services, and in-depth cultural interpretation. Tourist attractions, as developers and implementers of digital tools, focus on the diverse needs of visitors within the site to achieve efficient visitor management and service provision, often aiming to enhance the visitor experience and reputation of specific sites.

Local tourism authorities, in contrast, focus on the quality and competitiveness of the entire region's tourism. The digital tools they develop often include regional guide information, a compilation of activities and discounts across multiple attractions, and educational content related to local culture and history. These tools aim macroscopically to achieve more scientific resource planning and management by collecting extensive user data.

In this ecosystem, the participation and willingness of tourists to use these tools are crucial, especially in promoting a win-win development scenario. Gamification strategies, which integrate game design elements and psychological incentives into non-gaming contexts, have the potential to increase user engagement and retention significantly. Therefore, these strategies are expected to comprehensively optimize the application effects of digital tools for cultural tourism.

1) Integration of On-site and Digital Experiences

Figure 9

Gamified Digital Tool: Canal Mysteries

Note: The interface of Canal Mysteries.

Source: Screenshot by the author, May 8, 2023

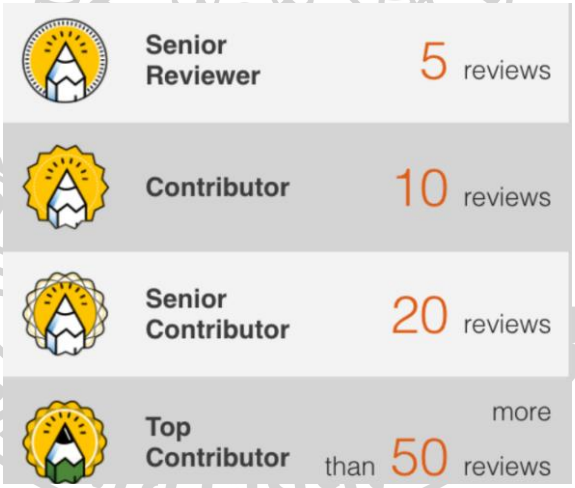
Gamification elements such as tasks, challenges, and reward systems can bridge the gap between digital and on-site experiences (Skinner et al., 2018). These elements can be effectively integrated with the on-site environment and digital media content to create an interactive and engaging experience. By setting tasks and challenges related to culture and history, tourists are encouraged to explore on-site cultural relics or information, achieving a seamless connection between digital and

on-site experiences. For example, the China Grand Canal Museum in Yangzhou launched a gamified digital tool called "Canal Mysteries," which uses role-playing and interactive puzzle elements like "escape room" games. It subtly integrates the on-site experience (i.e., physical observation) with the digital experience (digital media content). In this interactive puzzle-based participation process, visitors can immersive experience canal heritage and seamlessly bridge entertainment and learning, thereby gaining a deep understanding of canal heritage's cultural and historical value (Figure 9). This project won the 2023 Global World Heritage Education Innovation Case Award (AWHEIC).

2) Construction of User Incentive Mechanisms

Figure 10

The Review Badge in the TripAdvisor App



Note: The interface of the TripAdvisor app review badge.

Source: Screenshot by the author, May 9, 2023

Gamification strategies build a comprehensive and effective user incentive system through achievement systems, point incentives, and badges (Ueyama et al., 2014). This system enhances tourists' participation in cultural tourism and the use of digital tools, while encouraging them to share information and interact on social platforms. This approach enhances the brand influence of tourist attractions and effectively improves marketing effects. For instance, TripAdvisor, a popular travel application, successfully uses badges and achievement systems to actively motivate

users to share travel experiences (Ranas, 2020). Users can earn different "Reviewer" badges on this platform by writing reviews on hotels, restaurants, or attractions (Figure 10).

3) Enhancement of Digital Media Content

Gamification strategies significantly enhance the depth and complexity of digital media content through diverse means such as storytelling, role-playing, and multimedia interaction. Moreover, multisensory multimedia elements further enrich the multidimensional richness of cultural experiences (Deliyannis & Kaimara, 2019). It not only breaks through traditional modes of information dissemination but also deeply explores and displays the value of cultural attractions in social, economic, artistic, and other dimensions. The Dunhuang Research Institute, in collaboration with Tencent, has launched a gamified digital tool named the "Cloud Tour of Dunhuang," offering the rich experience of appreciating the art of the Dunhuang Mogao Caves (Figure 11). The application introduces a storyline where users interact with historical figures near the Dunhuang Mogao Caves in a fine brushwork ink painting style, immersing themselves in the past and present experiences of the scriptures. Accompanied by the melodies of traditional instruments like the pipa, users gradually collect and learn about Dunhuang through story-driven interactions, thus gaining a richer and more profound experience.

Figure 11

The WeChat App: Cloud Tour of Dunhuang

Note: The interface of Cloud Tour of Dunhuang.

Source: Screenshot by the author, May 9, 2023

2.3.6 TRENDS IN THE GAMIFICATION OF CULTURAL TOURISM

1) Promotion of the Tourism Industry

As the demand for tourism and cultural experiences continues to rise, gamified cultural tourism applications have emerged as a vital means to attract tourists and enhance the appeal of tourism destinations. These applications leverage the =convenience and entertainment value of the games, appealing to users across different age groups, including tourists and individuals interested in culture and history. This trend presents lucrative opportunities for collaboration between game developers and tourism organizations.

Figure 12

The Game: Sawadika Run

Note: The interface of Sawadika Run.

Source: Screenshot by the author, May 5, 2023

The Thailand National Tourism Bureau and Beijing Kung Fu Cat Network Technology Co., Ltd. jointly developed the leisure-focused parkour game "Sawadika Run," which is an example (Figure 12). This game aims to attract tourists to Thailand by combining an adventurous coin-collecting gameplay mechanic. Users can exchange the collected coins for travel discounts through Qunar APP (a Chinese

online travel agency). Notably, the developers have seamlessly integrated popular tourist cities in Thailand, such as Bangkok, Phuket, Pattaya, and Chiang Mai, into the game's visual backdrop, allowing users to experience the tourist attractions of Thailand during their entertainment journey.

2) Enhanced Interactivity

Advancements in game technology, particularly the integration of augmented reality (AR) and mixed reality (MR) technologies, have enabled developers to merge the virtual world with the real world, resulting in more immersive and interactive gaming experiences. Users can engage with virtual elements within the game using their mobile devices, enabling them to explore cultural landmarks, solve puzzles, and partake in role-playing activities. These enhancements facilitate a deeper understanding and appreciation of culture.

Figure 13

Gamification App: Turku Castle in Your Hand

Note: The interface of Turku Castle in Your Hand (Luimula & Trygg, 2016)

Source: Screenshot by the author

A noteworthy instance is "Turku Castle in Your Hand," a gamified application Turku University of Applied Sciences developed. Its primary objective is to encourage tourists to interactively experience the architecture and exhibits of Turku

Castle (Luimula & Trygg, 2016). This application offers users the choice between tour mode and game mode, leveraging augmented reality technology and the cameras on smart mobile devices (phones and tablets) to scan real-world objects, providing additional information in tour mode (Figure 13). In game mode, this information is made available to users through various tasks and mini games, enhancing overall engagement.

3) Online-Offline Synergy

Cultural tourism gamification applications empower users to visit real-world cultural sites and tourist destinations based on in-game prompts and tasks. Integrating offline components enables users to connect their virtual experiences with real cultural tourism activities, fostering a profound understanding and appreciation of the destination's cultural allure.

Figure 14

The Game: Jiangnan Hundred Scenic Views

Note: The interface of Jiangnan Hundred Scenic Views.

Source: Screenshot by the author, May 5, 2023

A case in point is "Jiangnan Hundred Scenic Views," a meticulously crafted historical simulation game by Coconut Game Studio (Figure 14). In this game, users

assume the role of administrative officials in the Ming Dynasty's Jiangnan region, addressing various urban development and economic, agricultural, architectural, and societal challenges. While the game's initial intent did not consider cultural tourism integration, the exquisite in-game architecture and gardens attracted a substantial user base, leading them to visit corresponding real-world tourist destinations, thus establishing a tangible link between the game and actual tourist spots.

4) Transition to Cloud Technology

The adoption of cloud computing technology is revolutionizing the gaming landscape. It centralizes game computations and storage tasks on cloud servers, allowing users to access high-quality gaming experiences via Internet connections without extensive game downloads. This approach proves particularly convenient and flexible for cultural tourism, which often involves experiences transcending geographical boundaries.

Figure 15

WeChat App: Cloud Tour of the Great Wall

Note: The interface for Cloud Tour of the Great Wall.

Source: Screenshot by the author, May 5, 2023

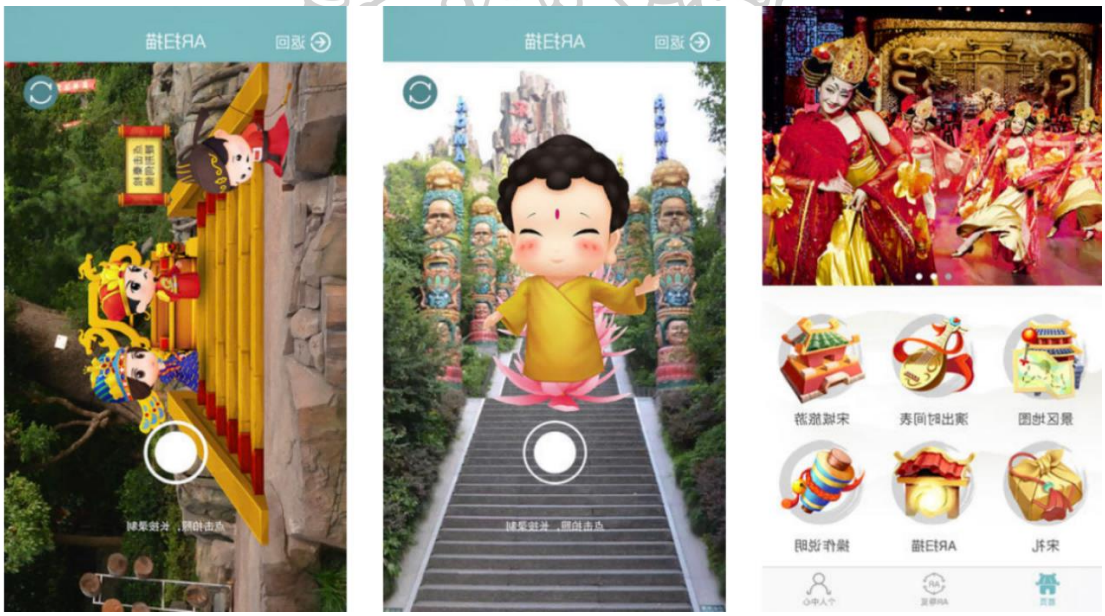
An example in this domain is "Great Wall on Cloud Travel," a virtual tourism gamification application developed through collaboration between the China Cultural

Heritage Foundation, Tencent Charity Foundation, Tianjin University School of Architecture, and various specialized organizations dedicated to Great Wall preservation (Figure 15). This app is the first in the world to use cloud gaming technology to digitally restore cultural heritage on a large scale, with millimeter-level accuracy and in an immersive and interactive way. Users can partake in a simulated virtual tour within the game and gain in-depth insights into the history and cultural significance of the Great Wall by engaging in interactive games related to its restoration.

5) Integration with Digital Tools

Figure 16

Songcheng Guide App



Note: The interface of Songcheng Guide App.

Source: Screenshot by the author, May 5, 2023

Certain cultural tourism gamification applications offer integrated features for tourism planning, navigation, and content sharing, providing users with practical travel information and recommendations within the gaming environment. This integration streamlines the user experience, making it more convenient and comprehensive while fostering a strong connection between the game and real-world

tourism activities. An instance illustrating this is the "Songcheng Guide," developed for the Hangzhou Songcheng Cultural Theme Park. This application enables visitors to access navigation, AR gamified scene interactions, route planning, show schedules, and online ticket and hotel bookings, enhancing their overall experience within the theme park (Figure 16).

2.3.7 SUMMARY

The gamification of cultural tourism applies game concepts and elements to the tourism sector, aiming to enhance tourists' participation, interest, and travel experience. The application forms of gamification in cultural tourism include, but are not limited to, gamified guides, interactive experiences, and learning. By integrating game design elements and psychological incentive mechanisms, gamification strategies can increase tourists' engagement and retention, thereby optimizing the application effects of digital tools for cultural tourism. These optimizations manifest in enhancing the integration of on-site and digital experiences, constructing user incentive mechanisms, and enriching digital media content. These measures help to improve the visitor experience and reputation of cultural tourism sites and are also beneficial for local tourism authorities to achieve more scientific resource planning and management. Therefore, applying gamification strategies to digital tools for cultural tourism has significant practical value and prospects for development.

2.4 GAMIFICATION DESIGN THEORY

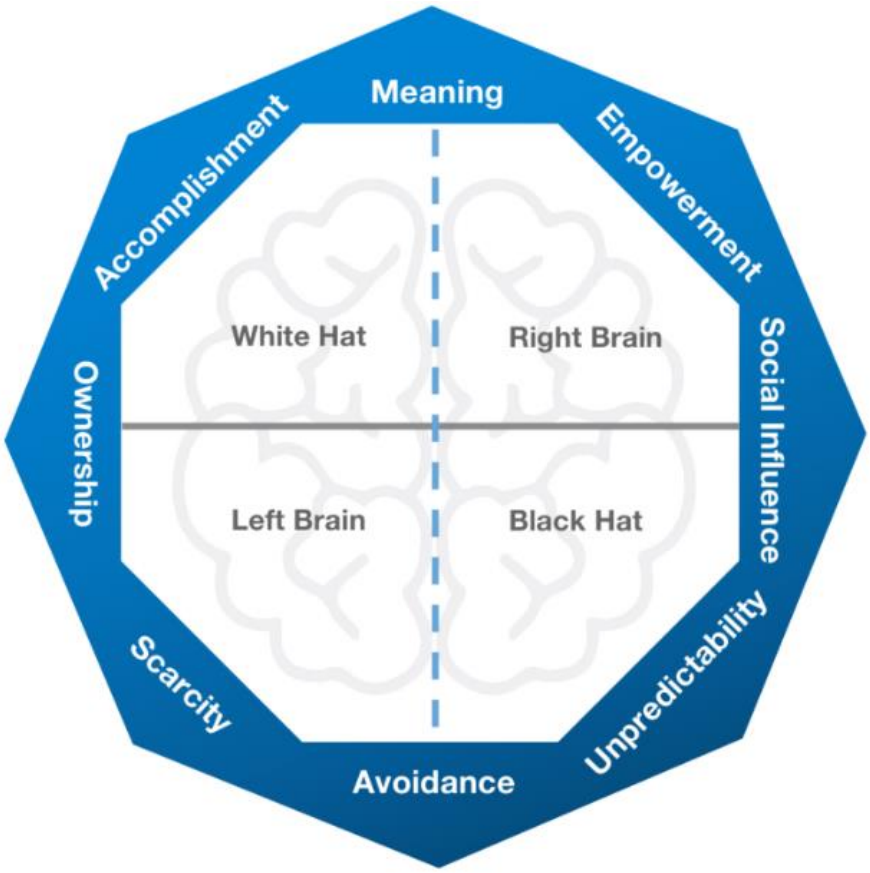
2.4.1 THE OCTALYSIS FRAMEWORK

The Octalysis Framework is a human-centric gamification design model proposed by gamification expert Yu-kai Chou (2019). Diverging from traditional function-focused design philosophies, this model suggests that gamification techniques should align with human motivation and emotion. As depicted in Figure 17, each facet of the octagon represents a fundamental human motivational driver, with these eight core drivers corresponding to various aspects of human motivation.

The following paragraphs elaborate on these drivers and their associated game mechanics:

Figure 17

The Octalysis Framework



Source: Drawn by the author

Epic Meaning and Calling: This driver involves the user's inclination to engage in tasks they perceive as transcending the self, often endowed with grand goals or missions. Game mechanics that provide narratives, themes, or purposeful elements can enhance the perception of this epic significance.

Accomplishment and Development: This driver represents the user's aspiration for progress, skill acquisition and enhancement, and overcoming challenges. Traditional gamification elements such as point systems, badges, or leaderboards are particularly effective at reinforcing this driver.

Empowerment of Creativity and Feedback: This driver reflects the user's desire to create, alter, and impact the game environment. Systems that offer opportunities for creative expression and provide constructive feedback can stimulate this motivational drive.

Ownership and Possession: This core driver stimulates the human tendency to cherish and augment what they own. Implementing game elements that enhance the sense of ownership, such as customizable avatars or virtual goods, can boost motivation derived from this driver.

Social Influence and Relatedness: This driver includes various social factors that inspire individual actions, such as mentorship, acceptance, social response, companionship, competition, and envy.

Scarcity and Impatience: This core driver relates to motivation due to the scarcity, uniqueness, or temporary unavailability of something. Mechanisms like time-limited offers or exclusive access can trigger this driver.

Unpredictability and Curiosity: This core driver engages users because of the inherent human fascination with the unknown and anticipation of future events. Introducing surprise elements or hidden Easter eggs can satisfy this drive.

Avoidance and Loss: This core driver is motivated to avoid negative outcomes. Utilizing penalties, deadlines, or elements that induce fear of missing out can stimulate this drive.

Additionally, within the Octalysis Framework, "White Hat" and "Black Hat" strategies represent distinctly different user behavior orientation mechanisms. Their core concepts are derived from motivational theories in psychology, especially the research on intrinsic and extrinsic motivation (Ryan & Deci, 2000).

"White Hat" strategies adhere to positive motivational methods, including but not limited to reward granting, recognition of user achievements and progress, and encouragement of community participation and collaboration (Chou, 2019). These strategies stimulate users' engagement by enhancing their sense of fulfillment and perceived value. Thus, applying White Hat strategies typically leans toward fostering long-term participation and sustaining continuous positive behavior (Deterding, 2012).

"Black Hat" strategies, on the other hand, try to change people's behavior by using more urgent and high-pressure methods, like making things competitive, setting goals that are hard to reach, or motivating people by letting them lose a reward (Hamari, 2017). While these strategies can produce strong motivation in the short term, they may also lead to user stress and frustration. Overuse could result in user fatigue or a loss of interest in the task over the long term (Nicholson, 2015).

In conclusion, the ideal gamification design should balance White Hat and Black Hat strategies to maintain long-term user engagement and satisfaction. It should also provide ample motivation and stimulation to guide them toward the desired behavioral goals (Landers, 2014). Achieving this balance requires designers to understand user needs deeply and to precisely apply motivational theories, ensuring that gamification design becomes an effective tool for driving behavioral change.

2.4.2 THE MDA FRAMEWORK

The MDA framework takes a formal approach to understanding games, providing a useful model for comprehending how game components operate (Kim, 2015). This framework breaks down game components into three interconnected parts: mechanics, dynamics, and aesthetics.

"Mechanics" are defined as the basic building blocks of game component design, including but not limited to tasks, challenges, achievement systems, point incentives, and badges. The mechanical aspect is the domain where designers have direct intervention and control. Within the context of gamification in cultural tourism, gamification mechanics add to the fun and interactivity of participation and facilitate the achievement of educational objectives. In this way, gamification transcends mere entertainment to become a potent tool for cultural dissemination and education.

"Dynamics" refers to the interplay between mechanics and user input and how these interactions evolve. Dynamics focuses on the game's behavioral patterns, which vary depending on challenges, player strategy choices, and game difficulty. Essentially, dynamics determine the experience of users within the gamified environment.

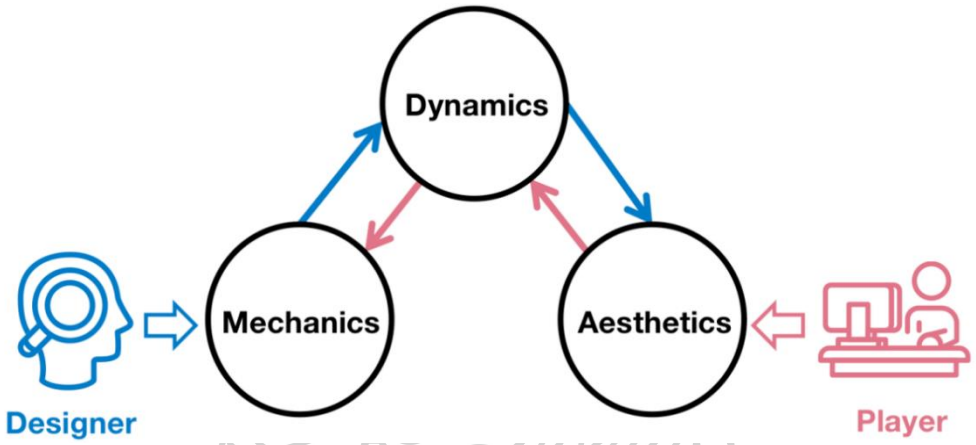
"Aesthetics" encompasses the user's sensory and emotional responses. It includes sensation (game as sense-pleasure), challenge (game as an obstacle course), fellowship (game as a social framework), discovery (game as uncharted territory), narrative (game as drama), expression (game as self-discovery), and submission (game as a pastime). The design goal of aesthetic elements is to build the game's appeal and emotional connection with the user.

Designers typically start with mechanics when constructing a game, then adjust and refine the design by observing the effects on dynamics and aesthetics.

Users often begin with the aesthetics, feeling the game's ambiance, and then gradually exploring the game's dynamic elements and underlying mechanic structure (Figure 18). The significance of the MDA framework in both theory and practice lies in its ability to help researchers better understand the user's gaming experience, thereby creating more engaging and entertaining game products.

Figure 18

The MDA Framework



Note: The figure illustrates the process in which designers establish game mechanics, generating dynamics during gameplay, ultimately leading to the aesthetics or emotional and experiential outcomes for the player.

Source: Created by the author based on the MDA framework (Hunicke et al., 2004)

2.5 THE DYNAMICS OF VISUAL FORM IN VISUAL PERCEPTION

2.5.1 THE CONCEPT OF VISUAL PERCEPTION

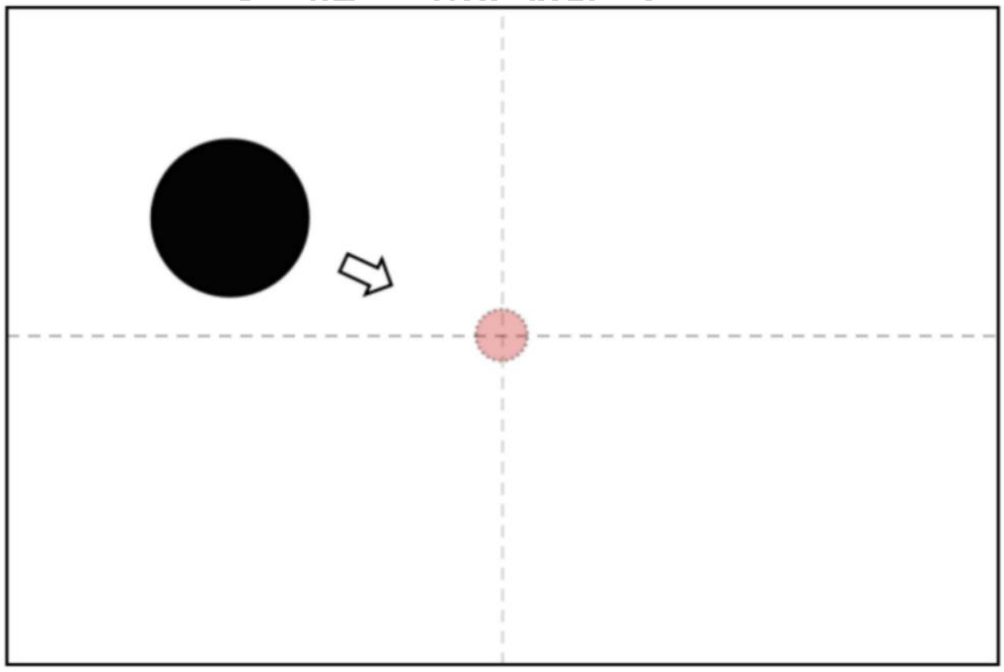
Vision is the most critical sense for humans, with approximately 80% to 85% of perception, learning, cognition, and activities being mediated through sight (Politzer, 2018, July 26). When observing external objects, the visual information captured by the eyes is first preliminarily encoded within the retina and transmitted to the brain's visual center via the optic nerve, where the visual center further processes, analyzes, and integrates all information, ultimately forming a visual perception. Visual perception is the process by which humans transmit visual information to the brain for information processing (Treisman, 1964).

2.5.2 THE ORIGIN OF THE DYNAMICS OF VISUAL FORM

Gestalt psychology is a school of psychology that emphasizes the impact of wholeness and structure on cognition and perception. Gestalt psychology posits that when individuals observe objective entities with similar traits, they are influenced by their own experiences and cultural backgrounds to form corresponding "Gestalt" images in their minds unconsciously. When the objective entity does not match the "Gestalt" in the brain, indicating a "discrepancy" in the "Gestalt," the brain tends to compensate for this "discrepancy" to match or closely approximate a good "Gestalt." Applying the laws of Gestalt organization can make visual forms achieve this "good Gestalt," providing the perceiving subject with a positive aesthetic experience (Treisman, 1964).

Figure 19

Points in motion



Note: When one sees a black dot, they feel a force and attempt to place the dot at the center of the image, thus proving that "dynamics" exist within visual forms (Arnheim, 1983).

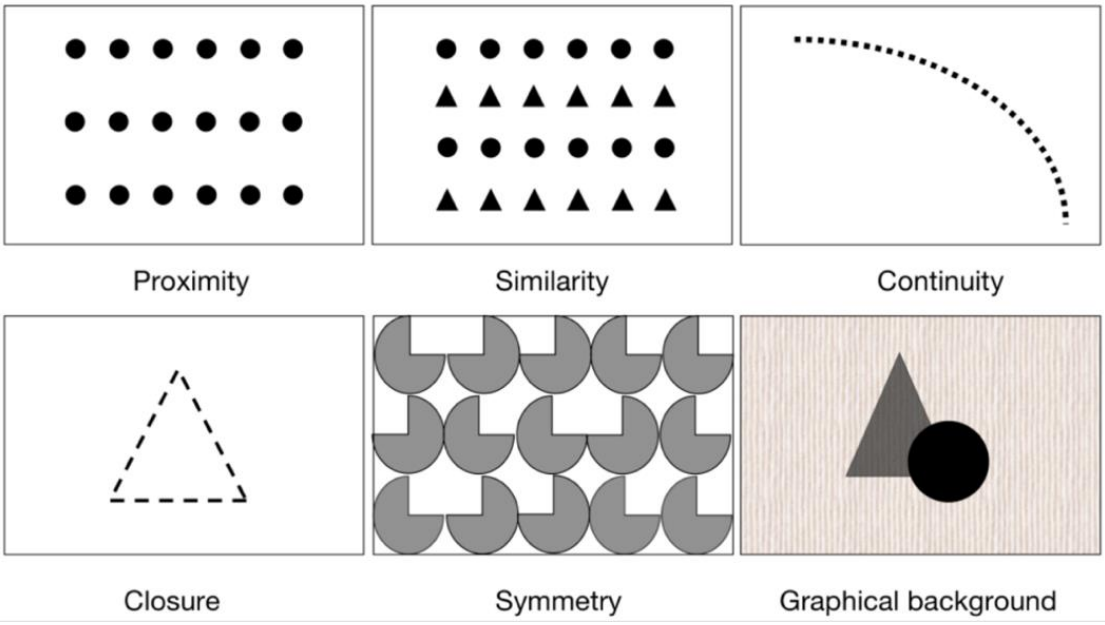
Source: Drawn by the author

Rudolf Arnheim, a German-American psychologist and aesthetician, creatively applied Gestalt psychology to studying visual art forms and visual thinking patterns. He initiated research into the dynamics of visual form through the "moving dot" experiment (Figure 19). The dynamics of visual form in visual perception are a further development and interpretation of the laws of Gestalt organization. The simplification of visual perception and the tendency toward Gestalt gradually transformed into the theory of dynamics of visual form with visual thinking, which has been widely applied in various fields such as art, design, psychology, and cognitive science.

From the perspective of the dynamics of visual form, the laws of Gestalt organization are the rules of expression for dynamics within visual forms, characterized by the following principles (Figure 20):

Figure 20

The Gestalt Organizational Principles Representing the Expression of Dynamics within Visual Forms



Source: Drawn by the author based on the Gestalt organizational principle

Proximity Principle: The distance between elements affects visual perception, with elements closer to each other being more likely to be perceived as a whole.

Similarity Principle: Elements with similar characteristics are seen as belonging to the same group or having similar properties.

Continuity Principle: When elements are visually continuous or form a smooth curve, people perceive them as a single line or path rather than as multiple isolated elements.

Closure Principle: Visual perception tends to complete incomplete figures or shapes into a whole, closed entity, satisfying our cognitive needs for completeness and integrity.

Symmetry Principle: Symmetrical elements are more easily perceived as a whole and tend to be viewed as symmetrical units.

Figure-Ground Principle: Visual perception differentiates between the subject and background within a visual area, focusing on the subject matter.

2.5.3 VISUAL PERCEPTUAL DYNAMICS IN GAMIFIED DIGITAL TOOLS

1) Information Recognition

Gamified digital tools have many visual elements, including characters, buildings, props, and badges, each with distinct shapes. The challenge lies in enabling users to identify, remember, and quickly gather key information. Designers must leverage the effects of visual perceptual dynamics to present visual elements in more regular, simplified, and appropriate artistic styles. Users can quickly gather information within the digital tools thanks to the Gestalt and simplification aspects of visual perceptual dynamics, making it possible to recognize and remember game elements and information quickly.

2) Interface Design

The interface is the medium through which users interact with digital tools. Good interface design can provide an excellent user experience and convenient operability. By employing the principles of similarity and continuity from the dynamics of visual perception, designers can create clear, intuitive, and easy-to-navigate interfaces. This visual consistency and coherence among interface elements enhance users' understanding and operational efficiency.

3) Scene Design

Art design is crucial for creating an atmosphere, enhancing immersion, and providing visual appeal. By applying the principles of symmetry, closure, and similarity from the dynamics of visual perception, one can craft intricate and coherent environmental details, thereby increasing the user's sense of immersion and engagement. These principles can effectively guide the arrangement of scene elements and the construction of environments to produce visually striking effects that align with the cultural tourism context.

2.5.4 SUMMARY

The theory of visual perceptual dynamics explains the basic rules of how people see and think about things. It can help make gamified digital tools for cultural tourism better. By applying this theory, researchers can make optimized decisions in art design, interface layout, character creation, and scene construction, thereby enhancing digital tools' quality and user experience.

2.6 SEMIOTIC THEORY

2.6.1 THE CONCEPT AND CLASSIFICATION OF SIGNS

In human societal communication, signs and meanings constitute information, where the sign is the external form of information, and meaning is its spiritual content. Semiotics is the discipline that studies sign systems and the meaning and use of signs. Its developmental trajectory can be traced back to studies of ancient cultures and languages, with research into the signs and their meanings evident in ancient Egyptian hieroglyphs and pictographs. The modern origins of semiotics can be traced to the end of the 19th century when Ferdinand de Saussure proposed the structuralist theory of linguistics, emphasizing that signs in language consist of the signifier and the signified (Yakin & Totu, 2014).

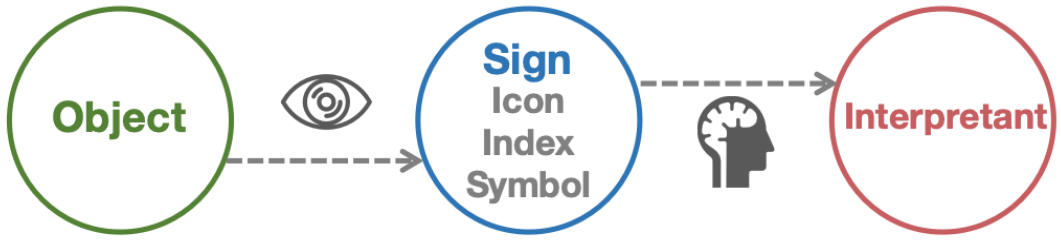
According to the literature review, scholars' definitions of signs are primarily reflected in the relationship between things and the meanings they represent. Ernst Cassirer regarded signs as the fundamental means humans comprehend and express the world. He defined a sign as a representational form with symbolic and representative qualities capable of conveying meaning and knowledge. Cassirer

identified three basic forms of cultural signs: linguistic signs, artistic signs, and scientific signs (Cassirer, 1923). These forms encompass various human expressions and are instrumental in conveying profound meanings and knowledge across diverse cultural backgrounds.

Peirce defined a sign as a triadic relation (Figure 21) consisting of the sign itself, the object it represents, and the interpretation or understanding of the user. According to his theory, signs are indicative; their connection to objects is established by a convention or mutual rule (Noeh, 2012). The function of a sign is to provoke an interpretation or meaning in the user's mind, thereby aiding the understanding and communication of information about the object. Peirce also differentiated between three main types of signs: icons, indices, and symbols. Icons involve cognitive abilities and can be expressed obviously and intuitively. Indices are signs that use the association between sign form and meaning to express their content and significance. They are related to the medium they convey and have an indicative function, often presented in a way that resembles the object they denote. Symbols not only involve the display of abstract symbolic language but also require establishing a close connection between the order of signs and symbolic meaning and associating with subjective emotions.

Figure 21

Symbolic Triad Model



Note: The figure shows the process by which we observe a symbol with our eyes, identify the object it represents, and then, through our own thinking, form an interpretation or understanding of it.

Source: Drawn by the author based on Peirce's definition of symbols

2.6.2 SEMIOTICS IN CULTURAL TOURISM

In 1976, MacCannell built upon the research of predecessors to first introduce semiotics into tourism studies (MacCannell, 2013). Since then, the tourism academic community has begun to explore the concept of tourism signs. Urry (1992) posits that everything a tourist sees comprises signs representing something. From this perspective, cultural signs that differ from the usual environment at a tourist destination can be considered tourism signs. Culler (2007) argued that tourists seek heterogeneous cultural signs. Zeng et al. (2013) believe that souvenirs are memory signs that represent a destination's nature, history, and customs, carrying the regional cultural sentiments of tourism. Meng and Liu (2018) contend that tourism signs are markers with special connotations and meanings, representing the characteristics of the aggregated tourism resources of a destination. In summary, the research considers cultural tourism signs to be representational forms related to specific cultures in tourism activities that convey cultural information and meanings. These signs may include specific figures, objects, buildings, attractions, artworks, allusions, legends, particular languages, customs, and sign systems, all serving to display and express the characteristics and values of a specific culture.

2.6.3 SEMIOTICS IN GAMIFICATION

Semiotics play a broad role in gamification, with diverse applications including conveying information, eliciting emotions, building storylines and worldviews, and guiding user behavior and understanding (Price et al., 2009). Common applications of semiotics in gamification design include:

1) Interface

In-game interface design, symbols such as icons, buttons, and indicators are widely used to convey specific functions and operations through simple shapes, colors, and patterns. Figure 22 introduces the applications of iconic symbols, indexical signs, and symbolic symbols in games. Indexical signs use the direct association or causal relationship with the represented object to convey information, such as health bars, indicators, or compasses, helping users understand character status, direction, or extent. Symbolic symbols convey meaning through shared cultural conventions and understanding, triggering user recognition and associations with specific concepts and

behaviors through text, signs, or patterns. These different types of symbols work together in visual design to create a rich gaming experience, guiding user behavior and understanding and enhancing engagement.

Figure 22

Symbol in the MOBA Game: Arena of Valor

Symbols Type	Iconic symbol	Indexical symbol	Symbolic symbol
Item	Avatar	Blood bar	Training
Function	Show the location of the game character in the map	Display the health status of the game character	Upgrade the skill level of the game character to enhance combat power

Note: The interface for Arena of Valor.

Source: Analyzed by the author

2) Characters

In games, the characters' attire, equipment, and distinctive facial features are considered symbols that convey their unique traits and attributes (such as identity), providing players with visual recognition and emotional connection to the characters (Ahmad et al., 2022).

3) Environment

In environmental design, buildings, signage, and decorations are often used as symbols to convey specific cultural or historical contexts or narrative elements.

Skillfully using these symbols can create unique settings within game scenes and environments, enriching the game's worldview and storyline. For example, a city management game entitled “Jiangnan Hundred Scenic Views” reconstructs the Porcelain Tower of Nanjing, an ancient Chinese structure damaged by war (Figure 23). The game meticulously recreates the urban landscape of the Jiangnan region during the Ming Dynasty using traditional Chinese line drawing styles, which has been well-received by players.

Figure 23

Porcelain Tower of Nanjing in Game: Jiangnan Hundred Scenic Views

Note: The Porcelain Tower’s symbolic realization in the game.

Source: Screenshot by the author, May 8, 2023

4) Pattern and Texture

Patterns and textures in gamified elements (like points and badges) can also be seen as symbols, conveying specific meanings and emotions. They can express different themes, moods, or styles through color, shape, and composition.

5) Narrative and Story

Semiotics can aid in constructing the narrative structure and storyline of gamified tasks. Symbols can convey emotions, themes, and moral concepts through symbolism and metaphor, making the story richer and more captivating.

2.6.4 SUMMARY

A review of the literature on semiotics and cultural tourism symbols reveals that discussions within the field of cultural tourism primarily focus on the

interpretation of cultural tourism symbols and the construction of tourism images and brands from a semiotic perspective, which are micro-level studies. The practical application of semiotics in gamified design is much broader, encompassing interface design, character design, environmental design, pattern design, and narrative construction. Through the theory of semiotics, designers can convey information, evoke emotions, construct stories and worldviews, and guide user behavior and understanding. Mastering these different types of symbols can help researchers create culturally rich, visually engaging, gamified digital tools for cultural tourism.

2.7 USER EXPERIENCE

2.7.1 DEFINITION OF USER EXPERIENCE

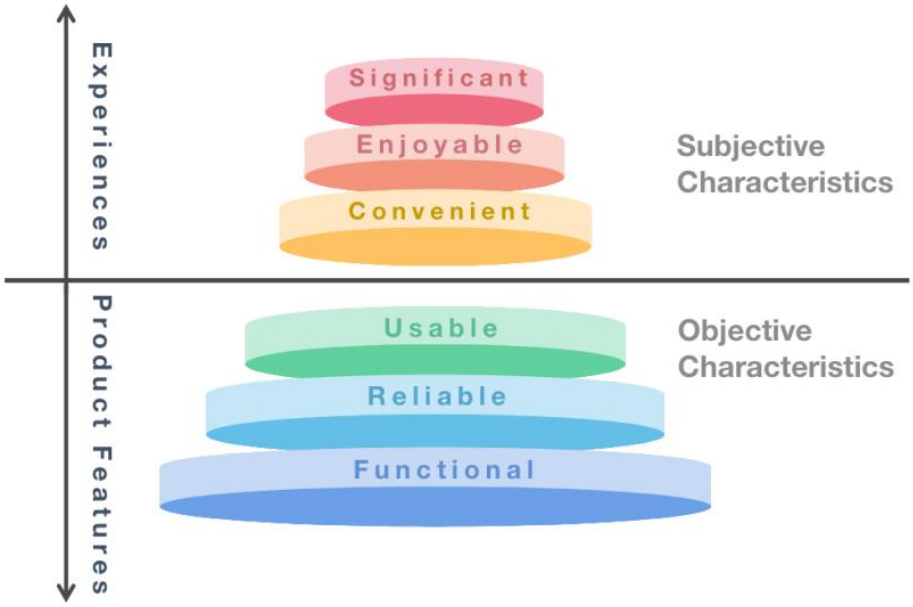
Donald Norman first introduced the concept of user experience in the 1980s, defining it as "all aspects of a person's interaction with a product, system, or service, including appearance, interaction, response time, and system feedback (Norman, 1988)." It encompasses the subjective feelings a user has throughout the product usage process. With the rapid development of information technology in fields such as mobile and graphic technologies, Human-Computer Interaction (HCI) has been widely applied in almost all human activities. User experience focuses on the interaction between the user and the product, extending the scope of usability within the HCI field. Maximizing a product's utility is no longer solely dependent on its functional attributes; the design process should also consider the non-instrumental aspects of user experience, including emotional and sensory aspects.

Rosenfeld and Morville (2002) further divided the levels and components of user experience, constructing the User Experience Design Pyramid model, which includes usability, usefulness, findability, credibility, desirability, and pleasure (Figure 24). In 2019, the International Organization for Standardization (ISO) established an international standard providing a normative definition and explanation of user experience, which has been widely recognized (ISO, 2019). According to this standard, user experience is defined as the user's perceptions and responses resulting from using and anticipating a system, product, or service. Furthermore, the standard elaborates that user experience encompasses the entire spectrum of feelings before, during, and after use, covering aspects such as emotions, beliefs, preferences,

perceptions, physical comfort, behaviors, and achievements. It indicates that user experience has expanded to encompass the entire system process of user engagement, focusing on the experiential aspect of interaction and emphasizing the importance of the use outcomes.

Figure 24

Design of the User Experience Pyramid Model



Note: The levels and components of user experience.

Source: Drawn by the author based on the design model (Rosenfeld & Morville, 2002)

2.7.2 GAMIFICATION USER EXPERIENCE

Gamification is a system controlled and adjusted by designers, encompassing strategies and rules that shape the user experience. For gamified digital tools, the user experience relates to their subjective feelings and emotional experiences during entertainment. The gamification user experience primarily comprises narrative, mechanics, audio, emotion, and human-computer interaction (HCI): 1) Narrative creates the worldview of the entire game, determining the storyline. 2) Mechanics include the objectives, rules, and rewards of gamification and the choices provided to users. 3) Emotions that stimulate excitement, tension, and joy can enhance the appeal of gamification. 4) Audio elements such as background music, sound effects, feedback sounds, and voiceovers can enhance the immersive feel of gamified digital

tools. 5) HCI serves as the bridge for user interaction with gamified digital tools, presenting the content and functionality of the game through interactive behaviors (Daneels et al., 2021; Klimmt & Possler, 2019; Plass et al., 2020).

User experience plays a key facilitative role in gamification design (Jakubowski, 2015). Researchers developing gamified designs first have a general set expectation of the user experience that gamification brings, although this anticipated user experience may differ from the actual user experience.

2.7.3 EVALUATION OF GAMIFICATION USER EXPERIENCE

In the field of gamification, user experiences are diverse, presenting multiple challenges for assessment. As the industry evolves, researchers and practitioners are actively exploring more effective and practical assessment methods to deeply understand users' experiences during gamification (Carvalho & Furtado, 2020). They are committed to grasping user needs more profoundly and optimizing accordingly to enhance the gamification user experience. Common methods for assessing gamification user experience include questionnaires, interviews or semi-structured interviews, experience sampling, and heuristic evaluation. (Bernhaupt, 2010; Johnson et al., 2018; Kirginas, 2022). These convenient methods produce intuitive effects, hence their widespread application in practice.

Phan et al. (2016) developed and validated the Game User Experience Satisfaction Scale (GUESS) based on assessing over 450 unique video game titles. The GUESS includes nine subscales: 1) Playability, 2) Narratives, 3) Play Engrossment, 4) Enjoyment, 5) Creative Freedom, 6) Audio Aesthetics, 7) Personal Gratification, 8) Social Connectivity, 9) Visual Aesthetics, totaling 55 items.

However, due to its complexity and the lengthy time required for testers to complete it, there is a risk of losing patience, which may affect the objectivity of the assessment results. Keebler et al. (2020) simplified the GUESS in 2020, developing the GUESS-18 scale to address this issue. This streamlined version of the scale aims to maintain the comprehensiveness of the original while enhancing its practicality and ease of use. The GUESS-18, through rigorous statistical methods and empirical testing, ensures the representativeness of its items and the reliability of its measurements. This improvement makes the scale more suitable for time-sensitive

environments and increases its applicability across different game types and user demographics (Table 6).

Table 6

Items of the GUESS-18

Constructs	Statements
Playability	I find the controls of the game to be straightforward. I find the game's interface to be easy to navigate.
Narratives	I am captivated by the game's story from the beginning. I enjoy the fantasy or story provided by the game.
Play Engrossment	I feel detached from the outside world while playing the game. I do not care to check events that are happening in the real world during the game.
Enjoyment	I think the game is fun. I feel bored while playing the game.
Creative Freedom	I feel the game allows me to be imaginative. I feel creative while playing the game.
Audio Aesthetics	I enjoy the sound effects in the game. I feel the game's audio enhances my gaming experience.
Personal Gratification	I am very focused on my own performance while playing the game. I want to do as well as possible during the game.
Social Connectivity	I find the game supports social interaction between players. I like to play this game with other players.
Visual Aesthetics	I enjoy the game's graphics. I think the game is visually appealing.

Source: Keebler et al., 2020

2.7.4 SUMMARY

User experience plays a pivotal role in gamification design and the assessment of gamification effects. An in-depth study of theories related to user experience aids researchers in directing game design, optimizing interactivity, and creating emotional resonance to deliver satisfying gaming experiences to users. Additionally, the researcher has learned to utilize game user experience assessment tools to understand user needs, evaluate game quality, and validate design hypotheses, thus providing a reliable foundation for game design and improvement.

2.8 RELATED RESEARCH

Pasca et al. (2021) systematically reviewed the application of gamification in tourism and hospitality management, focusing on its role in the context of digital platforms. The study constructed a conceptual framework through a literature review to explore how gamification affects users' psychology and behavior through game mechanisms (such as point systems and reward mechanisms). The study showed that gamification can effectively improve user engagement and loyalty, but its effectiveness depends on the sophistication of game design and user motivation.

Marques et al. (2023) systematically reviewed the existing literature and analyzed the application of gamification in cultural heritage. The study found that many projects focused on improving the efficiency of information transmission through gamification, especially in the education and cultural heritage protection framework. The study used qualitative and quantitative methods and conducted content analysis on many documents. The results showed that although gamification can effectively attract audiences and enhance interactivity, most studies only focused on the output results of the project and lacked in-depth discussion on the long-term impact on the audience. The researchers suggested that more attention should be paid to audience feedback and the project's actual impact in the future to better understand the role of gamification in cultural heritage.

Negruşa et al. (2015) explored how gamification can promote sustainable development in the tourism industry. The study selected several successful gamification applications as research objects through case analysis and analyzed the performance of these applications in the three pillars of sustainable development: economic, social, and environmental. The study found that gamification can motivate tourists to adopt environmentally friendly behaviors and enhance the interaction between communities and tourists by increasing participation, ultimately promoting the development of local economies. The researchers also proposed a framework to guide tourism companies in balancing various aspects of sustainable development when designing gamification applications.

Roinioti et al. (2022) developed a gamification application for cultural tourism. The study used a design research method, user needs analysis, and multimedia design principles to develop the application. TRIPMENTOR motivates tourists to learn

cultural knowledge during their travels by introducing points, reward systems, and interactive tasks. The study found that this gamification design effectively improved user participation and satisfaction, especially among young tourists.

Hamari et al. (2014) systematically analyzed the application of gamification in multiple fields through a literature review, focusing on the application of gamification in cultural tourism. The study's main goal was to integrate existing empirical research and propose an integrated model of how gamification affects user behavior. The research methods included literature retrieval, screening, and meta-analysis, focusing on how gamification affects user engagement and behavior through incentive mechanisms and feedback systems. The study found that although gamification has different effects in different contexts, in cultural education and tourism, gamification can often significantly improve user engagement and learning outcomes. The research conclusions emphasized the key role of design and context and suggested that future research should further explore the best practices of gamification design.

Huotari and Hamari (2017) proposed a new definition of gamification by combining the concept of gamification with service marketing theory and exploring its application in cultural tourism. Through theoretical analysis, the research team constructed a gamification framework based on service marketing and applied it to cultural tourism scenarios, explicitly analyzing how to improve tourists' engagement and satisfaction through gamification strategies. The research methods included theoretical construction and case studies, which analyzed gamification practices in existing cultural tourism projects. The study found that successful gamification design can improve tourists' immediate sense of participation and increase tourists' long-term memory and identification of cultural heritage through continuous interactive design. The study emphasized the potential of gamification in cultural tourism and proposed future research directions, such as integrating gamification elements to enhance tourists' experience effectively.

Xu et al. (2017) analyzed the application of gamification in the tourism industry, with a particular focus on cultural tourism, and proposed a comprehensive model to explain how gamification affects tourists' experience. The research team conducted an in-depth analysis of several successful cases, including applying gamification in cultural venues such as historical sites and museums. The research

method adopted qualitative research, using expert interviews and focus group discussions to analyze the impact of gamification elements (such as virtual rewards and storylines) on tourists' behavior. The study found that gamification increased tourists' participation and enhanced their interest and understanding of cultural content. The study's conclusion shows that gamification in cultural tourism has broad prospects, can effectively improve tourists' experience, and promotes the protection and dissemination of cultural heritage.

Junior and Silva (2021) redefine the MDA framework to improve its practicality and design orientation in game development, thereby promoting the development of the digital game industry. The study pointed out that although there have been many attempts to create a widely accepted ontology for the game world, these attempts are often based on an academic perspective and are difficult to apply in game development. The authors proposed a redefined MDA framework that aims to better adapt to the needs of designers, include design attributes within the field, and overcome problems in the existing literature. Through theoretical analysis and practical cases, the study redefined the three key components of the framework: mechanisms, dynamics, and aesthetics, making it easier for developers to understand and use. The study found that the RMDA framework has higher operability and practical value in game development and can achieve more structured game design without weakening creativity, thereby promoting the maturity and standardization of game design methods.

2.9 CHAPTER SUMMARY

The rapid development of digital media arts and information and communication technology drives the digital transformation of Huizhou's cultural tourism, a trend fundamentally altering traditional tourism modalities. For rich choices, cultural tourism tools offer personalized tour guidance, commentary, and interactive experiences. However, due to user experience and content quality issues, tourists' acceptance and enthusiasm for using cultural tourism digital tools are relatively low. It leads to a scant understanding of the cultural content carried by tourist attractions, which runs counter to the original intent and vision of developing cultural tourism digital tools. Therefore, how to better drive user engagement with the

cultural content of cultural tourism attractions through gamification and enriching the tourism experience becomes an important research topic.

Creating engaging digital media content and motivational factors is essential to enhance user participation. As a tool or method that can bring enjoyment to users, gamified digital tools can create captivating stories and tasks, allowing users to experience the cultural essence of cultural tourism attractions more immersively. Through the interaction between the virtual and real worlds, users can gain a deeper understanding of cultural backgrounds, historical stories, and the significance of artworks, further enhancing their comprehension and appreciation of the cultural content of cultural tourism attractions. Moreover, users' interest and participation can be sparked by introducing gamification strategies with engaging challenges and tasks, reward and incentive mechanisms, and personalized and customized experiences. This comprehensive gamification strategy can increase users' willingness to use cultural tourism digital tools, leading to a more enjoyable and meaningful tourism experience. In summary, research directions for gamified digital tools in cultural tourism have significant implications for the digital development of cultural tourism and the enhancement of the cultural tourism experience.

In the design of gamified digital tools for Huizhou's cultural tourism, the target audience is a critical variable. Different audience groups have different gamification objectives. Therefore, before proceeding, it is crucial to conduct in-depth research into the behavior and needs of the target audience. This will help ensure that Huizhou's cultural tourism gamified digital tools can effectively meet the needs and expectations of the target audience.

The application of gamification in cultural tourism has garnered significant attention. However, much of the existing research is primarily rooted in theoretical frameworks, emphasizing the evaluation of gamification effects and the construction of application models. Such studies often need to pay more attention to practical applications and innovative designs from the designers' perspective. To address this gap, the present study aims to integrate and refine existing gamification frameworks, proposing a more design-oriented model that better aligns with the practical development needs of cultural tourism.

CHAPTER 3
RESEARCH METHODOLOGY AND PROCESSES

The study and creation of game-based digital tools to help the growth of cultural tourism in Huizhou is a multidisciplinary one that combines three areas: cultural tourism, digital tools, and gamification. The researcher employs a mixed-methods approach, combining qualitative and quantitative research, using tools such as interviews and surveys to process relevant concepts, theories, and research findings (Table 7).

Table 7

Research Methods and Tools

Research Objective	Research Methodology	Research Tools
To explore the concept of gamification and the use of gamified digital tools in enhancing the tourism experience in Huizhou's cultural tourism.	Literature review Field research Case study.	Questionnaire for Visitor Expert Interview Visitor Interview Scenic Staff Interview
To propose guidelines for the design of digital tools for cultural tourism gamification.	Literature review Case study	Questionnaire for Visitor Expert Interview
To develop and evaluate a Huizhou cultural tourism gamified digital tool.	Practical research Design and development	Evaluation Form for Experts Pre-Test Questionnaire Post-Test Questionnaire Evaluation Form for User

Source: Created by the author

3.1 RESEARCH POPULATION SCOPE

3.1.1 TARGET POPULATION

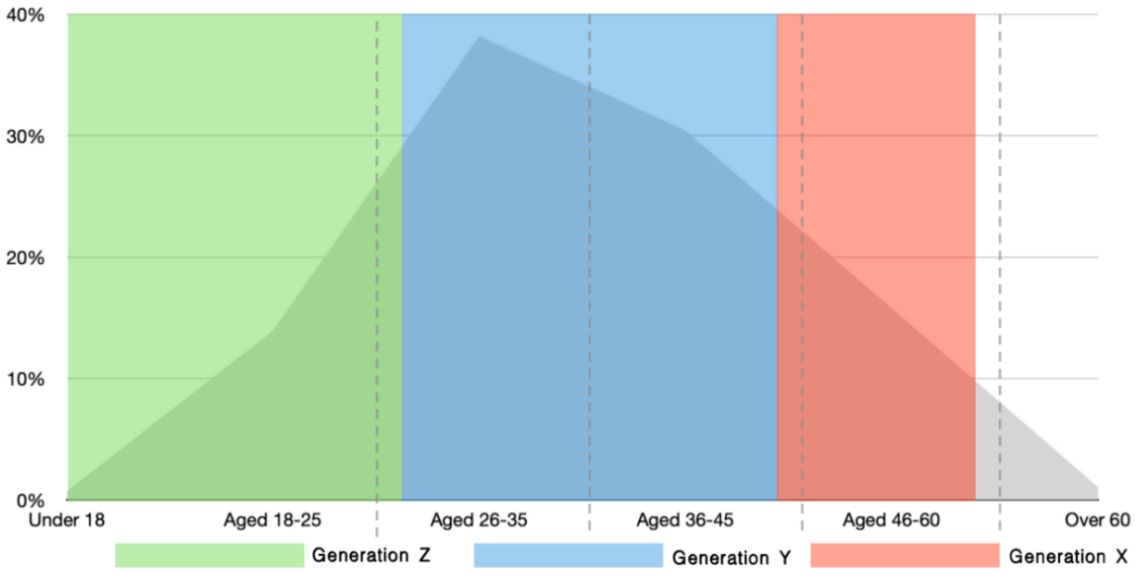
To provide needs and services that meet the needs of different user groups, users must be categorized into different groups. These groups are distinguishable by traits like gender and age range. Utilizing data from the Huizhou Cultural Tourism

Development Promotion Centre, the researcher compiled the following statistics from January to April 2023.

From January to April 2023, the Huizhou cultural tourism digital tools saw a cumulative addition of 340,282 new users (Figure 25). Gender segmentation reveals 206,598 new male users and 133,684 new female users. Age segmentation indicates 2,449 users under 18 years, 47,379 users between 18 to 25 years, 129,878 users between 26 to 35 years, 103,431 users between 36 to 45 years, 54,608 users between 46 to 60 years, and 3,537 users over 60 years old.

Figure 25

New Users of Huizhou's Cultural Tourism Digital Tools by Gender and Age



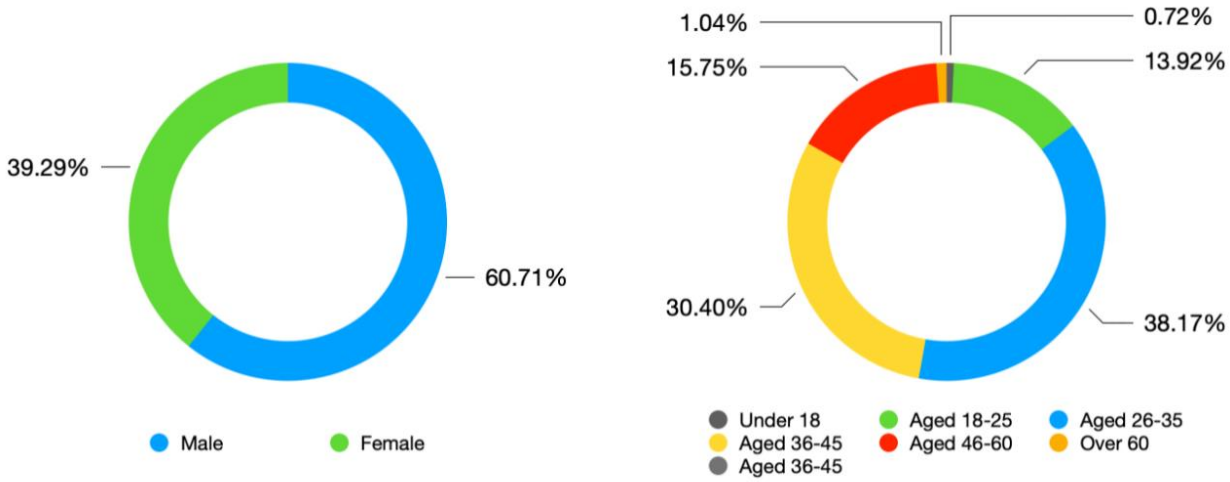
Source: Compiled by the author using data on new digital tools for cultural tourism development in Huizhou from January to April 2023, provided by the Huizhou tourism development promotion center

According to the foregoing data, most new users of digital tools in Huizhou's cultural tourism sector fall within the age range of 26 to 45 (68.57%). In contrast, the proportion of future primary users (under 25) stands at 14.61%, with users aged 45 and below constituting 83.18%. This age range aligns closely with the age brackets of Generation Y and Generation Z (Figure 26).

The birth years of Generation Y, also known as Millennials, are defined as spanning from the 1980s to the mid-1990s (Cavagnaro et al., 2018). By 2023, their age ranges from 28 to 43. Growing up in the era of the Internet and smartphones, they are a tech-savvy generation known for being constantly connected (KPMG, 2017, June 1).

Figure 26

New Users of Huizhou's Cultural Tourism Digital Tools by Generation



Source: Compiled by the author using data on new digital tools for cultural tourism development in Huizhou from January to April 2023, provided by the Huizhou tourism development promotion center

Generation Z refers to those born from the mid-1990s to the early 2010s (Singh & Dangmei, 2016). Therefore, by 2023, their age range varies from 13 to 27. They came of age amidst the transformations brought about by the Internet, smartphones, laptops, free Wi-Fi, and digital media (Evans & Robertson, 2020).

Regardless of the precise age brackets, the significance of these two generations lies in their representation of the future market. Both Generation Y and Generation Z are considered digital natives, showing a preference for immersive digital and gamified travel experiences (Skinner et al., 2018). They are the primary target audience of the research.

3.1.2 VISITORS TO HUIZHOU CULTURAL TOURISM

The researcher conducted interviews with 15 visitors to Huizhou's cultural tourism.

A total of 550 questionnaires were distributed, with 516 questionnaires returned, resulting in a response rate of 93.82%. Among these, 514 questionnaires were deemed valid, yielding an effective response rate of 93.45%.

3.1.3 HUIZHOU CULTURAL TOURIST ATTRACTION EMPLOYEES

The researcher conducted interviews with 15 Staff at Huizhou’s Cultural Tourist Attractions.

3.1.4 TEST PARTICIPANTS

Thirty individuals voluntarily participated in evaluating the effectiveness of gamified digital tools for cultural tourism in Huizhou.

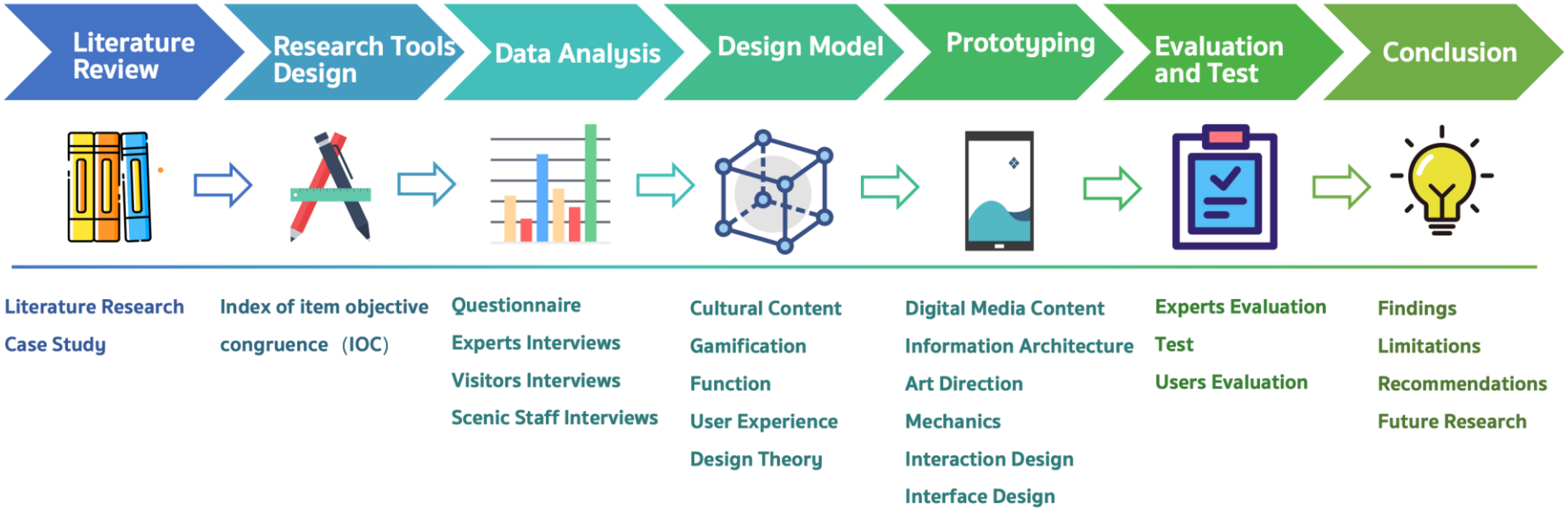
3.2 RESEARCH PROCESSES

The research aims to explore the process of designing gamified digital tools for cultural tourism in Huizhou, which is a form of research within the knowledge domain. The research employs a mixed-methods approach to construct an academic database to gather design-related data. The primary focus is on the target audience's tourism behavior and visual aesthetic preferences. Additionally, qualitative data related to content and creativity are collected through expert interviews. To achieve this objective, the research design process is divided into seven main steps (Figure 27):

1) Learning concepts, theories, research findings, and relevant cases
2) Designing research tools
3) Collecting, analyzing, and summarizing data
4) Designing models
5) Prototyping
6) Gathering feedback through testing
7) Concluding and presenting the research outcomes

Figure 27

Research Process



Note: The figure illustrates the steps and content of the research process, aligning with the details provided in 1.10 (on page 8).

Source: Created by the author

3.3 RESEARCH CONCEPTS, THEORIES, FINDINGS, AND RELATED CREATION PROCESS

In this phase, the researcher gathered information from academic literature, papers, relevant research reports, and publicly available online electronic sources. This information encompassed academic content, research-related knowledge, and creative works for the design and development of the cultural tourism gamified digital tools. The researcher synthesized crucial theories, content, and operational methods from this material, creating a guide for creating gamified digital tools for cultural tourism. Additionally, the researcher used this material as a guide for creating questionnaires and research tools to ensure the effectiveness and credibility of the study. The specific research components are as follows:

3.3.1 Study of Cultural Tourism Concepts

3.3.2 Study of Cultural Tourism in Huizhou

3.3.3 Study of Gamification and Related Concepts

3.3.4 Study of Gamification in Cultural Tourism

3.3.5 Study of Digital Tools in Cultural Tourism

3.3.6 Study of Gamified Digital Tools in Cultural Tourism

3.3.7 Study of Gamification Design Theories

3.3.8 Study of the Target Audience

3.4 RESEARCH TOOL DESIGN PROCESS

Based on the research and synthesis of the literature in sections 3.3.1 to 3.3.8, an information analysis was conducted to create a semi-structured qualitative research tool in the form of expert interviews.

3.4.1 RESEARCH TOOLS FOR COLLECTING HUIZHOU CULTURAL TOURISM CONTENT DATA

To gather data related to Huizhou's cultural tourism content, including locations, cultural information, historical figures, stories, and more, the following tools were employed:

1) On-Site Investigation

Conducting field research at Huizhou's cultural tourism attractions to observe the behavior and routes of tourists.

2) Tourist Interview Questionnaire

Visiting Huizhou's cultural tourism attractions and conducting semi-structured and unstructured interviews with tourists to collect information related to their participation in cultural tourism activities in Huizhou.

3) Attraction Staff Interview Questionnaire

Visiting Huizhou's cultural tourism attractions and conducting semi-structured and unstructured interviews with attraction staff to gather information related to tourists' participation in cultural tourism activities in Huizhou.

4) Huizhou Cultural Tourism Expert Interview Questionnaire

Conducting semi-structured and unstructured interviews with three experts in Huizhou cultural tourism. This data collection involves information and data related to Huizhou cultural tourism, including historical figures, cultural heritage sites, legends, and anecdotes, serving as guidelines for designing game content.

5) Surveying Target Users Employing Questionnaire

Collecting perceptions of Huizhou cultural tourism from target users. Analyzing this data to guide the design of cultural content. The questionnaire was created based on literature reviews from the cultural tourism field and expert opinions.

3.4.2 RESEARCH TOOLS FOR COLLECTING GAMIFICATION DATA

1) Case Studies

Researching relevant case studies related to gamification in cultural tourism.

2) Gamification Expert Interviews

The Gamification Expert Interview Questionnaire is used to collect data through semi-structured interviews to obtain valuable research information. The aim of analyzing and summarizing the collected information and data is to enhance tourists' perceptions of cultural content while engaging in Huizhou cultural tourism.

Comprehensive screening of research information in the gamification field, combined with expert opinions, has led to the identification of key principles for gamification design, as follows:

a. Clearly define the target users

Identifying factors influencing the target users, especially considering that different user groups may have varying usage patterns and needs. This is particularly critical in gamification design and aesthetics because the initial design phase needs to prioritize engaging the target audience and considering their specific requirements and motivational mechanisms.

b. Balance on-site and digital experiences of tourism

The primary intention of this research is to enhance tourists' experiences of participating in cultural tourism by finding a balance between assisting users in real-world visits and facilitating digital media information access.

c. Appropriate tasks

The arrangement of task content should be distributed reasonably to ensure those involved do not feel overwhelmed by the volume of information. This is crucial as it can impact user perception and lead to cognitive fatigue.

These comments and literature research points can be used as key aspects for designing consumer questionnaires for the target audience, as described in Chapter 4.

3) Surveying Target Users Employing Questionnaires

Gathering preferences from the target users of Huizhou cultural tourism gamified digital tools. The purpose of analyzing this data is to guide gamification design. The questionnaire was created based on literature reviews, case studies, and expert opinions from the gamification field.

3.4.3 RESEARCH TOOLS FOR COLLECTING GAMIFIED DIGITAL TOOL DESIGN DATA

1) Case Studies

Researching relevant case studies related to gamified digital tools in cultural tourism.

2) Expert Interview Questionnaire

A semi-structured interview approach was employed in this study to collect data on gamified digital tool design from two digital tool design experts. The data were then used for design analysis and identifying design patterns. Furthermore, these patterns were applied to the image creation process, leading to the construction of a

questionnaire. The aim of the questionnaire was to explore the preferences of the target user group for the Huizhou cultural tourism gamified digital tool regarding image usage, focusing primarily on the following three aspects:

a. Artistic Style

b. Presentation Dimensions of Images (commonly 2D and 3D images)

c. Color

3) Surveying Target Users Employing Questionnaires

Collecting data on the target audience's preferences for artistic styles in Huizhou cultural tourism gamified digital tools. The data analysis is used to guide the visual design of gamified digital tools in Huizhou cultural tourism. This questionnaire was created based on literature reviews, case studies, and expert opinions from the field of gamification visual design.

3.4.4 EXPERIENCE ASSESSMENT DATA COLLECTION TOOLS

Testing the user experience of the gamified system by utilizing data from literature reviews, development data from related creative works, and questionnaire summary analyses. Gathering and summarizing suggestions from target users, gamification experts, and digital tool design experts to optimize the design. The primary tools used include:

1) Expert Evaluation Questionnaire

Collecting expert evaluation data on the gaming experience using a questionnaire.

2) User Effectiveness Analysis Questionnaire

Using pre-test and post-test questionnaires to collect and analyze data on user interaction with the game.

3) User Experience and Effectiveness Analysis Questionnaire:

Employer an evaluation questionnaire to collect user experience and game effectiveness data.

The purpose of the foregoing data collection and analysis was to guide the optimization and improvement of the game. This questionnaire was created based on literature reviews, case studies, and expert opinions from the gamification design field.

3.5 DETAILED EXPLANATION OF RESEARCH TOOLS

The questionnaire types used in this research are categorized into the following five types:

1) Ranking

2) 5 Rating Scale (Likert scale)

3) Single Choice

4) Multiple Choice

5) Open Ended

3.5.1 QUESTIONNAIRE DETAILS

FIRST SET OF QUESTIONNAIRES (VISITORS' QUESTIONNAIRE)

The data collection objectives for the first set of questionnaires are as follows:

a. To identify the behavioral characteristics of target users when participating in cultural tourism.

b. To Discover the Motivating Factors for User Engagement.

c. Understanding User Needs and Technology Acceptance.

d. To Provide Guidelines for Art Styles.

1) Questionnaire

a. Respondent's Basic Information

b. Perception of Huizhou Cultural Tourism by Visitors

c. Factors Influencing User Engagement

d. Artistic Design of the Game

e. Suggestions

2) Sample Group

The sample population used in this questionnaire dataset was 514 people randomly selected from the cultural tourism visitors in Huizhou.

SECOND SET OF QUESTIONNAIRES (EXPERT INTERVIEW)

1) Questionnaire, with Open-Ended Questions

a. Relevant Content on Huizhou Cultural Tourism

b. Relevant Content on Gamification Design

c. Relevant Content on Digital Tool Design and Development

d. Suggestions

2) Sample Group

The sample group used to collect questionnaire data consists of seven experts selected through purposive sampling.

THIRD SET OF QUESTIONNAIRES (VISITOR INTERVIEW)

1) Questionnaire, with Open-Ended Questions

a. Visitor's Participation in Huizhou Cultural Tourism

b. Visitor's Use of Digital Tools in Huizhou Cultural Tourism

c. Suggestions

2) Sample Group

The sample group used for this questionnaire data consists of 15 individuals randomly selected from tourists in Huizhou's cultural tourism sector. Among them, five individuals are group tour tourists, and ten are independent travelers.

FOURTH SET OF QUESTIONNAIRES (STAFF INTERVIEWS)

1) Questionnaire, with Open-Ended Questions

a. Operation Status of the Scenic Area

b. Digital Services in the Scenic Area

c. Suggestions

2) Sample Group

The sample group for this questionnaire data consists of nine individuals selected through purposive sampling.

FIFTH SET OF QUESTIONNAIRES (EXPERTS EVALUATION)

1) Questionnaire Content

a. Expert's Satisfaction with the Experience and Effects

b. Suggestions, with Open-Ended Questions

2) Sample Group

The sample group for this questionnaire data consists of nine individuals selected through purposive sampling.

SIXTH SET OF QUESTIONNAIRES (PRE-TEXT)

1) Questionnaire

Test on knowledge of Huizhou culture and tourism

2) Sample Group

The sample group used for this questionnaire data consists of 30 individuals randomly selected from tourists in Huizhou's cultural tourism sector.

SEVENTH SET OF QUESTIONNAIRES (POST-TEXT)

1) Questionnaire

Test on knowledge of Huizhou culture and tourism

2) Sample Group

The sample group for this questionnaire data consists of 30 individuals selected through purposive sampling.

EIGHTH SET OF QUESTIONNAIRES (USER EVALUATION)

The purpose of collecting data from the fifth set of questionnaires is to determine the satisfaction of the target audience with the prototype of the Huizhou cultural tourism gamification digital tool.

1) Questionnaire

a. User's Basic Information

b. User's Experience Evaluation

c. Usage Effectiveness Evaluation

d. Suggestions

2) Sample Group

The sample group for this questionnaire data consists of 30 individuals selected through purposive sampling.

3.5.2 DETERMINING THE QUALITY OF QUESTIONNAIRES

The researcher submitted a formal application for a specific research project to an advisor. To ensure the academic quality and practical feasibility of the research, the school successfully invited three evaluation experts with professional backgrounds and rich experience following relevant academic standards and procedures. A

comprehensive review of the research instruments used in this study was conducted by experts.

1) Expert Information

a. Professor Wattana Jutavipard

Faculty of Digital Art, Rangsit University

b. Assistant Professor Kriangsak Khiaomang

Faculty of Fine & Applied Arts, Burapha University

c. Dr. Miyoung Seo

Assistant Professor, Faculty of Fine & Applied Arts, Burapha University

2) Questionnaire Quality Evaluation

The quality of research questionnaires was assessed using the IOC standard, which examines the correspondence between the questionnaire and its objectives or content. The evaluation was conducted as follows:

If the question content aligned with the objectives, it scored +1.

If unsure about the alignment of question content with objectives, a score of 0 was assigned.

If the question content did not align with the objectives, it scored -1.

Table 8

Expert Review Results for Research Tools

Item	Score
Questionnaire for Visitors	0.93
Experts' Interview	0.94
Visitors' Interview	1
Scenic Staff Interview	1
Evaluation Form for Experts	1
Pre-Test Questionnaire	1
Post-Test Questionnaire	1
Evaluation Form for Users	0.98

Source: Created by the author

The expert review results shown in Table 8 demonstrate that all research tools scored above 0.8, indicating their reliability for data collection. The researcher also

considered specific recommendations from experts and conducted detailed revisions and enhancements to the questionnaire content, ensuring further improvements in the quality of the questionnaire and the accuracy of data collection (Figure 28).

Figure 28

The IOC Experts' Review of the Research Tools

Source: Photo by the author

3.6 PROCEDURES AND RESULTS

The results of data collection through questionnaire surveys were analyzed and summarized. Expert recommendations were integrated for use as guidelines for the design work. Additionally, the prototype of the Huizhou cultural tourism gamified digital tool, and the satisfaction results obtained from its trial by the target audience will be explained further in subsequent chapters.

3.7 EXPERTS INVOLVED IN THE STUDY

Seven experts were selected through purposive sampling based on the knowledge domains covered in this research. The criteria for qualifying as experts were based on their prior work achievements and a minimum of eight years of relevant work experience. The experts were divided into three groups:

1) Huizhou Cultural Tourism Experts

a. Ms. Chen Feng

Director, Huizhou Tourism Development Promotion Center

b. Dr. Lin Bowei

Director, Huizhou Cultural Center

c. Ms. Zheng Ying

Huizhou's Gold Tourist Guide

Ten years of experience in Huizhou cultural tourism

2) Gamification Design Domain Experts

a. Professor Li Fan

Dean, College of Fine Arts and Design, Huizhou College

b. Associate Professor Gong Chengwei

Dean, College of Art and Design, City College of Huizhou

3) Digital Tool Design Domain Experts

a. Mr. Lin Zexin

Product Manager, West Lake Shore Network Co., Ltd., Huizhou

b. Mr. Zhang Ruoying

User Interface Designer, Tencent Technology (Shenzhen) Co., Ltd.

3.8 EVALUATION EXPERTS INVOLVED IN THE STUDY

Nine evaluation experts were chosen through purposive sampling. The criteria for qualifying as experts were based on their prior work accomplishments and a minimum of eight years of relevant work experience. The experts were divided into three groups:

1) Huizhou Cultural Tourism Experts

a. Ms. Chen Feng

Director, Huizhou Tourism Development Promotion Center

b. Mr. Lin Bowei

Director, Huizhou Cultural Center

c. Ms. Zheng Ying

Huizhou's Gold Tourist Guide

2) Gamification Experts

a. Professor Li Fan

Dean, College of Fine Arts and Design, Huizhou College

b. Associate Professor Gong Chengwei

Dean, College of Art and Design, City College of Huizhou

Associate Professor Wang Ying

College of Art and Design, Huizhou City Vocational College

3) Digital Tool Design Domain Experts

a. Mr. Lin Zexin

Product Manager, West Lake Shore Network Co., Ltd., Huizhou

b. Mr. Zhang Ruoying

User Interface Designer, Tencent Technology (Shenzhen) Co., Ltd.

c. Ms. Shi Shaoting

Programmer, Huizhou Xiyu Entertainment Technology Co., Ltd.

3.9 CHAPTER SUMMARY

This chapter provides a detailed overview of the research methodology and process, demonstrating a powerful mixed-methods approach that combines qualitative and quantitative research to develop a gamified digital tool designed to enhance cultural tourism in Huizhou. The chapter begins with a detailed introduction to the study population, focusing on the age and gender segmentation of the target users, with particular emphasis on digital natives of Generation Y and Generation Z, who are the primary audiences of the study. The chapter then elaborates on the research process, including the design and development of research instruments, data collection methods, and an iterative prototype evaluation process. A large proportion of this chapter is dedicated to designing and applying various questionnaires and interview instruments used to collect data from tourists, staff, and experts in cultural tourism, gamification, and digital tool design. A panel of experts rigorously evaluated the quality of these research instruments to ensure their reliability and alignment with the research objectives. The research results and expert feedback were then used to improve the gamified digital tool prototype, which was essential to the research goal of enhancing the cultural tourism experience in Huizhou. This chapter lays the foundation for the subsequent analysis and discussion of the research findings.

CHAPTER 4
EMPIRICAL RESEARCH AND DESIGN MODEL FORMULATION

This chapter builds on the foundation laid by the earlier literature review, delving into the empirical exploration and formulation of a design model for gamified digital tools to enhance cultural tourism experiences in Huizhou. The research systematically examines the current digital tools employed in Huizhou's cultural tourism sector, analyzing their effectiveness and identifying existing challenges.

The discussion begins with a comprehensive analysis of the digital tools currently available, distinguishing between those developed by individual cultural tourism attractions and those managed by local tourism departments. This analysis highlights significant disparities in user engagement and information depth across different tools, suggesting a need for more cohesive and user-friendly solutions.

The research presents findings from on-site observations and interviews with various stakeholders, including tourists, scenic staff, and local residents. These insights reveal crucial gaps between on-site cultural tourism experiences and the potential of digital tools, underscoring the necessity for improved integration and user incentive mechanisms.

Building on these findings, the researcher proposes a conceptual framework for gamified digital tools tailored to Huizhou's cultural tourism context. This framework encompasses the original experience, gamified integration, task design, user incentives, content development, aesthetic presentation, and technical implementation. Each framework aspect is designed to address specific challenges identified in the analysis, aiming to bridge the gap between digital and on-site experiences and enhance the overall tourist experience.

Finally, this chapter outlines a design process model for developing these gamified digital tools, which includes research, analysis, design, development, and evaluation phases. This model provides a practical guide for implementing the proposed framework, ensuring that the digital tools are user-friendly, culturally rich, and can enhance tourists' engagement and learning experiences. Additionally,

hypotheses regarding the potential impact of gamification strategies on user motivation, participation, and cultural knowledge retention are presented, setting the stage for further empirical validation in subsequent sections.

4.1 ANALYSIS OF THE CURRENT STATE OF CULTURAL TOURISM DIGITAL TOOLS IN HUIZHOU

Huizhou City boasts abundant cultural and natural tourism resources, making it a destination with immense potential. However, despite this, the region's recognition on a national scale still needs to improve. This phenomenon underscores an urgent need to enhance Huizhou City's tourism brand image and awareness in a broader geographical and cultural context. Currently, on a global scale, the rapid development of digital and information technologies is profoundly altering the operational modes and user experiences in the cultural tourism industry. Under the impetus of this trend, Huizhou City has also actively embraced digital tools to serve tourists, developing platforms including, but not limited to, WeChat Mini Programs, official public accounts, and dedicated tourism websites. The digital tools in Huizhou's cultural tourism can be categorized into two main types, developed and maintained by either individual tourist attractions or local government tourism management departments. While these two categories differ in terms of functionality, target audience, and scope of application, they constitute a complex and diverse digital tourism ecosystem.

4.1.1 DIGITAL TOOLS DEVELOPED BY CULTURAL TOURISM ATTRACTIONS

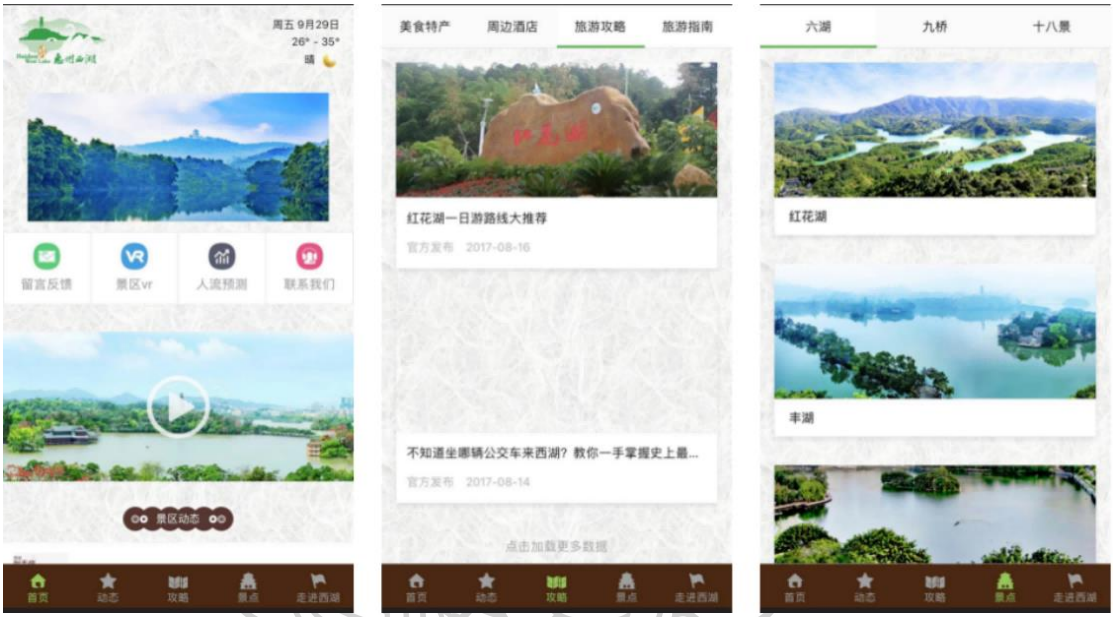
Digital tools developed by cultural tourism attractions typically focus on services within specific scenic spots or regions. These tools explain attractions, route planning, and related information services to enhance tourists' travel experiences in specific areas. Moreover, these tools often include educational content related to local culture and history, allowing tourists to gain a more comprehensive understanding and appreciation of the cultural value of the respective attractions.

For instance, the digital tool for Huizhou West Lake is based on the WeChat Mini Program platform and custom-developed for Huizhou West Lake scenic area (Figure 29). It aims to provide tourists with a comprehensive and convenient tourism

information service platform. This tool integrates multidimensional information on Huizhou West Lake, including but not limited to introductions to attractions, tourist route planning, real-time route planning, and navigation services, thereby achieving the holistic optimization of tourists' travel experiences.

Figure 29

Huizhou West Lake Tourism Digital Tool



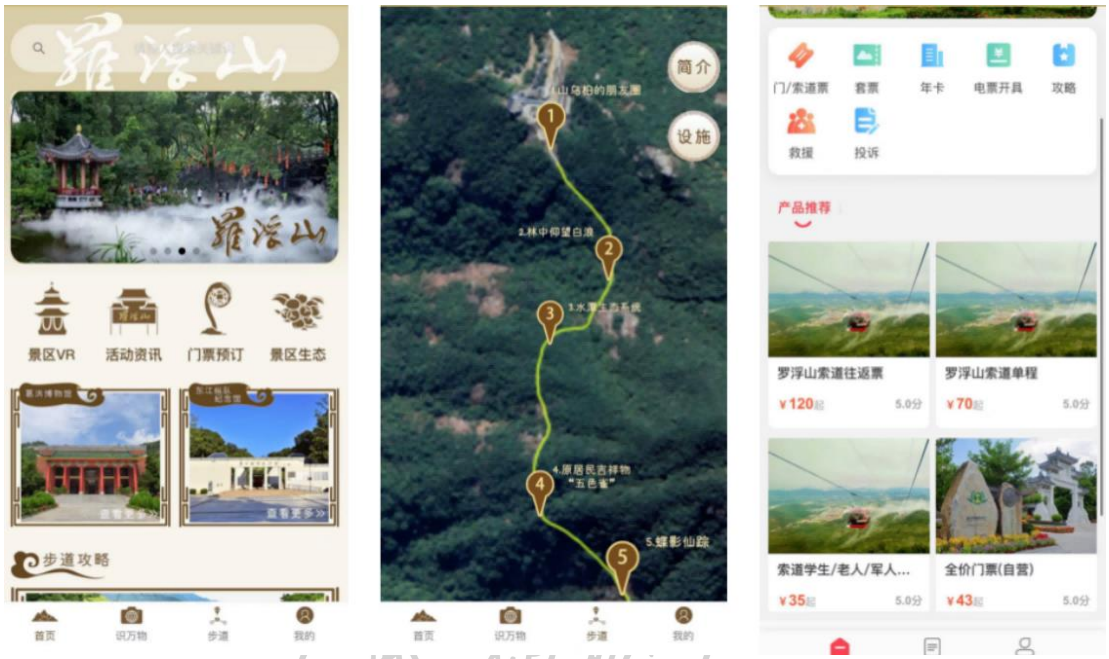
Note: The interface of Huizhou West Lake tourism digital tool.

Source: Screenshot by the author, May 9, 2023

Similarly, "Zuimei Luofu" is a digital tool developed specifically for the Luofu Mountain scenic area based on the WeChat Mini Program platform (Figure 30). This tool offers a range of comprehensive tourism information services, such as explaining attractions, multimodal route planning, real-time inquiries about local events, and a convenient ticket booking interface. Furthermore, the tool incorporates in-depth content related to the local culture and history, aiming to enhance tourists' comprehensive understanding and appreciation of the cultural value of Luofu Mountain.

Figure 30

Luofu Mountain Tourism Digital Tool



Note: The interface of the Luofu Mountain tourism digital tool.

Source: Screenshot by the author, May 9, 2023

4.1.2 DIGITAL TOOLS DEVELOPED BY TOURISM MANAGEMENT DEPARTMENTS

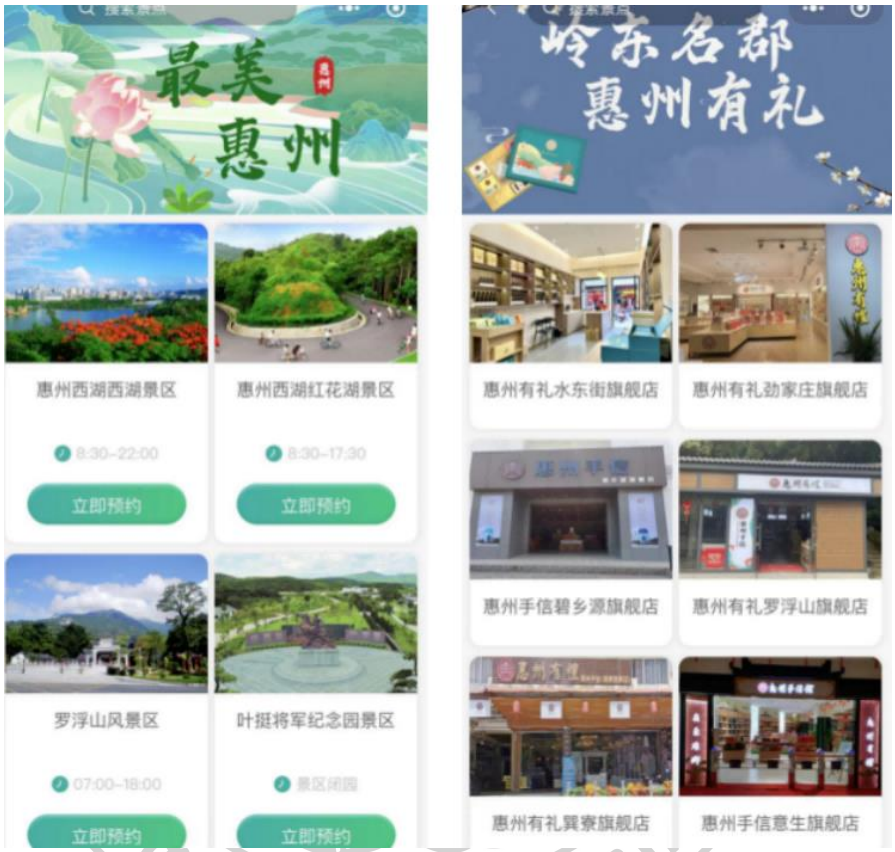
Digital tools developed by tourism management departments tend to be comprehensive with a broad scope. These tools typically cover a wider geographical range and multiple tourist attractions, providing a range of services from regional guided tours to reservations for entry to multiple attractions and shopping guidance for tourists. They help tourists plan and execute their travel plans more efficiently and assist local governments in effectively managing and promoting tourism resources.

For example, Huizhou Wenlv Tong is an official WeChat Mini Program developed by the Huizhou Municipal Culture and Tourism Bureau in collaboration with enterprises (Figure 31). Serving as a comprehensive tourism information integration platform for the entire Huizhou City, this application aggregates detailed data on all tourism resources within the city. The app provides regional guided tour information, a reservation mechanism for multiple attractions, shopping guidance, and educational content related to local culture and history. The app offers a range of

detailed digital services specifically for large-scale tourist attractions, while for smaller attractions, it provides basic yet comprehensive tourism information.

Figure 31

WeChat Mini Program: Huizhou Wenlv Tong



Note: The interface of Huizhou Wenlv Tong.

Source: Screenshot by the author, May 9, 2023

Cost and demand predominantly influence the development of cultural tourism digital tools. For instance, certain well-known or financially robust tourist attractions may be more inclined to adopt digital tools. In contrast, smaller or financially constrained attractions may rely primarily on signage and printed materials. This disparity leads to uneven quality and depth of information, resulting in fragmented tourist experiences. This lack of unified experiences reflects the diversity in resource allocation and management strategies among cultural tourism attractions and directly impacts tourists' awareness and cultural absorption.

4.1.2 ON-SITE OBSERVATIONS

To gain a deeper understanding of the practical application of cultural tourism digital tools in Huizhou City, the researcher conducted systematic on-site observational studies of visitor behaviors at 11 cultural tourism attractions in the city. The research revealed significant differences in the experiences of group tourists and individual self-guided tourists at cultural tourism sites. These differences not only manifested in the visitors' modes of exploration and the depth of their cultural interactions but also significantly influenced their acceptance and frequency of cultural tourism digital tools.

1) Group Tourist Behavior

In the common mode of group tourism, visitors rely on tour guides or specialized interpreters at the attractions to receive comprehensive guidance and explanations. While this approach provides an integrated and convenient service, it also results in lower usage frequency of cultural tourism digital tools among this group. However, this group tourism mode has limitations, including fixed itinerary arrangements, restrictions on individual freedom, and shallow cultural experiences. These limitations often stem from predetermined travel schedules and activities set by tour agencies, leaving tourists with limited opportunities for personalized exploration and a need for an in-depth understanding and experience of the destination's culture.

Based on observations by the researcher (Figure 32), tourists in group tour mode typically skew toward an older age demographic, while group sizes generally range from six to 14 people. During visits to the attractions, interested tourists closely follow the tour guides, while those at the rear of the group often engage in conversations or simply enjoy the scenery. Unlike tour group guides, the specialized interpreters at the attractions provide more accurate and professional cultural information, possibly because of their deeper understanding of the local culture. However, the expertise of interpreters varies, directly affecting the quality of cultural information dissemination. Both tour guides and specialized interpreters often include commercial promotions or shopping recommendations in their explanations, which can create additional psychological pressure for tourists.

Figure 32

Tourism Behavior of Group Tours at Huizhou Cultural Tourist Attractions

Source: Photo by the author, May 4, 2023

2) Self-guided Tourist Behavior

In the independent travel mode, tourists' behaviors exhibit diverse characteristics. Some tourists join tour groups to receive free guidance and cultural explanations from group tour guides. However, most self-guided tourists prefer to use traditional signage, information display boards, and digital media devices provided by the attractions, such as televisions and electronic screens, to obtain tourism information (Figure 33).

Despite some tourists attempting to use digital tourism tools to enhance their experience, on-site observations reveal that they primarily use these tools to access digital explanations of attractions. Unfortunately, only a few tourists continue to use these tools for in-depth exploration. Some tourists quickly give up their attempts to explore further due to the complexity or need for intuitiveness in the interface design of digital tools. Additionally, even among tourists who attempt to use digital interpretation features, they often only briefly browse the information and refrain from engaging extensively.

Figure 33

Self-Guided Tourists' Access to Information Related to Cultural Tourism

Source: Photo by the author

Furthermore, the research also reveals that although some tourists engage in spontaneous cultural discussions during their visits, these often lack depth and

structure, possibly because of the tourists' limited understanding of the local culture and historical background. In the self-guided travel mode, tourists' understanding of the destination's culture often remains superficial, lacking depth and breadth.

The collective feedback from tourists in the two travel modes described above reveals a problem: cultural tourism digital tools still need to be fully utilized to optimize the tourists' travel experiences. Although these tools provide comprehensive tourism information services with the intention of deepening tourists' understanding and appreciation of cultural aspects of the attractions, on-site observations show that group tourists mainly rely on tour guides or interpretive staff to receive guidance and explanations. In contrast, independent tourists use traditional signage, information display boards, and digital media devices provided by the attractions to obtain tourism information.

The reasons for this are twofold. On the one hand, the threshold for using cultural tourism digital tools is relatively high, requiring tourists to possess a certain level of information technology literacy and digital device operating skills. On the other hand, the design of these tools often needs more user-friendliness and intuitiveness, causing confusion or inconvenience for tourists during usage. Additionally, the digital interpretation content of some attractions often consists of simple listings of information, requiring more depth and breadth and helping to meet tourists' desires for an in-depth exploration of cultural content.

4.1.3 SUMMARY AND ANALYSIS OF CURRENT ISSUES

The collective feedback from tourists in the two travel modes described earlier reveals a common issue: cultural tourism digital tools still need to be fully utilized to enhance tourists' travel experiences. Based on on-site observations and interview data with tourists conducted in Huizhou's cultural tourism attractions, it is clear that the digital tools offered in this region have significant limitations in practical application. As a result, the role of these digital tools in constructing an overall cultural tourism experience requires more recognition. To delve deeper into the current problems with Huizhou's cultural tourism digital tools, the researcher conducted practical tests of these tools and, in conjunction with observational and interview data, attempted to analyze the underlying causes further. The specific elements are as follows:

1) Disconnection Between On-Site Experience and Digital Experience

Cultural tourism digital tools, as potent mediums, primarily aim to enhance tourists' travel experiences through digital media forms. These tools tend to focus on providing digital information, attracting tourists' attention by conveying cultural and historical information. However, such emphasis also reveals apparent limitations, especially in bridging the gap between digital experiences and on-site experiences (the actual experiences of tourists on-site). This gap is manifested as follows: 1) Insufficient real-time interaction between digital tools and tourists, resulting in tourists mostly passively receiving information without active participation opportunities. 2) Ineffective integration of digital tools with the on-site environment and cultural elements, thus missing the potential to provide more personalized and enriched experiences. These limitations have affected the practicality and attractiveness of cultural tourism digital tools, constraining their broader application in cultural dissemination and education.

2) Lack of User Incentive Mechanisms

Originally, cultural tourism digital tools were designed to mediate tourists' information-sharing and dissemination behaviors, further promoting the branding and marketing of tourism attractions. However, the research results indicate that tourists primarily view these tools as platforms for short-term, one-time information retrieval in actual applications rather than environments that encourage sustained engagement and social sharing. This phenomenon diminishes the expected benefits of cultural tourism digital tools in brand communication and marketing. This is further exacerbated by the absence of user incentive mechanisms, resulting in tourists discontinuing the use of these tools throughout their journey.

The core issue lies in the current design of cultural tourism digital tools, which has not undergone an in-depth analysis of user psychology and behavioral patterns, thus failing to establish effective user incentive mechanisms. This design flaw results in tourists lacking motivation for further engagement and social sharing after obtaining initial information and not continuing to use these tools for information retrieval or social interaction. This limits the tools' expansion of social and cultural influence, diminishing their potential value in overall marketing.

3) Lack of Depth and Multidimensionality in Digital Media Content

Huizhou's cultural tourism digital tools primarily rely on basic media forms such as images, text, audio, and video for cultural explanations. This heavy reliance leads to two problems: firstly, digital content significantly duplicates the informative signage on-site, lacking uniqueness (Figure 34); secondly, this content often lacks depth in most cases. Even more critically, this superficial mode of content dissemination fails to delve into and showcase the multidimensionality and complexity of cultural attractions. Providing basic information on dates, events, and figures is insufficient for attractions with rich historical and cultural backgrounds. This approach overlooks the cultural, economic, and artistic elements and more.

Figure 34

The Digital Tool for Accessing the Attraction's Information Content Is Exactly the Same as That on the Signage

Source: Photo by the author

In the ecosystem of cultural tourism digital tools, tourists, tourism attractions, and local tourism management departments each play indispensable roles and are the main beneficiaries of this system. Tourists enrich their travel experiences and cultural knowledge as end-users by accessing convenient and comprehensive tourism information, precise navigation services, and in-depth cultural explanations through digital tools. Meanwhile, as the developers and implementers, tourism attractions focus on the diverse needs of tourists within their specific attractions, aiming to achieve efficient tourist management and service provision. This is typically done to enhance the visitor experience of a particular attraction and increase its visibility. In contrast to individual attractions, tourism management departments' digital tools often cater to all attractions within their region, typically encompassing regional tour information, consolidating information on activities and discounts at multiple attractions, and educational content related to local culture and history. These tools have broader objectives to improve the overall quality and competitiveness of tourism in the entire region. Tourism management departments hope to utilize the vast amount of user data collected through these tools to engage in more scientifically informed resource planning and management, including infrastructure development, the long-term preservation and effective utilization of cultural resources, and precise marketing strategies for target markets. Therefore, in developing cultural tourism digital tools, the common interests of all parties should be considered comprehensively to achieve a win-win development situation. It is worth noting that tourists' willingness to participate plays a crucial role in driving this win-win development situation.

4.2 INTERVIEW ANALYSIS

4.2.1 EXPERT INTERVIEWS

Through purposeful sampling, the researcher selected seven experts (Figure 35). Detailed information on these experts can be found in Chapter 3.

Figure 35

Interviews with Experts

Source: Photo by the author

ANALYSIS OF EXPERT INTERVIEWS ON HUIZHOU CULTURAL TOURISM

The researcher conducted interviews with three experts in the field of cultural tourism in Huizhou, aiming to gain a deeper understanding of the uniqueness of Huizhou's cultural tourism, its future development potential, and the possibilities of integrating gamified digital tools. The experts unanimously acknowledged Huizhou's esteemed status due to its rich historical heritage, unique geographical features, and diverse folk culture. They particularly emphasized that West Lake, Luofu Mountain, and Su Dongpo Shrine are Huizhou's most culturally valuable tourist attractions. They regarded cultural symbols, Su Dongpo and the culture of Huizhou Ancient City as important representatives of Huizhou's culture. From a technological perspective, the experts generally saw significant potential in successfully combining cultural tourism with gamified digital tools through digital media art. They recommended integrating the most suitable cultural elements of historical figures, geographical landmarks, and folk activities into the design.

SUGGESTIONS FROM HUIZHOU CULTURAL TOURISM EXPERTS

1) Integration of Regional Culture and History

To enhance the cultural and historical depth of gamified digital tools, it is suggested that Huizhou's historical culture and geographical information be integrated. This would showcase the location's unique features and closely associate task challenges with Huizhou's distinctive cultural attractions or activities.

2) User Experience and Engagement

From a user experience perspective, gamified digital tools should first introduce attractions, allowing users to gain comprehensive insights into detailed information about Huizhou's cultural tourism attractions. Adding interactive elements to real-world attractions not only enables user engagement to be increased, but the allure of the gamified digital tools can also be enhanced. Personalized recommendations based on user behavior and preferences should be included to meet the needs of different user groups.

3) Business Models and Sustainable Development

Firstly, regarding business models, the experts recommend establishing partnerships with local businesses and tourism organizations, contributing to the commercial success of gamified digital tools. Secondly, data analysis should be applied to collect and analyze user data more effectively, enabling a better understanding of the gamified digital tools' impact and improvement direction.

ANALYSIS OF INTERVIEWS WITH GAMIFICATION EXPERTS

The researcher conducted interviews with two gamification experts to explore the application and development potential of gamification in the field of cultural tourism in Huizhou. The experts generally believed that gamification could enhance user experience and engagement and effectively promote cultural dissemination. To support this viewpoint, they cited successful gamification application cases, such as location-based cultural exploration, gamified digital tools, and augmented reality (AR) technology-based tourist guides. The experts emphasized key aspects of the gamification design process, such as needs analysis, goal setting, incentive mechanism design, and user testing. They pointed to the feasibility of gamification

design in Huizhou due to its rich cultural heritage and significant development potential.

SUGGESTIONS FROM DIGITAL TOOL DESIGN EXPERTS

1) Psychological Incentives and User Engagement

Psychological incentive mechanisms in gamification form the foundation for user engagement. Multilayered and multidimensional achievements and reward mechanisms are of particular importance. These mechanisms enhance the appeal of digital tools and stimulate user participation. Social elements like sharing and competitive features further strengthen user social engagement. To maintain players' long-term interests, the design should gradually increase challenge levels to encourage continuous improvement.

2) User Interface and Cross-Platform Adaptability

User interface and interaction design are critical to optimizing the digital tool experience. Intuitive and user-friendly interface design reduces the user's learning curve and enhances user engagement through real-time feedback. Cross-platform adaptability becomes another important consideration in this context, ensuring the digital tool provides a consistent, high-quality experience on different devices and screen sizes.

3) Content Quality and Educational Value

Digital media content should strike a suitable balance between entertainment and education. Through storylines or character guidance, cultural and educational content could be more effectively conveyed while deepening user engagement. Furthermore, multimedia elements such as audio, video, and images enrich the digital tool experience and provide diverse channels for information dissemination.

ANALYSIS OF INTERVIEWS WITH DIGITAL TOOL DESIGN EXPERTS

The researcher conducted interviews with two digital tool design experts to explore the feasibility, design process, and key factors for developing gamified digital tools in the field of Huizhou cultural tourism. The experts first shared successful cases of cultural tourism gamified digital tools in the current market, such as "Mystery of

the Canal," and emphasized that carefully integrating cultural elements and gamification mechanisms was the key to their success. Next, when assessing the feasibility of gamified digital tools in Huizhou cultural tourism, the experts unanimously agreed that the region's rich cultural and diverse tourism resources offer vast potential for the application of gamified digital tools. Finally, regarding art style and technical implementation, the experts recommended an art style that aligns with Huizhou's culture and history, such as traditional Chinese aesthetics or locally distinctive folk art. They also provided specific suggestions for color scheme design, including using warm and natural tones to create the atmosphere of a harmonious experience and increasing color saturation to optimize outdoor visual experiences.

SUGGESTIONS FROM DIGITAL TOOL DESIGN EXPERTS

1) User Experience and Interface Design

To reduce the learning curve for users, gamified digital tools for cultural tourism in Huizhou should prioritize intuitiveness and ease of use as core design principles. Multimodal interaction, achieved through the comprehensive application of text, images, audio, and video, provides users with a rich and comprehensive way of presenting information. Furthermore, responsive design ensures the tool can adapt to different devices and screen sizes, further optimizing the user experience.

2) Content and Functionality

Gamified digital tools for cultural tourism in Huizhou should systematically integrate cultural tourism information from the Huizhou region to provide comprehensive and in-depth reference resources. To effectively enhance user engagement and satisfaction, the tool should also incorporate social sharing and gamification elements, such as achievement systems, points, and reward mechanisms, to promote user interaction.

3) Technology and Optimization

At the technical level, performance optimization is the primary task for ensuring the smooth operation of gamified digital tools on various hardware, a prerequisite for gaining broad user acceptance. Simultaneously, data security is a crucial aspect and the foundation for earning user trust and ensuring the long-term sustainability of gamified digital tools. Regarding technical implementation, the

experts recommend utilizing widely adopted domestic digital tool development platforms like WeChat Mini Programs.

4.2.2 VISITOR INTERVIEW ANALYSIS

The researcher interviewed 15 tourists of different travel modes (five group tour tourists and ten independent travelers), randomly selected at tourist attractions to better understand their experiences of cultural tourism destinations (Figure 36). The interview data revealed that tourists planned to stay in Huizhou for one to two days; therefore, the gamified design of digital tools should consider tasks and activities that could be completed quickly. West Lake, Luofu Mountain, and Dongpo Shrine were the most frequently mentioned attractions and should be considered as primary scenes for the game. Additionally, tourists wanted to explore more cultural and natural attractions through gamified digital tools. The use of cultural tourism digital tools varied among tourists, with some primarily employing them to explore and understand the local history and cultural background. In contrast, others focused on obtaining tourism-related information.

Figure 36

Interviews with Visitors

Source: Photo by the author

Among the interviewees in the research (Table 9), four explicitly stated that they had already used various digital tools provided by tourist attractions, including WeChat Mini Programs and mobile applications designed to enhance the tourism experience. In contrast, within the group of tourists who had not used these digital tools, five respondents from the group tours believed there was no need to use such tools. In comparison, another six respondents from group tours expressed that the impact of digital tools on enhancing the tourism experience was insignificant. Even tourists who had already used digital tools reported issues with such tools.

Table 9

Information on the Interviewed Visitors

Gender	Age	Occupation	Travel Mode	Features of Digital Tools Used
Male	22	Student	Self-guided	Site explanation, route inquiry
Female	45	Teacher	Group	-
Male	35	Retired	Group	-
Female	32	Engineer	Self-guided	-
Male	35	Doctor	Self-guided	-
Female	18	Student	Self-guided	
Male	35	Sales	Self-guided	
Female	31	Business	Group	-
Male	40	Programmer	Self-guided	Site explanation, electronic ticketing
Female	28	Designer	Self-guided	Site explanation
Male	44	Retired	Group	-
Female	18	Student	Self-guided	-
Male	25	Student	Self-guided	Site explanation
Female	32	Employee	Group	-
Male	44	Teacher	Self-guided	-

Source: Compiled by the author (N=15)

The feedback from tourists aligns with the observations made by the researcher at the scenic area, revealing limitations in the current digital tools concerning functionality and content. These tools often lack enhanced user interactivity. For instance, while they can provide basic information on attractions, they need to improve when delving deeper into cultural and historical backgrounds. Regarding information presentation, the singular format (primarily text and audio) of

the tools also fails to fully leverage the multimedia and interactive elements to enrich the user experience.

4.2.3 SCENIC STAFF INTERVIEW ANALYSIS

The researcher interviewed ten staff members randomly selected from ten different scenic spots in a survey to better understand each scenic spot's operational status and visitor behavioral characteristics (Table 10, Figure 37).

Table 10

Information on Interviewed Scenic Staff

Gender	Age	Scenic Area Affiliation
Male	49	Huizhou West Lake
Female	28	Chaojing Gate
Male	42	Hejiang Tower
Male	36	Shuidong Street
Male	55	Su Dongpo Shrine
Female	37	Binxing Pavilion
Male	45	Zhuwu Lane
Female	29	Hakka Po Scenic Area
Male	33	Luofu Mountain
Male	26	Yuanmiao Taoist Temple

Source: Compiled by the author, N=10

Figure 37

Interviews with Scenic Staff

Source: Photo by the author

In most scenic areas, visitors can access various services, including on-site guide commentary and electronic guides, all centered around introducing the attractions' historical, cultural, and natural aspects, providing a rich content foundation for educational tasks and challenges within gamified digital tools. However, despite a few scenic areas developing dedicated digital tools, their usage rates are not ideal.

4.2.4 ANALYSIS OF LOCAL RESIDENTS' INTERVIEWS

The researcher interviewed ten local residents living near scenic areas to understand their perspectives on promoting Huizhou cultural tourism through gamified digital tools. The interviewed residents unanimously suggested integrating the digital tool with local businesses, such as dining, shopping, and accommodation, to boost the local economy. This integration could be achieved by including features that showcase and link to nearby businesses, offering discounts or incentives for visiting certain locations and incorporating local products and services into the game’s narrative and challenges.

Insights from the local residents emphasized the potential of gamified digital tools to enhance Huizhou cultural tourism by integrating local commerce, adapting to visitor traffic patterns, balancing task structures, and enriching educational content. These findings provide a solid foundation for developing a tool that attracts and engages users and supports local economic development and cultural preservation.

4.3 ANALYSIS OF VISITOR QUESTIONNAIRE

The research employed a diverse data collection strategy to gain a comprehensive insight into visitor preferences and needs while ensuring their convenient participation in the research. Specifically, the researcher utilized an online survey tool as the primary electronic data collection channel, with paper questionnaires available to accommodate different occasions and target groups (Figure 38).

To ensure the representativeness and adequacy of the samples, the researcher further collaborated with the scenic area staff responsible for the on-site distribution of online questionnaires. The researcher distributed 550 questionnaires. Of these, 516

were successfully collected, resulting in a response rate of 93.82%. Among the collected questionnaires, 514 were deemed valid, leading to an effective response rate of 93.45%. The data from this survey questionnaire primarily served the following purposes: 1) Investigating the behavioral characteristics of visitors participating in cultural tourism. 2) Identifying factors influencing visitors' use of cultural tourism digital tools. 3) Assessing visitors' functional requirements and technological acceptance of gamified cultural tourism digital tools. 4) Understanding visitors' style preferences for gamified cultural tourism digital tools to guide the subsequent design and development of such tools for cultural tourism in Huizhou.

Figure 38

Visitors' Questionnaire

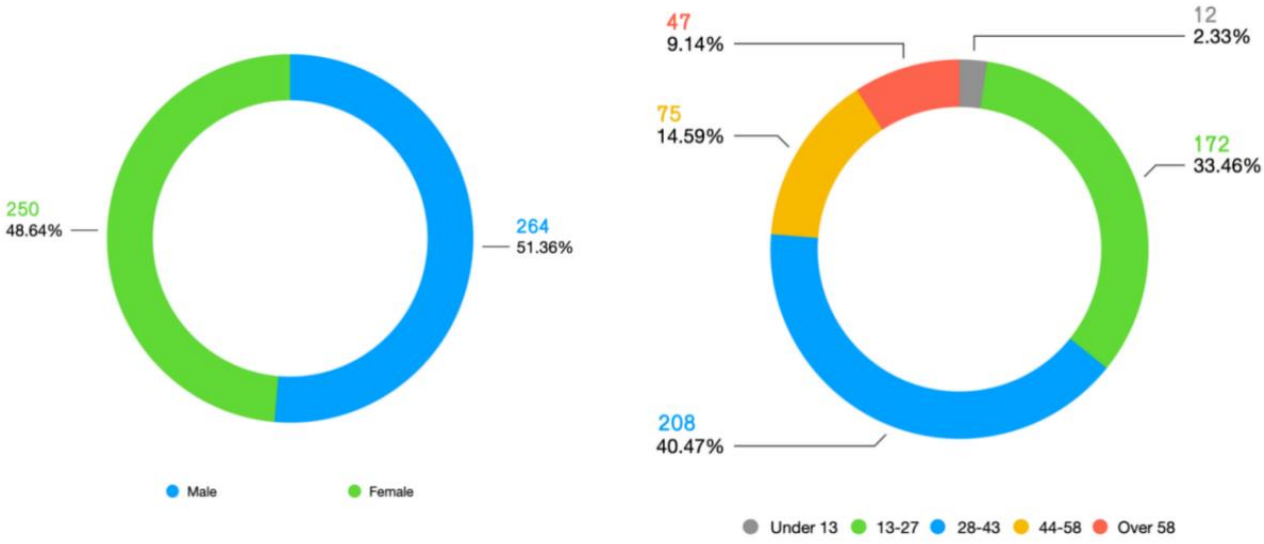
Source: Photo by the author

4.3.1 BASIC INFORMATION ON THE VISITORS

Based on the demographic information obtained from the questionnaires, it can be observed that slightly more males participated in this research than females (Figure 39). The overall age distribution trend leaned toward a younger demographic, with the 13–27 age group (Generation Z) and the 28–43 age group (Generation Y) constituting 73.93% of the respondents. The proportion of individuals under 13 years old and those above 58 years old was relatively low. Many of the surveyed individuals received higher education, with a focus on associate and bachelor's degrees. Considering all these data, the demographic composition of the surveyed visitors in terms of gender distribution and age group showed slight biases, but these variations did not affect the integrity of the survey results.

Figure 39

New Users of Huizhou's Cultural Tourism Digital Tools by Gender and Age



Source: Compiled by the author (N=514)

4.3.2 CHARACTERISTICS OF VISITORS' PARTICIPATION IN HUIZHOU CULTURAL TOURISM

1) Reasons for Respondent Participation in Cultural Tourism

Respondents identified the three most important factors influencing their participation in cultural tourism activities: gaining knowledge of historical culture and

related information, broadening their horizons, and relaxation (Table 11). Their ranking of importance was as follows: acquiring knowledge of historical culture and related information > broadening horizons > relaxation.

Table 11

Reasons for Respondents' Participation in Cultural Tourism

Options	No. of Sel. 1st	No. of Sel. 2nd	No. of Sel. 3rd	Score
To learn about history, culture, and related knowledge.	283	80	39	4.39
To broaden one's horizons and enhance one's experience.	90	166	60	3.13
Relaxing and relieving stress.	58	73	96	2.13
To improve cultural and aesthetic skills.	30	58	86	1.58
Visiting friends and relatives and making new friends.	44	38	50	1.27

Note: The table displays the average scores calculated based on a ranking multiple-choice question, with respondents asked to select and rank the three most important reasons from a list of five for participating in cultural tourism.

Source: Compiled by the author (N=514)

2) Most Preferred Cultural Tourism Attractions in Huizhou

Based on recommendations from Huizhou cultural tourism experts and considering the results of interviews with Huizhou cultural tourism scenic spot personnel and tourists, the researcher selected the top 10 cultural tourism attractions in Huizhou with the highest tourism value. The survey data (Table 12) show that Huizhou West Lake, Luofu Mountain, and Ye Ting's Former Residence are the three most favored cultural tourism attractions among the respondents, with the ranking of importance being Huizhou West Lake > Luofu Mountain > Ye Ting's Former Residence.

When developing the Huizhou cultural tourism gamified digital tool prototype, the researcher will focus on the Huizhou West Lake scenic spot, which has great visitor attention and favorability.

Table 12

Preferred Cultural Tourism Attractions in Huizhou

Options	No. of Sel. 1st	No. of Sel. 2nd	No. of Sel. 3rd	Score
Huizhou West Lake	246	53	28	6.15
Luofu Mountain	40	114	45	3.47
Ye Ting's Former Residence	97	50	41	3.4
Shuidong Street	25	51	60	2.31
Su Dongpo Shrine	25	48	61	2.28
Zhu House Lane	22	49	38	1.88
Hakka Po Scenic Area	34	30	25	1.58
Hejiang Tower	16	20	27	1.08
Science and Technology Museum	8	14	21	0.73
Binxing Pavilion	1	2	2	0.09

Note: The table presents the average scores calculated based on a ranking multiple-choice question with respondents being asked to select and rank their top three favorite attractions from a list of ten popular sites.

Source: Compiled by the author (N=514)

3) Respondents' knowledge of the cultural resources carried by Huizhou's cultural tourism attractions

Table 13

Respondents' Knowledge of the Cultural Resources at Huizhou's Cultural Tourism Attractions

Options	No. of Selections	Percentage
Unfamiliar	77	14.98%
Slightly Familiar	81	15.76%
Moderately Familiar	155	30.16%
Substantially Familiar	124	24.12%
Thoroughly Familiar	77	14.98%

Note: The table presents the selection data from a single-choice question.

Source: Compiled by the author (N=514)

Regarding the understanding of the cultural resources carried by Huizhou cultural tourism scenic spots (Table 13), most respondents had a moderate level of understanding (30.16%). This indicates that tourists have some awareness of the cultural resources in this area but have yet to reach widespread familiarity. Notably, 14.98% of respondents either needed more or had a very good understanding. This polarization reflects a certain level of differentiation in tourists' understanding of the cultural resources carried by Huizhou cultural tourism scenic spots. According to the survey data, challenges and opportunities exist for integrating tourism experience and cultural learning effects in Huizhou cultural tourism scenic spots.

4.3.2 FACTORS INFLUENCING TOURISTS' USE OF S FOR CULTURAL TOURISM

1) Factors Facilitating Respondents' Use of the Huizhou Cultural Tourism Gamified Digital Tool

Table 14

Factors Facilitating Respondents' Use of the Huizhou Cultural Tourism Gamified Digital Tool

Options	No. of Sel. 1st	No. of Sel. 2nd	No. of Sel. 3rd	Score
Enhancement of the tourism experience.	221	62	49	3.56
Material rewards (tourism souvenirs, derivative cultural and creative products).	53	88	111	2.34
Fun of the game.	59	112	54	2.19
Coupons (scenic spot tickets, food and beverage, accommodation).	74	79	64	2.13
Virtual achievements (badges, titles).	80	66	42	1.90
Social sharing.	27	37	43	1.01

Note: The table presents data from a ranking multiple-choice question, with respondents selecting and ranking up to three options.

Source: Compiled by the author (N=514)

According to the questionnaire data analysis (Table 14), "Enhancing Travel Experience" scored the highest among all listed options, achieving 3.71. Additionally,

61.73% of respondents ranked it as their top priority, indicating that tourists are most concerned about how gamified digital tools can enhance their travel experiences.

2) Factors Negatively Impacting Users' employment of Huizhou cultural tourism gamified digital tools

Regarding potential concerns about using gamified digital tools to enhance cultural tourism experiences, the most significant worry among users was the excessive consumption of mobile phone memory, with a composite score of 3.04, while over half of respondents (51.5%) ranked it as their top concern (Table 15). Furthermore, other concerns such as "Consuming mobile data traffic," "Difficulty in operation," "Design style," "Reducing the travel experience," and "Fun and interactivity" scored similarly, indicating the possibility of the tool negatively affecting users' willingness to employ the application. Therefore, to improve the acceptance and satisfaction of users toward Huizhou cultural tourism gamified digital tools, developers need to pay special attention to the issue of memory usage, ensuring ease of operation, reasonable consumption of mobile data traffic, and an attractive design style.

Table 15

Factors Negatively Impacting Users' Employment of the Huizhou Cultural Tourism Gamified Digital Tool

Options	No. of Sel. 1st	No. of Sel. 2nd	No. of Sel. 3rd	Score
Takes up too much memory	155	76	49	2.93
Consumes too much mobile data traffic	71	104	44	2.18
Reduced travel experience	110	38	54	2.07
Difficulty of operation	67	67	79	2.05
Art style	56	81	71	1.99
Fun and interactive	55	76	62	1.86

Note: The table presents data from a ranking multiple-choice question, with the respondents selecting and ranking up to three options.

Source: Compiled by the author (N=514).

To better meet tourists' expectations and needs, the Huizhou cultural tourism gamified digital tool should focus on enhancing tourists' actual travel experiences. Incorporating rewards, virtual achievements, and coupons should be considered. During the design and development process, the researcher should also address the issue of high memory usage in Huizhou gamified digital tools by opting for a lightweight model while also ensuring ease of operation, reasonable consumption of mobile data traffic, and an appealing design style.

4.3.3 RESPONDENTS' FUNCTIONAL REQUIREMENTS AND TECHNOLOGICAL ACCEPTANCE OF THE HUIZHOU CULTURAL TOURISM GAMIFIED DIGITAL TOOL

1) Interest of Respondents in Using Gamified Digital Tools to Enhance the Cultural Tourism Experience

Most respondents expressed high interest in using gamified digital tools to enhance their cultural tourism experience (Table 16). According to the data, 68.68% of respondents indicated they were "quite interested" or "very interested." Notably, 37.16% of respondents strongly expressed interest, exceeding other options. In contrast, only 16.34% of respondents stated they were " uninterested " or " slightly interested." The survey data suggest that gamified digital tools have a high potential acceptance rate in cultural tourism and are worth further practical application.

Table 16

Interest of Respondents in Using Gamified Digital Tools to Enhance Their Cultural Tourism Experience

Options	No. of Selections	Percentage
Uninterested	57	11.09%
Slightly Interested	27	5.25%
Moderately Interested	77	14.98%
Considerably Interested	162	31.52%
Extremely Interested	191	37.16%

Note: The table presents the selection data from a single-choice question.

Source: Compiled by the author (N=514)

2) Respondents' Functional Requirements for Cultural Tourism Gamified Digital Tools

To meet the needs and expectations of most respondents (Table 17), developers of cultural tourism-themed games should focus on three main functions: cultural information on attractions, tourist route planning recommendations, and scenic area refinement navigation.

Table 17

Respondents' Functional Requirements for Cultural Tourism Gamified Digital Tool

Options	No. of Sel. 1st	No. of Sel. 2nd	No. of Sel. 3rd	Score
Cultural information on attractions	186	94	97	3.84
Tourist route planning recommendations	99	165	53	3.17
Scenic area refinement navigation	141	36	62	2.48
Recommendation of nearby restaurants and accommodation	54	105	84	2.31
Scenic area tourism product purchase	19	21	35	0.7
Social sharing	15	16	29	0.56

Note: The table presents data from a ranking multiple-choice question, with the respondents selecting and ranking up to three options.

Source: Compiled by the author (N=514)

3) Interest of Respondents in Using Gamified Digital Tools to Enhance Cultural Tourism Experience

Most respondents expressed high interest in using gamified digital tools to enhance their cultural tourism experience (Table 18). The data revealed that 68.68% of respondents indicated they were "quite interested" or "very interested." Notably, 37.16% of respondents strongly expressed interest, exceeding other options. In contrast, only 16.34% of respondents stated they were " uninterested " or "slightly Interested." The survey data suggest that gamified digital tools have a high potential acceptance rate in cultural tourism and are worth further practical application.

Table 18

Interest of Respondents in Using Gamified Digital Tools to Enhance Their Cultural Tourism Experience

Options	No. of Selections	Percentage
Uninterested	57	11.09%
Slightly Interested	27	5.25%
Moderately Interested	77	14.98%
Considerably Interested	162	31.52%
Extremely Interested	191	37.16%

Note: The table presents the selection data from a single-choice question
Source: Compiled by the author (N=514)

4) Respondents' Expectations for the Difficulty Level of Tasks in the Huizhou Cultural Tourism Gamified Digital Tool

Most respondents expect the task difficulty to remain moderate rather than easy or difficult (Table 19). Developers should balance maintaining the challenge and entertainment for players while ensuring they can easily experience the cultural tourism content.

Table 19

Respondents' Expectations toward the Difficulty Level of Tasks in the Huizhou Cultural Tourism Gamified Digital Tool

Options	No. of Selections	Percentage
Very Easy	74	14.40%
Easy	61	11.87%
Moderate	212	41.25%
Challenging	97	18.87%
Difficult	70	13.62%

Note: The table presents the selection data from a single-choice question.
Source: Compiled by the author (N=514)

5) Respondents' Technical Acceptance of Cultural Tourism Gamified Digital Tools

Based on the collected data, 66.43% of respondents agree that gamified digital tools can serve as cultural educational tools within cultural tourism sites (Table 20). Over 67.71% of respondents hold a positive view of using gamified digital tools for tour route planning, believing that this combined approach enhances the cultural tourism experience (Table 21). Whereas 68.29% of respondents express a relatively positive attitude toward the interactivity between game tasks and the actual touring experience, considering this interactive mode fun or satisfactory (Table 22). Overall, respondents demonstrate high technical acceptance of cultural tourism gamified digital tools.

Table 20

Respondent's Acceptance Level for Using Gamified Digital Tools as Cultural Educational Tools within Cultural Tourism Sites

Options	No. of Selections	Percentage
Uninterested	57	11.09%
Slightly Interested	20	3.89%
Moderately Interested	96	18.68%
Considerably Interested	150	29.18%
Extremely Interested	191	37.16%

Note: The table presents the selection data from a single-choice question
Source: Compiled by the author (N = 514)

Table 21

Respondent's Acceptance Level toward Using Gamified Digital Tools for Tour Route Planning

Options	No. of Selections	Percentage
Uninterested	60	11.67%
Slightly Interested	16	3.11%
Moderately Interested	90	17.51%
Considerably Interested	195	37.94%
Extremely Interested	153	29.77%

Note: The table presents the selection data from a single-choice question
Source: Compiled by the author (N = 514)

Table 22

Respondent's Acceptance Level for the Interactivity between Game Tasks and the Actual Touring Experience

Options	No. of Selections	Percentage
Uninterested	52	10.12%
Slightly Interested	22	4.28%
Moderately Interested	89	17.32%
Considerably Interested	154	29.96%
Extremely Interested	197	38.33%

Note: The table presents the selection data from a single-choice question

Source: Compiled by the author (N = 514)

4.3.4 RESPONDENTS' PREFERENCES FOR THE STYLE OF CULTURAL TOURISM GAMIFIED DIGITAL TOOLS

1) Respondents' Preferences for the Art Style of Cultural Tourism Gamified Digital Tools

In selecting art styles, the traditional Chinese line drawing style (Figure 40) is the most favored, with a high proportion (55.84%) choosing this option (Table 23). The Chinese traditional line drawing style is an artistic style that primarily utilizes lines as its main means of expression and is known for its elevated level of organization. This style is widely used in classical painting, calligraphy, and decorative arts, typically employed to depict natural landscapes, figures, animals, and plants, among other subjects. It achieves the texture, form, and dynamics of objects through highly organized lines of varying thickness, length, and curvature.

When exploring the relationship between visual style and cultural tourism sites, the traditional Chinese line drawing style complements the essence of Chinese cultural tourism destinations. Furthermore, from a technical and economic perspective, this style has relatively relaxed requirements for graphic rendering, providing a smooth experience for most mobile devices without relying on high-end hardware. Its distinctive simplicity in lines and minimalistic details also results in smaller file sizes, reducing download and installation times for users and saving device storage space. Therefore, the traditional Chinese line drawing style is strongly favored in the current

Chinese gaming market, especially in game designs that emphasize cultural experiences. In summary, the traditional Chinese line drawing style not only lowers the technical and economic barriers to development but also makes it easier to market gamified cultural tourism digital tools in Huizhou, potentially making the target audience more open to using them.

Figure 40

Traditional Chinese Line Drawing Style

Note: The interface of Jiangnan Hundred Scenic Views.

Source: Screenshot by the author, May 5, 2023

Table 23

Respondents' Preferences for the Art Style

Options	No. of Selections	Percentage
Minimalist style	145	28.21%
Pixel style	88	17.12%
Cartoon style	60	11.67%
Q(Cute) style	105	20.43%
Traditional Chinese line drawing style	287	55.84%
Illustration style	131	25.49%
2.5D Style	83	16.15%
3D comic style	141	27.43%
Realistic style	130	25.29%

Note: The table presents data from a multiple-choice question, with respondents selecting up to three options.

Source: Compiled by the author (N=514)

2) Respondents' Preferences for the Color Scheme of Cultural Tourism Gamified Digital Tools

Table 24

Respondents' Preferences for the Color Scheme

Options	No. of Selections	Percentage
A	139	27.04%
B	162	31.52%
C	87	16.93%
D	100	19.46%
E	197	38.33%
F	58	11.28%
G	88	17.12%
H	59	11.48%
I	59	11.48%
J	48	9.34%
K	117	22.76%
L	60	11.67%

Note: The table presents data from a multiple-choice question, with the respondents selecting up to three options.

Source: Compiled by the author (N=514)

Figure 41

Respondents' preferences for the color scheme

Source: Created by the author

Regarding the choice of color scheme (Table 24), option E has the highest proportion at 38.33%, followed by options B and A at 31.52% and 27.04%, respectively (Figure 41). Therefore, the color scheme suitable for the Huizhou cultural tourism gamified digital tool should primarily follow the color scheme of option E while considering the color schemes of options B and A as alternative choices.

4.3.5 RECOMMENDATIONS FROM RESPONDENTS FOR THE DEVELOPMENT OF THE HUIZHOU CULTURAL TOURISM GAMIFIED DIGITAL TOOL

Respondents provided insightful and constructive recommendations that encompass not only the operability and functionality of the game but also the depth and manner of integrating gaming and cultural content. To ensure accuracy and depth in the analysis, the researcher employed quantitative and qualitative methods, tallying recommendations by frequency and providing in-depth interpretations of the significance behind each suggestion. Through this synthesis and consolidation, the following key conclusions were drawn:

Cultural content related to attractions must be accurate and presented vividly to ensure the authenticity of cultural heritage and resonate with users.

From a technical and user experience perspective, gamified digital tools should emphasize simplicity, user-friendliness, and ease of operation to reduce users' learning curve and usage difficulty.

Maintaining user trust and sustained engagement are crucial to ensuring network privacy and security.

Balancing the level of task difficulty with fun is essential for meeting the needs of different user groups.

On the visual front, design should strive for intricacy and attention to detail to reflect the depth and richness of the culture.

4.4 USER TYPES

Based on the earlier visitor surveys, the target users of Huizhou cultural tourism gamified digital tools can be categorized into three main types: cultural learners, entertainment seekers, and sightseeing enthusiasts. Through a needs analysis

of questionnaire surveys and user interviews, Table 25 presents the proposed gamification strategies based on the preferences and interests of each user type experiencing cultural tourism.

Table 25

User Types and Gamification Strategies

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

Source: Compiled by the author

When designing gamified digital tools, a key consideration is that they effectively meet the diverse needs of different user groups. This process involves an in-depth analysis of user behavior and preferences to ensure that the tools developed balance education, entertainment, and usefulness. Especially in the field of cultural tourism, this balance is particularly important. The ideal gamification tool should provide rich cultural and historical knowledge to enhance the user's learning experience and increase their engagement and entertainment experience through the game mechanics and interactive elements. In addition, practicality is also an aspect that must be addressed, especially for users whose main purpose is sightseeing.

4.5 THE GAMIFIED FRAMEWORK FOR CULTURAL TOURISM DIGITAL TOOLS

In cultural tourism, the application of gamified digital tools stems from an in-depth exploration of gamification and digital technology. The research primarily focuses on seamlessly integrating digital tools with cultural tourism experiences through gamification strategies to enhance the tourist's overall experience. Regarding the gamification design, the researcher employs elements and mechanisms closely related to cultural tourism experiences. They enhance engagement and immersion by incorporating task design and storytelling. Aesthetic presentation encompasses visual design and audiovisual elements, user interface, and interaction logic, aiming to enhance sensory experiences. In content development, deep integration with local culture and history is emphasized, with gamification elements like badges, points, and leaderboards used to establish incentive mechanisms to engage tourists further.

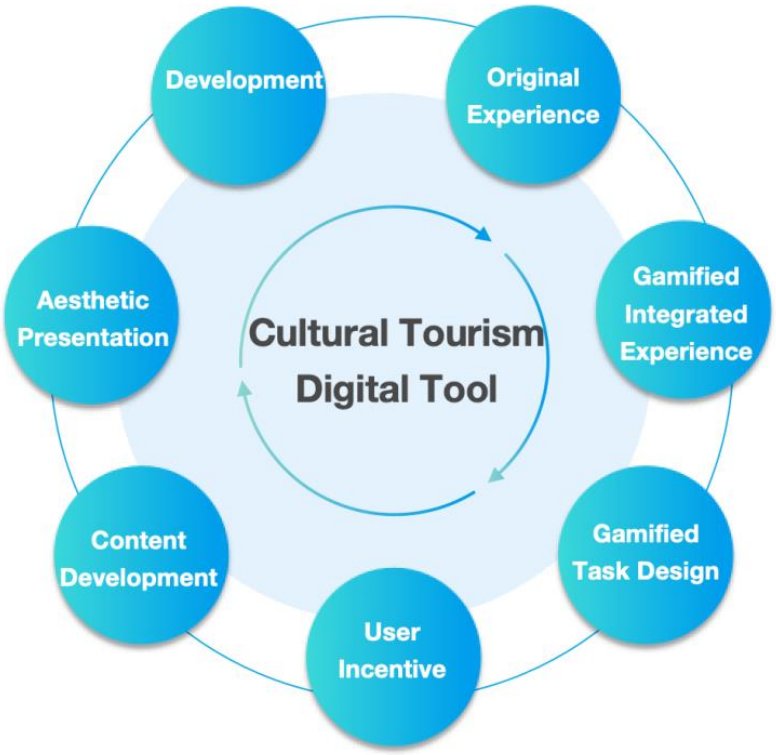
In the technical implementation phase, the researcher considers technical performance, development costs, and factors like platform usability, audience acceptance, and network security. This comprehensive assessment provides the researcher with a holistic perspective to accurately select the most suitable platform for their project needs and tailor the development accordingly.

The researcher analyzes existing cultural tourism experiences and explores how to enhance the vitality of these experiences through gamified digital tools, offering tourists an innovative travel experience. To capture tourists' attention, an innovative and intuitive presentation method is employed that is easy to understand and operate, to create a profound impact on tourists.

Combining various research and analysis aspects, both from literature review and experimental design perspectives, the researcher has gained a profound understanding of the numerous challenges and issues associated with applying gamified digital tools to cultural tourism experiences. The researcher has designed the following framework for cultural tourism gamified digital tools (Figure 42):

Figure 42

Gamified Framework for the Development of Cultural Tourism Digital Tools



Source: Created by the author

1) The Framework of Original Experience

In the design phase, the researcher clearly defines the scope of physical tourist attractions, tour routes, digital tool applications, and existing travel experiences. These factors collectively form the foundation of the original cultural tourism experience framework. The researchers introduce appropriate gamification elements to enhance visitor interaction while ensuring effective application within the existing environment and conditions.

2) The Framework of Gamified Integration Experience

The disconnect between on-site and digital experiences is a common issue when tourists use digital tools in cultural tourism. This gap often results from the differing characteristics and objectives of these two types of experiences. On-site experiences emphasize physical environments and interpersonal interactions, while digital experiences focus on information delivery and accessibility. Gamification intervention is proposed as a potential solution. Gamification strategies, integrated

with digital platforms, have the potential to create a seamless experience, bridging the gap between on-site and digital experiences.

3) The Framework of Gamified Task Design

During the game task design phase, the focus lies on core gameplay, balancing education with entertainment, and integrating cultural elements. Core gameplay covers the fundamental rules and operational aspects of tasks. To achieve a balance between education and entertainment, researchers need to define the educational goals of game tasks and design engaging challenges and reward systems around these objectives. Additionally, integrating cultural elements is crucial, requiring the avoidance of cultural misunderstanding and stereotypes while showcasing cultural elements through characters, stories, and environments.

4) The Framework of User Incentive

In cultural tourism gamified digital tools, the user incentive framework has a more complex and multidimensional nature. Compared to traditional touring modes relying on information reading and guide commentary, this framework efficiently stimulates tourists' interests and motivations through gamified storytelling and task design. Tourists can independently choose tour routes, unlock new tasks, and engage in social sharing through mobile applications, enhancing their subjective initiative and social participation in cultural experiences. Furthermore, feedback mechanisms like points, achievements, and virtual items reinforce emotional involvement and long-term memory, enhancing the overall attractiveness and educational value of cultural tourism activities.

5) The Framework of Development Content Development

Transforming cultural tourism resources into digital media content is a core aspect of designing and developing cultural tourism gamified digital tools. During the content development phase, the design focuses on task configuration and the comprehensive presentation of cultural elements. Game tasks should be highly relevant to cultural tourism themes, offering users additional cultural exploration and educational interaction. All cultural and historical information must be verified to ensure accuracy and credibility. Additionally, games should comprehensively showcase cultural characteristics from multiple angles, including but not limited to food and traditional customs.

6) The Framework of Aesthetic Presentation

In the design of cultural tourism gamified digital tools, the aesthetic presentation framework is a comprehensive element, encompassing visual design, audio design, and more. Visual design should align with cultural themes and the gaming atmosphere, covering aspects like color schemes, graphics, animations, and user interfaces. Audio design should include music and sound effects relevant to cultural tourism and gaming contexts.

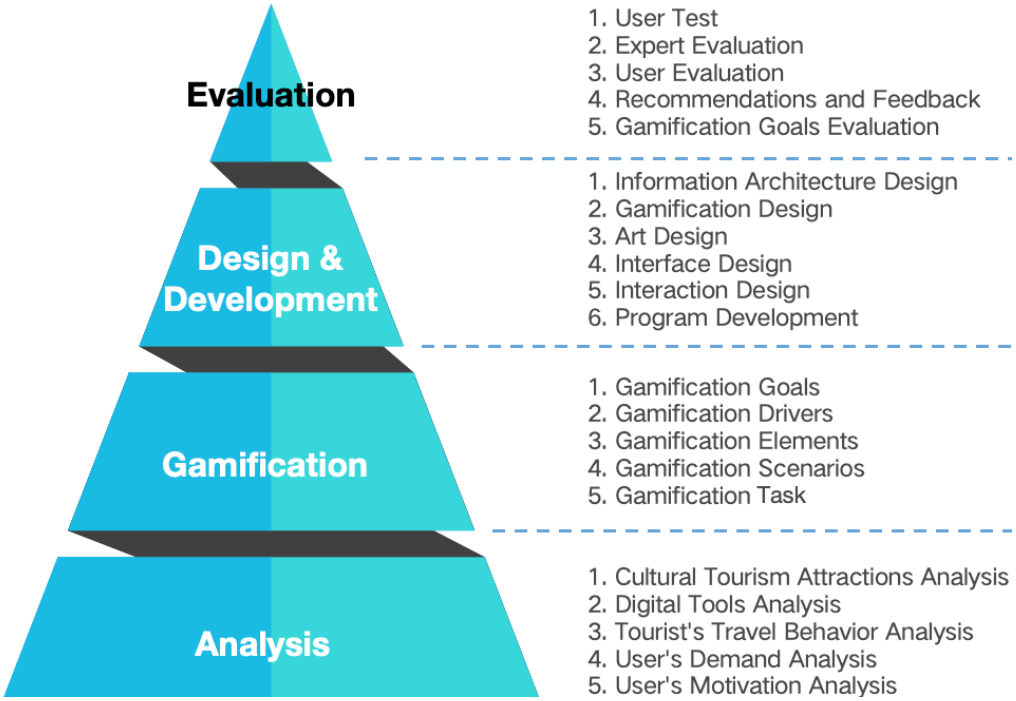
7) The Framework of Development

The WeChat Mini Program is selected as the development platform for the Huizhou cultural tourism gamified digital tool, with appropriate data structures designed to store information and content. Regarding security, identity verification is typically achieved through the WeChat login, while sensitive information is encrypted for storage and transmission.

4.6 THE DESIGN PROCESS MODEL FOR THE GAMIFIED CULTURAL TOURISM DIGITAL TOOL

Figure 43

Design Process Model for Cultural Tourism Gamified Digital Tools



Source: Created by the author

The researcher has summarized the design process model for gamified cultural tourism digital tools into five steps: research, analysis, design, development, and evaluation (Figure 43). The specific content of these four steps is presented in the following sections.

4.6.1 ANALYSIS

The first step in the process is analysis, which holds critical importance in the design and development phases. Specific analysis components include:

1) Analysis of digital tools focuses on their current state and existing issues to identify areas for optimization.

2) Cultural content interpretation provides a vital link between tourists and attractions and requires an in-depth analysis of the tourist attractions' cultural elements, traditional customs, and historical stories to better meet tourists' interests and expectations.

3) Analysis of tourist travel behavior focuses on tourists' specific behavior patterns during cultural tourism activities, such as their motivation for cultural tourism, duration of stay, and attitudes toward using gamified digital tools during travel.

4) Tourist needs analysis focuses on tourists' requirements and usage habits concerning digital tools (e.g., commentary on attractions and navigation applications) during cultural tourism.

5) Tourist preference analysis explores various factors that influence tourists' use of gamified cultural tourism digital tools and their preferences in terms of aesthetic presentation.

4.6.2 GAMIFICATION

1) Defining gamification objectives is crucial to this research, providing clear directional guidance for the entire design and development process. Well-defined gamification objectives are also measurable, providing robust data support for later effectiveness evaluation and academic research.

2) Gamification drivers include, but are not limited to, challenges, progress and achievements, feedback, rewards, social interaction, storytelling, autonomy, and novelty.

3) Gamification elements include, but are not limited to, points, badges, feedback, and rewards, all of which aim to motivate users to explore the cultural tourism attractions in Huizhou more deeply.

4) The selection of gamification scenarios should be based on the attractions' significance and popularity among tourists. This approach ensures that gamification elements not only enhance the attractiveness of the tourism experience but also promote awareness and appreciation of Huizhou's rich cultural heritage.

5) Gamified tasks include, but are not limited to, virtual tours, treasure hunts, social interactions, and educational tasks.

4.6.3 DESIGN AND DEVELOPMENT

Design encompasses information on architectural design, art design, digital media content design, interface design, and interaction design. Once the design of gamified digital tools is complete, there follows an important "digital product development" process based on the conceptual model and design prototypes. This further improves production, content creation, technology, and programming applications.

4.6.4 EVALUATION

Evaluation involves providing tourists with the gamified cultural tourism digital tools developed based on the researcher's concept and conducting assessments on the effectiveness of these tools in enhancing the cultural tourism experience through observations, interviews, and experimental evaluations.

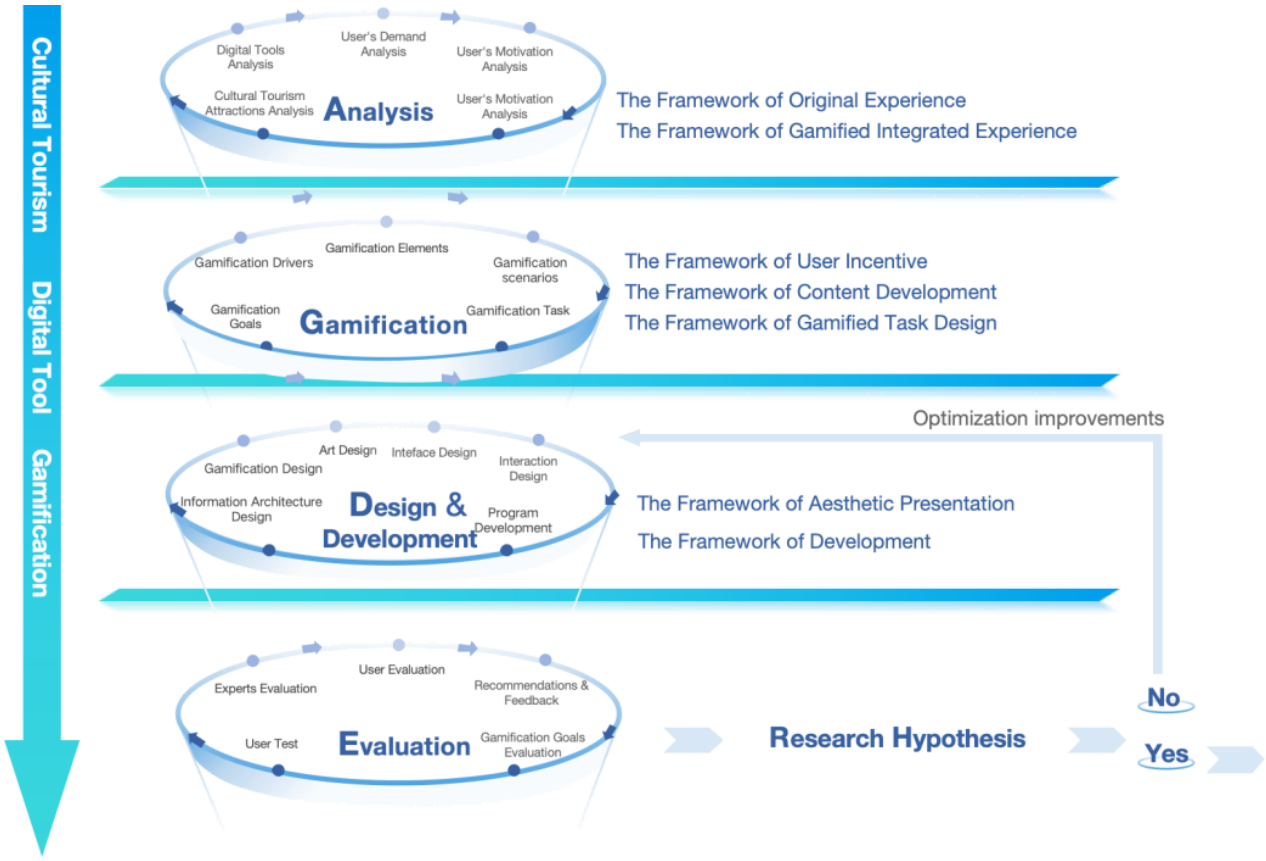
4.7 THE CONCEPTUAL MODEL FOR GAMIFIED CULTURAL TOURISM DIGITAL TOOLS

Through the integration of conceptual models, framework models, and design process models, the researcher has developed the "Conceptual Model of Gamified Cultural Tourism Digital Tools" (Figure 44). This model stems from an alternative strategy aimed at facilitating the organic integration of on-site and digital experiences for tourists through gamified digital tools, with task and incentive mechanisms at its

core. This enhanced interactivity is expected to enrich the overall tourist experience further. To empirically validate this theoretical framework, a specifical application, entitled "Cultural Tourism Gamified Digital Tools in Huizhou," has been successfully designed and implemented.

Figure 44

Conceptual Model for Cultural Tourism Gamified Digital Tool



Source: Created by the author

This conceptual model consists of three core elements: cultural tourism, digital tools, and gamification, which are interrelated and pervasive throughout the model. Based on the design process, the model can be divided into the following five main stages:

The first stage is analysis. These analytical steps enable a more comprehensive understanding of the target user groups and application scenarios for gamified cultural tourism digital tools, enabling more precise product positioning. This stage

incorporates the Original Experience Framework and Gamification Fusion Experience Framework.

The second stage is gamification. Based on the results of the previous analysis, gamification objectives are clarified, and corresponding gamification strategies are developed. These strategies encompass gamification drivers, elements, scenarios, and tasks. This stage involves using the Gamification Task Design Framework, User Incentive Framework, and Content Development Framework.

The third stage is design and development. This design and development process starts with a specific design related to gamification objectives and measures. It includes information architectural design, gamification design, art design, interface design, and interaction design. Finally, it involves project development. Work in this stage is combined with the Aesthetic Presentation, Content Development, and Development Framework.

The fourth stage is evaluation. Following the development of gamified cultural tourism digital tools in Huizhou, it must be validated against the three existing issues with digital tools. If the design solutions address these three core problems, the design is successful. If not, adjustments to the design must be made for further validation until the issues are resolved. Following the validation of core issues, early experiences must be tested, with user feedback collected to identify and address issues promptly through iterative processes.

4.8 HYPOTHESIS OF USING MODEL

The research proposes assumptions based on gamification theory and user experience to explore how gamification elements in digital tools affect tourists' cultural tourism experiences. The specific hypotheses are as follows:

1) Gamification strategies will positively influence user motivation to employ Huizhou cultural tourism digital tools, enhancing their willingness to engage. This assumption anticipates that gamified user experiences, aesthetic experiences, and digital media capacity can increase the attractiveness of cultural tourism digital tools to users.

2) Gamified digital tools for cultural tourism will increase user participation in tourism activities. This hypothesis posits that gamified task interactions and incentive

mechanisms can increase users' intrinsic motivation, encouraging them to actively participate in cultural tourism exploration.

3) Gamified digital tools for cultural tourism will effectively deepen users' perception and memory of cultural knowledge toward attractions. This assumption posits that gamified learning can facilitate the processing and retention of information by providing contextual and narrative content, thereby increasing the absorption and retention of cultural knowledge.

4.9 CHAPTER SUMMARY

This chapter delves into the application of a cultural tourism model and its practical challenges. The researcher conducted on-site observations of tourist travel behavior and the use of cultural tourism digital tools in multiple cultural tourism attractions. The researcher examined the status and challenges of the Huizhou Cultural Tourism digital tools. A mixed-methods approach, combining on-site observations and qualitative interviews, was employed, involving in-depth discussions with tourists, attraction staff, and domain experts to collect their suggestions for gamified cultural tourism digital tools. Additionally, quantitative data were gathered through a survey of the target user group to validate and enrich the research findings.

Based on this comprehensive data, a conceptual model that integrates the research conceptual models, framework models, and design process models was constructed. The model aims to facilitate the organic integration of on-site and digital experiences for tourists through gamification elements and incentive mechanisms at its core. This model follows four major stages of work, including analysis, gamification, design and development, and evaluation. Application of this conceptual model is expected to deepen tourists' cultural tourism experiences and create a win-win ecosystem for all stakeholders, including tourists, attraction operators, and tourism management authorities.

CHAPTER 5
PROTOTYPE DEVELOPMENT AND EVALUATION

5.1 INFORMATION ARCHITECTURAL DESIGN

The gamified digital tool for Huizhou cultural tourism developed in this study has been designed to meet the needs of two digital technology-centric groups, Generation Y and Generation Z. The tool adopts a task-driven incentive model, points system, and virtual reward mechanism to encourage tourists to explore and learn about Huizhou's cultural heritage actively. It provides comprehensive tourism information services, including tourist maps, scenic spot descriptions, customized travel routes, local food recommendations, and tourism product information.

Specifically, when tourists participate in gamified tasks, they will conduct tour activities under the guidance of virtual characters (NPCs). By completing tasks, tourists earn points, which can be exchanged for virtual prizes, including, but not limited to, travel vouchers and badges. Travel vouchers can be used to purchase tourism products and deduct dining expenses during the next trip. Stores and restaurants can become sponsors of this digital tool, thus forming a complete commercial loop. Details of the specific modules are as follows (Figure 45):

1) Map Module:

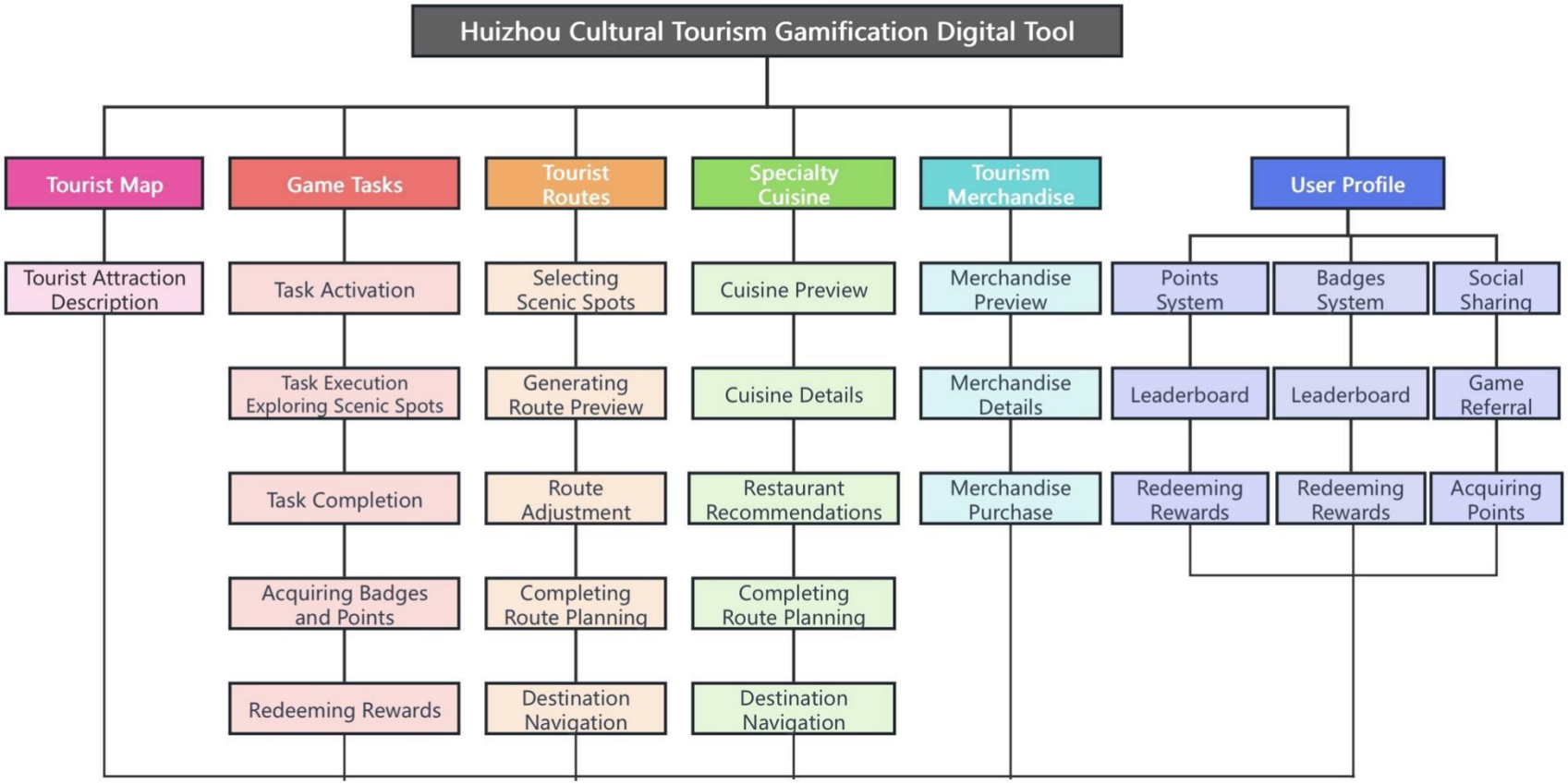
This module provides users with an artistically designed spatially approximate geographic identification system. This design is typically employed to emphasize the visual appeal and user-friendliness of the map while conveying a general spatial layout, providing tourists with enough information for general exploration.

2) Task Module

The task module is the core of the gamified experience, motivating tourists to delve deeper into Huizhou's history and culture by setting cultural exploration tasks and challenges. These tasks may also be interconnected with other modules, such as the route or culinary modules, to offer a comprehensive gamified tourism experience.

Figure 45

Information Architecture of Digital Tools for the Gamification of Huizhou Cultural Tourism



Source: Created by the author

3) Route Module

This module allows for customizing travel routes and guiding tourists along specific paths for cultural exploration. It can integrate closely with the map module to provide tourists with an optimized travel itinerary.

4) Gastronomy Module

Food is an integral part of the cultural experience, and this module showcases Huizhou's distinctive cuisine and related dining establishments, increasing user interest and participation in the local food culture.

5) Merchandise Module

This module is linked to local specialty goods and souvenir shops, allowing users to unlock special products or discounts by completing tasks. It promotes local economic development and provides tourists with tangible souvenirs, enhancing the longevity of the cultural experience.

6) Personal Center Module

The personal center records users' badges and points, encouraging sharing and continued usage.

5.2 GAMIFICATION DESIGN

5.2.1 GAMIFICATION SCENARIOS

The data analysis in Chapter 4 indicates that as a tourist destination, Huizhou West Lake enjoys significant preference among tourists. Therefore, the researcher has chosen to focus the game tasks on Huizhou West Lake and its surrounding areas.

Huizhou West Lake, situated in the central urban area of Huizhou City, is the core scenic area of Huizhou's ancient city, covering a total area of 20.91 square kilometers, with a water area occupying 3.13 square kilometers. Huizhou West Lake is renowned for its unique and elegant landscape, rich historical and cultural significance, and its role as a primary leisure and sightseeing location. The region boasts beautiful mountains, intricate waterways, and scattered islands, with lush greenery and classical architecture seamlessly blending into the lush natural environment (Figure 46). Due to its natural beauty and cultural heritage, Huizhou West Lake is often called the Pearl of South China.

Figure 46

Huizhou West Lake

Source: Photo by the author

Figure 47

A Sculpture in the Huizhou West Lake Scenic Area

Source: Photo by the author

Historically, several famous literati, including Su Dongpo, Li Shangyin, Yang Wanli, and Zhu Zhishan, visited Huizhou West Lake and left behind a rich cultural legacy (Figure 47). Su Dongpo sponsored the dredging of Huizhou West Lake and constructed embankments and bridges, bringing tangible benefits to the residents. During his residence in Huizhou, Su Dongpo created numerous poems and prose works, praising Huizhou's natural beauty and cultural uniqueness, thereby enhancing Huizhou's national reputation.

Based on the analysis above, the research team has proposed a gamification design plan: to use the historical figure Su Dongpo as a non-player character (NPC) and create a narrative storyline to connect the various tourist attractions around Huizhou West Lake that have a close association with Su Dongpo. Su Dongpo is a versatile literary figure in Chinese history and a highly influential social activist and politician. Many accomplishments marked his life, and he left behind a rich cultural legacy in Huizhou, including poetry, lyrics, prose, calligraphy, and painting, among other forms of artistic expression. Therefore, selecting Su Dongpo as the central character for the narrative storyline holds immense historical and cultural significance.

Under the guidance of cultural tourism experts in Huizhou and based on Su Dongpo's life trajectory in Huizhou, the researcher selected five culturally and historically significant sites from Huizhou West Lake and its surrounding areas: Su Causeway, Wang Chao Yun's Tomb, Hejiang Tower, Lin Po Wine Shop, and Dongpo Shrine. These sites have been seamlessly integrated into the gamified tasks, serving as interactive scenarios that bridge the virtual and real worlds.

OVERVIEW OF POINTS ON TOURIST ATTRACTIONS

1) Su Causeway

Su Causeway is a wide stone dike located at the entrance of the Huizhou West Lake scenic area, named in honor of the contributions made to the region by the historical figure Su Dongpo (Figure 48). During Su Dongpo's era, more than half of Huizhou West Lake had become silted up due to prolonged neglect, leading to a gradual decrease in water levels. This hindered agricultural production and resulted in the lake being overgrown with wild grasses. To address this issue, Su Dongpo used

the gold awarded by the emperor to fund the dredging project for West Lake and further constructed the long dike.

Figure 48

Su Causeway

Source: Photo by the author

2) Wang Zhaoyun's Tomb

Located at the eastern foothills of Guishan Mountain in Huizhou's West Lake Scenic Area, Wang Zhaoyun’s Tomb is an important historical and cultural site (Figure 49). In front of the tomb is a stone wall adorned with three inscriptions. Among them, the renowned early Qing Dynasty painter Shi Tao produced the relief carving "Boat Passing LiuRu Pavilion." Su Dongpo wrote the "Wang Zhaoyun's Tomb Inscription," and Yi Bingshou inscribed it. This tomb site was listed as a cultural heritage site in Guangdong Province in 2015.

Wang Zhaoyun was a concubine of Su Dongpo and accompanied him during his exile to Huizhou. Unfortunately, she passed away at the age of 34 due to poor adaptation to the local environment. Her death deeply saddened Su Dongpo, and he wrote the tomb inscription and composed poems to express his deep affection and mourning for Wang Zhaoyun.

Figure 49

Wang Zhaoyun's Tomb

Source: Photo by the author

3) Hejiang Tower

Figure 50

Hejiang Tower

Source: Photo by the author

Hejiang Tower is in the northeastern part of Huizhou's ancient city, at the confluence of the Dong and Xizhi Rivers (Figure 50). It is one of the six famous towers in Guangdong. After Su Dongpo arrived in Huizhou, he stayed at Hejiang Tower for 13 months, writing famous poems like "Residing at Hejiang Tower."

4) Lin Po's Wine Shop

Lin Po's Wine Shop is located next to Dongpo Shrine. Lin Po was a neighbor of Su Dongpo in Huizhou, and she ran a wine house to make a living by brewing and selling wine (Figure 51). Su Dongpo had a natural fondness for wine and famously wrote, "In the year of abundance, with rice being cheap, one can run a tab at Lin Po's Wine house." This expression reflected his love for Lin Po's Wine, and her wine became widely popular among the social elite.

Figure 51

Lin Po's Wine Shop

Source: Photo by the author

5) Su Dongpo Shrine

Situated at Baihe Peak in Huizhou, the Su Dongpo Shrine covers an area of approximately 33,600 square meters, serving as the residence of Su Dongpo during his stay in Huizhou (Figure 52). This location holds multiple cultural and historical

significance: it is not only the property purchased and designed by Su Dongpo during his lifetime but also the only authenticated residence of Su Dongpo known to date, serving as the primary carrier of Su Dongpo's culture. The scenic area consists of four parts: the core area of Su Dongpo Shrine, the Su Dongpo Memorial Museum, the Dongpo Pavilion Grain Warehouse Art Exhibition Area, and the garden landscape leisure area.

Figure 52

Su Dongpo Shrine

Source: Photo by the author

THE SU DONGPO CULTURAL JOURNEY TOUR ITINERARY

Based on the location mapping of these sites, the researcher meticulously planned a tour route for the Su Dongpo cultural journey (Figure 53). The tour begins at Su Causeway in the West Lake area, with an estimated visit duration of 20 minutes. The distance to the next stop, Wang Chao Yun's Tomb, is 0.7 kilometers, with an estimated walking time of 8.5 minutes. This relaxed starting point provides tourists with a delightful beginning to their exploration.

Next, tourists will proceed to Wang Chao Yun's Tomb, with an expected visit duration of another 20 minutes. However, the distance to the following stop, Hejiang Tower, extends to 2.5 kilometers, with an estimated walking time of 30 minutes.

Despite the greater distance, tourists can enjoy crossing the beautiful Huizhou West Lake.

Figure 53

Su Dongpo Cultural Journey Tour Itinerary

Source: Drawn by the author from Google Maps satellite imagery

The third stop is Hejiang Tower, with an expected visit duration of 30 minutes. The distance to the fourth stop, Lin Po Wine Shop, is 1.2 kilometers, with an estimated walking time of 14.5 minutes. During this stage, tourists will pass through Shui Dong Street and experience the Lingnan architectural style of arcade buildings.

The fourth stop is Lin Po Wine Shop, with the shortest expected visit duration of only 10 minutes. The distance to the final stop, Su Dongpo Shrine, is a mere 0.2 kilometers, with an estimated walking time of three minutes. This stop is a transition point, allowing tourists to proceed to the next destination quickly.

Su Dongpo Shrine has the longest expected visit duration of 140 minutes.

The total estimated visit duration is 200 minutes, covering a total distance of 4.6 kilometers and an estimated walking time of 56 minutes. Therefore, the overall estimated duration for the entire tour, including commuting, is 256 minutes, providing tourists with a fulfilling itinerary from half a day to a full day (Table 26). The well-

planned route ensures tourists have ample time for in-depth exploration and learning at each site.

Table 26

Su Dongpo Culture Tour Schedule

Tourist Attraction	Estimated Visit Duration	Distance to Next Attraction
Su Causeway	20 min	0.7 km
Wang Zhaoyun’s Tomb	20 min	2.5 km
Hejiang Tower	30 min	1.2 km
Lin Po's Wine Shop	10 min	0.2 km
Dongpo Ancestral Hall	60 min	—
Total	140min	4.6km

Source: Compiled by the author

5.2.2 GAMIFICATION TASK DESIGN

Five gamified spaces are identified based on the cultural content of Huizhou's West Lake and the focal points of tourists within the scenic area, aiming to enrich the cultural tourism experience through light gaming. In line with user needs, the Huizhou cultural tourism mobile application integrates the points of interest and overall impressions of tourists at the lifesaving association into the design practice. Tourists can activate the Huizhou cultural tourism gamified digital tool by scanning a code at the entrance. In the task module, an NPC named Su Dongpo initiates tasks for users, who can play the game upon accepting these tasks. The specific stages of the task are as follows (Table 27):

1) Stroll around West Lake

Upon entering the Huizhou West Lake scenic area, tourists first encounter the Su Causeway, funded and constructed by Su Dongpo. Visitors are invited to stroll along the causeway to explore the virtual character of Su Dongpo (NPC) while being education on the history of West Lake. By watching videos and interacting with the "Su Causeway Moon Play" inscription for photo opportunities, tourists complete the task and earn points, thereby unlocking the next task, "Search for the Portrait of Wang Zhaoyun."

Table 27

Gamified Task Series for the Su Dongpo Cultural Journey

Task 1. Stroll Along West Lake	
Location	Huizhou West Lake, Su Causeway.
Task	To appreciate the scenic beauty of Huizhou's West Lake on Su Causeway.
Interaction	Access digital media content and watch a video. Take a photo depicting the "Su Di Wan Yue" monument inscription.
Cultural Information	Historical and cultural information on West Lake; Stories of Su Dongpo and West Lake.
Feedback	Complete the video viewing, take a photo, and finish the task to unlock the next task, “Search for the Portrait of Wang Zhaoyun.”
Rewards	Points
Task 2. Search for the Portrait of Wang Zhaoyun	
Location	Huizhou West Lake, Wang Zhaoyun's Tomb.
Task	To assist Su Dongpo（NPC) in retrieving the portrait of his beloved Wang Zhaoyun.
Interaction	Access digital media content and watch a video.
Cultural Information	Love story of Su Dongpo and Wang Zhaoyun.
Feedback	Complete video viewing, obtain task item, complete the task, and unlock the next task, "Decrypt Hejiang Tower."
Rewards	Points
Task 3. Decrypt Hejiang Tower	
Location	Hejiang Tower.
Task	Learn about the origins of Hejiang Tower.
Interaction	Access digital media content and watch a video at the top of Hejiang Tower, overlooking the river view.
Cultural Information	Historical and cultural information about Hejiang Tower Stories of Su Dongpo and Hejiang Tower
Feedback	Complete the task to unlock the next task, "Acquiring Lin Po's Wine through Wisdom."
Rewards	Points
Task 4. Acquiring Lin Po's Wine through Wisdom	
Location	Su Dongpo Shrine, Linpo Liquor Shop.
Task	To answer three questions about Huizhou's West Lake.
Interaction	Scan the statue of Linpo to activate digital media content.
Cultural Information	The story of Su Dongpo and his neighbors
Feedback	Complete video viewing. Correct answers allow the task to be completed, unlocking the next task, "Visit Dongpo Shrine."
Rewards	Points
Task 5. Visit Dongpo Shrine	
Location	Su Dongpo Shrine, Deyoulin Hall.
Task	To recite a poem by Su Dongpo and upload the recording.
Interaction	Scan the portrait of Su Dongpo to activate digital media content.
Cultural Information	Story of Su Dongpo and Huizhou.
Feedback	Complete the video viewing and recite a poem by Su Dongpo to complete the task.
Rewards	Points and Badge

Source: Compiled by the author

2) Search for the Portrait of Wang Zhaoyun

Tourists are directed to the tomb of the Wang dynasty's Chao Yun to assist the virtual Su Dongpo (NPC) in finding the portrait of his beloved. Visitors acquire the portrait of Chao Yun (a virtual item) by watching a video story. After returning the portrait to Su Dongpo, tourists complete the task, earn points, and trigger the " Decrypt Hejiang Tower" task.

3) Decrypt Hejiang Tower

Tourists are guided to the top of Hejiang Tower. Here, they learn about its history through videos, complete the task, and earn points, thereby unlocking the next task, " Acquiring Lin Po's Wine through Wisdom."

4) Acquiring Lin Po's Wine through Wisdom

At the Lin Po's Wine Shop within the Dongpo Shrine scenic area, tourists reach a designated location through quiz-style interaction. After correctly answering three questions about Huizhou cultural tourism, tourists acquire Linpo wine (a virtual item), complete the task, and earn points, unlocking the "Visiting Dongpo Shrine" task.

5) Visit Dongpo Shrine

Tourists are guided to the De You Lin Hall within the Dongpo Shrine scenic area. Tourists complete the final task by watching videos, reciting Su Dongpo's poetry, and earning points. After completing all tasks, tourists receive the "Dongpo Iron Fan" badge, signifying their successful completion of the Su Dongpo cultural journey.

5.3 ART DIRECTION

5.3.1 ARTISTIC STYLE

The researcher synthesized data from the survey questionnaires to more accurately meet the aesthetic and cultural needs of the target user group. After careful analysis and incorporating expert recommendations, the researcher selected the popular Chinese line drawing cartoon style as the dominant visual language for the artistic style (Figure 54). This choice integrates the delicacy and intricacy of traditional line drawing while cleverly incorporating the exaggeration and vivacity of cartoon elements. Such a visual language possesses profound cultural depth while maintaining a modern feel. In depicting natural landscapes and characters, the lines and intricate details of traditional line drawing are particularly outstanding.

Meanwhile, the addition of cartoon elements adds an element of fun and approachability. This unique fusion expands the diversity of artistic expression and provides users with a novel visual and cultural experience.

Figure 54

Chinese Line Cartoon Drawing Style

Source: Created by the author

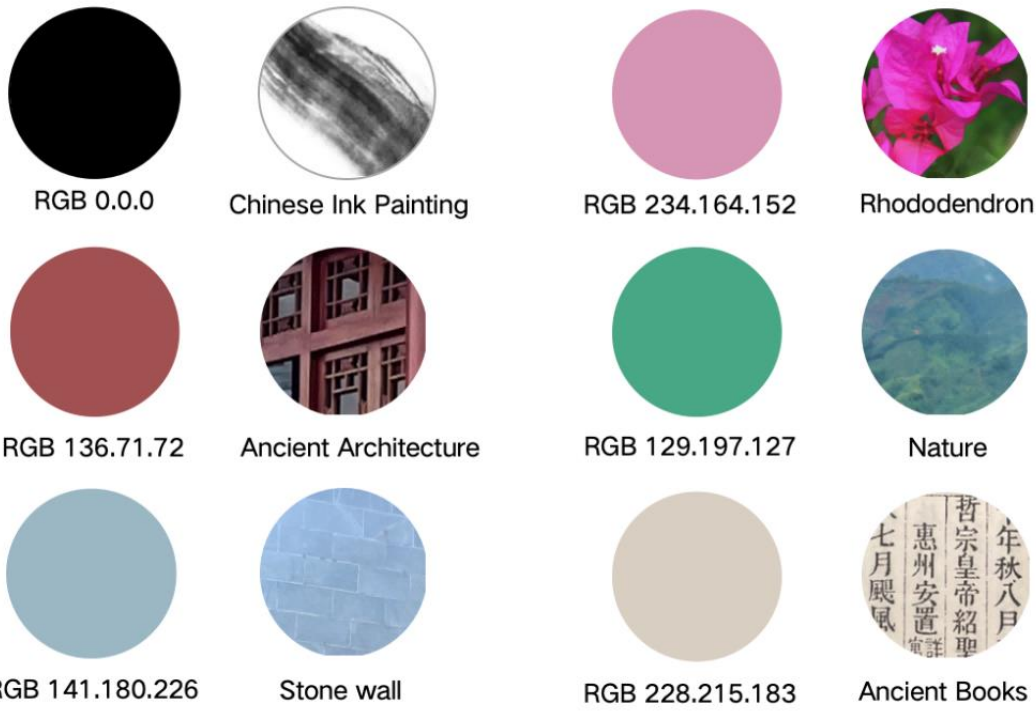
5.3.2 COLOR SCHEME

The research involved a comprehensive and in-depth analysis of the color scheme for Huizhou cultural tourism. The first step of the research was to reference survey data to identify the colors most preferred by tourists, often closely related to

the visual experiences encountered during travel. Upon confirming this key finding, the researcher further considered how to integrate specific elements of Huizhou cultural tourism into the color scheme. After a detailed synthetic analysis, the researcher selected six colors rich in cultural and semantic connotations. More specifically, each color was chosen for its symbolic significance at the cultural and semantic level and its close connection to specific cultural tourism elements of Huizhou, detailed as follows (Figure 55):

Figure 55

Color Scheme for Huizhou Cultural Tourism Gamified Digital Tools



Source: Created by the author

Black (RBG 0.0.0), derived from the lines of ink paintings, aims to reflect a solemn and restrained atmosphere.

Reddish brown (RBG 136.71.72) as a representative color of ancient architecture, undoubtedly emphasizing its profound historical and cultural heritage.

Blue gray (RBG 141.180.226) symbolizes stone walls, further conveying a sense of solidity and historical accumulation.

Pink (RBG 234.164.152), taken from the azaleas, the city flower of Huizhou, signifies happiness and joy and symbolizes a spirit of enthusiasm and resilience.

Green (RBG 129.197.127) is used to express the vitality and vigor of nature.

Beige-gray (RBG 228.215.183), taken from the color of book pages, aims to highlight the value of learning in cultural tourism.

Overall, the application's color scheme achieves visual harmony and displays the multidimensional characteristics of Huizhou's culture and tourism on semantic and cultural levels. Such a comprehensive and multidimensional design strategy is expected to attract a broader user base and provide a rich and holistic experience on both visual and cultural levels.

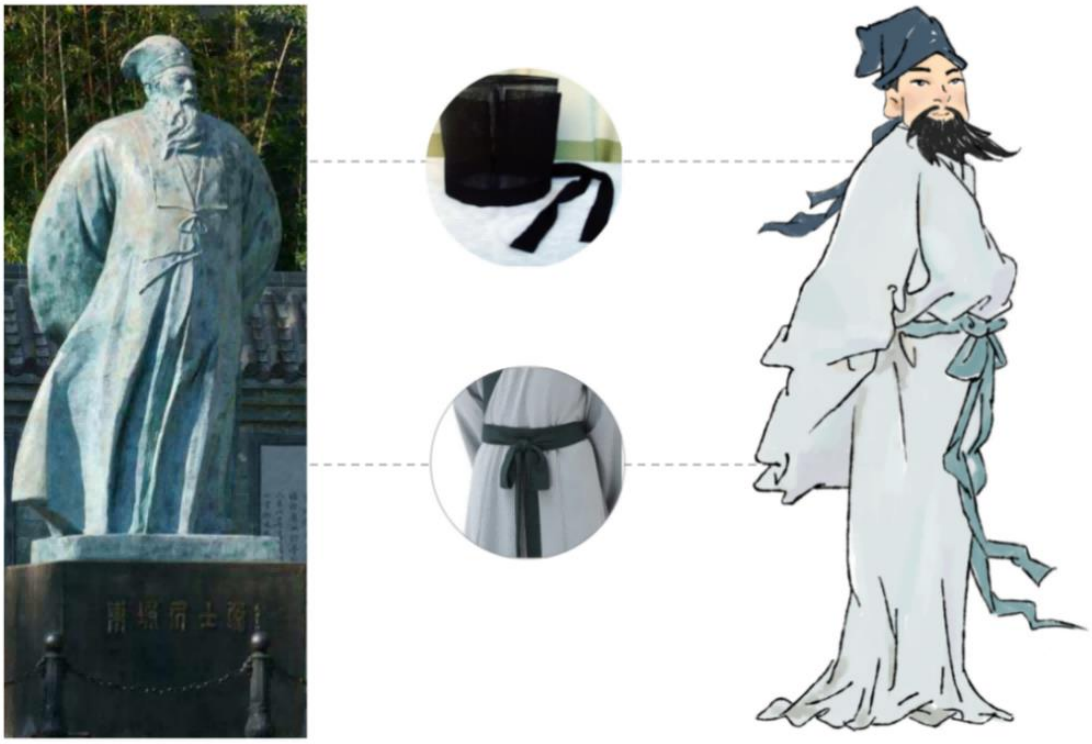
5.3.3 NPC CHARACTER DESIGN

The aim of this task model is to construct virtual avatars for each non-player character (NPC) based on historical figures. Since little information was available on how these historical figures looked, the researcher devised a plan to use sculptures of historical figures in the scenic area as guides for their visual design. This approach allowed the creation of character images that conform to visual aesthetics and reflect the historical and cultural essence, even without direct historical evidence. Additionally, the design of the characters' attire and accessories was meticulously recreated following the clothing standards of the Song Dynasty period to enhance historical authenticity and cultural verisimilitude.

1) Su Dongpo, an eminent literary figure and historical celebrity, is widely acclaimed for his bold and unrestrained style of poetry. The researcher intentionally lifted his head in the character design to reflect his spirited temperament. In designing his attire and accessories, the researcher carefully studied the cultural and historical context of Su Dongpo and considered his state of mind during his demotion to Huizhou. Therefore, official uniforms were avoided; he was portrayed as a white-robed scholar (Figure 56). To increase the historical and cultural accuracy of the character, he was also equipped with a "Dongpo turban" (an ancient headscarf named after him).

Figure 56

Su Dongpo Character Design



Source: Created by the author

2) Wang Zhaoyun, the late spouse of the literary giant Su Dongpo, had her character designed visually and culturally dedicated to capturing her gentle and refined personality and deep emotional connection with Su Dongpo. Visually, a delicate line drawing technique was employed to accurately convey her elegant and reserved temperament. The costume design was fully integrated with cultural and historical elements to enhance the character's cultural accuracy and depth. Notably, a silk scarf was entwined between the arms of Wang Zhaoyun's character, symbolizing the unbreakable emotional bond with Su Dongpo. The design of her hairstyle and head ornaments also referenced the costume system of the Song Dynasty, enhancing the character's authenticity within the historical and cultural context (Figure 57).

Figure 57

Wang Zhaoyun Character Design

Source: Created by the author

3) Linpo, originally a working woman who made her living brewing and selling wine, gradually gained attention from the world through her neighbor Su Dongpo's mention of her brewing skills in his poetry. In the research dimension of character image design, the researcher emphasized Linpo's simple, unadorned, and generous character traits, delving into her close connection with the local culture and social environment. To more accurately present the character's cultural and social background, the researcher intentionally paired her with an apron characteristic of a tavern in the costume design (Figure 58). This design choice highlighted Linpo's professional characteristics and endowed the character with a richer, more multidimensional interpretive space in visual representation and cultural connotation.

These three characters complement and echo each other through their unique visual styles and cultural attributes, constructing a diverse, meaningful, gamified world. This not only enriches the visual and cultural experience provided by digital tools, but also provides users with an engaging platform on which to delve into the culture and history of Huizhou.

Figure 58

Lin Po Character Design

Source: Created by the author

5.3.4 TOURISM GUIDE MAP

The Huizhou cultural tourism gamified digital tool is not only entertaining but also provides tourist information. Comprehensive tourism resource information on Huizhou was collected and organized, and then meticulously integrated over 180 diverse tourist attractions in Huizhou City to construct a detailed and comprehensive tourist map of the entire region. This map encompasses historical and cultural sites, natural scenic areas, and modern tourism facilities.

The researcher meticulously extracted each attraction's main visual and cultural characteristics from the collected data. Using the Chinese line cartoon drawing style, they transformed these features into recognizable and memorable icons or symbols (Figure 59).

This design aims to differentiate from the visual representation of traditional tourism applications to attract tourists and encourage usage behavior (Figure 60).

Figure 59

Visual Symbol Translation of Huizhou Cultural Tourism Attractions

Source: Created by the author

Figure 60

Huizhou Cultural Tourism Guide Map

Source: Created by the author

5.3.5 USER INCENTIVE MECHANISM

The researcher developed an intuitive user incentive mechanism to enhance users' anticipation and awareness of impending rewards (Figure 61). The Huizhou cultural tourism gamified digital tool incorporates a module for the real-time dynamic display of points and badges, allowing users to instantly track their progress in accumulating points and earning badges. The system also clearly presents to users the possibility of redeeming points for prizes. This mechanism boosts user engagement and provides immediate feedback on achievement, fostering sustained interest and deeper exploration of tourism activities.

Figure 61

User Incentive Mechanism

Source: Created by the author

5.4 INTERFACE DESIGN

The interface design of the Huizhou cultural tourism gamified digital tool represents a harmonious blend of traditional Chinese aesthetics and modern usability to engage users through the region's rich heritage and scenic beauty. Design elements such as typography, color schemes, and iconography were thoughtfully selected to reflect Huizhou's cultural identity while ensuring a user-friendly experience.

5.4.1 TYPOGRAPHY

Typography, within the context of interface design, not only forms the foundational infrastructure of visual presentation but also serves as a crucial medium for cultural connotations and information exchange. In selecting typefaces for the Huizhou cultural tourism gamified digital tool, the researcher chose fonts that harmonize with the cultural traits of the Huizhou region and effectively convey and enhance the area's cultural characteristics (Figure 62).

Figure 62

Typefaces Used in the Huizhou Cultural Tourism Gamified Digital Tool

Typeface Classifications	Font Weight	Typeface	Typeface Demonstration
Special Typeface	Regular	Hanyi Shang Wei Handwriting W	惠州文化旅游
Secondary Typeface	Regular	Founder Type Cartoon Simplified	惠 州 文 化 旅 游
Secondary Typeface	Regular	Founder Type Bold Song Simplified	惠 州 文 化 旅 游
Primary Typeface	Regular	Arial	惠 州 文 化 旅 游

Source: Created by the author

1) Specialty Typeface

To prominently display the unique charm of Chinese culture on the application's main interface, the researcher carefully selected the "Hanyi Shangwei Handwriting W" font. This handwritten style font carries a rich traditional Chinese cultural ambiance, and its fluid strokes reflect the cultural connotations of the gamified digital tool. Integrating this visual element allows users to feel the product's cultural traits upon first contact, enhancing their identification with and depth of experience in Huizhou cultural tourism.

2) Secondary Typeface

For a harmonious unity between the artistic style of the interface design and the choice of typography, the researcher thoughtfully selected "Founder Type Cartoon Simplified" as the font for the button text. This choice is based on the font's pleasant

and lively visual qualities and its natural correspondence with the main interface's artistic design style. With its light-hearted and lively characteristics, this typeface enhances the interface's approachability and the user's interactive experience.

For content headings and texts that require emphasis, the researcher used "Founder Type Bold Song Simplified," a font inspired by the popular typeface of the Song Dynasty era. Its use not only aptly reflects the writing style of the Song Dynasty but also resonates with the historical character images and cultural background of the game, providing users with a visual experience of traversing time and space.

3) Primary Typeface

For the bulk of the body text, the researcher chose the Arial font. This sans-serif typeface is known for its clear lines and modernity, ensuring the readability of information and the neatness of the interface. Arial's minimalist style effectively contrasts the specialty and secondary typefaces, ensuring a clear information hierarchy and helping users maintain reading comfort while receiving culturally distinctive information.

5.4.2 COLOR OPTIMIZATION

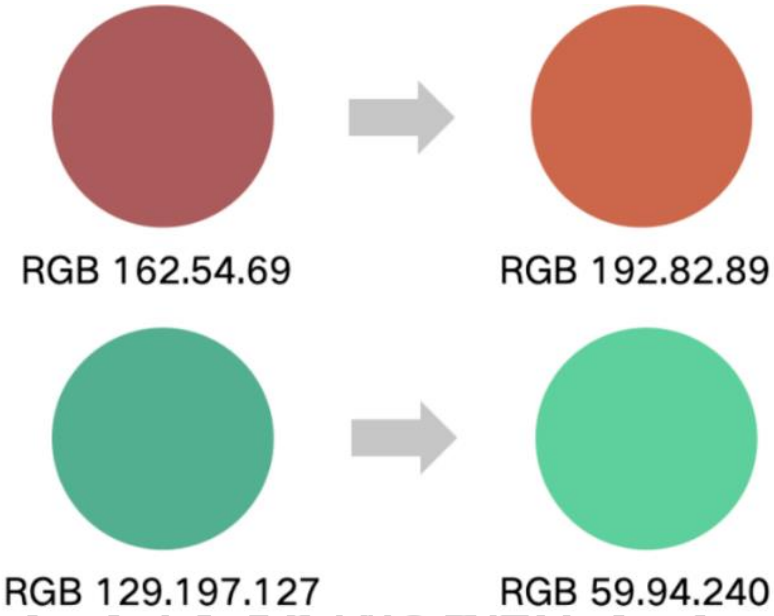
As the primary visual interface for user interaction with the digital tool, the color configuration of the interface design should not only follow the overall artistic design's color-matching principles but also consider functionality and environmental adaptability in actual application scenarios. The researcher employed a high-contrast color strategy to ensure the interface's readability and the operation's intuitiveness under outdoor lighting conditions. Building on the green and reddish-brown colors from the previous artistic design, brightness was enhanced to serve as the main color tone for the buttons (Figure 63), ensuring the visibility of these key interactive elements on the mobile screen, even in direct sunlight. Using contrasting colors improves the operations' recognizability and aligns with the principles of visual guidance.

To create a comfortable visual experience space, the researcher chose a gentle beige as the background color for secondary pages. This color choice aims to reduce visual fatigue during outdoor use and enhance the readability of the text and images. The beige background provides a visual sense of warmth, complementing the cultural

atmosphere of Huizhou and adding a touch of approachability to the interface. The researcher also derived a color series based on different interface levels to ensure the appropriate balance between both uniformity and diversity of color throughout the application (Figure 64).

Figure 63

Color Optimization of the Interface Buttons for the Huizhou Cultural Tourism Gamified Digital Tool



Source: Created by the author

Figure 64

Background Color of the Huizhou Cultural Tourism Gamified Digital Tool

Source: Created by the author

5.4.3 ICONS

To ensure visual coherence and enhance the user experience, the icon design for the Huizhou cultural tourism gamified digital tool adopted a cartoon hand-drawn style consistent with its overall artistic style. With vivid and friendly characteristics, hand-drawn cartoon-style icons quickly capture the user's attention and create a relaxed and enjoyable tourism experience atmosphere. In the design of the icon shapes, the researcher emphasized the intuitive association between shape and function. A series of widely recognized and easily identifiable visual symbols were selected and utilized, which have a universal cognitive basis were selected and utilized (Figure 65). This approach ensures the intuitiveness of the icons, allowing even first-time users to recognize and understand their functions quickly, enhancing their universality.

Figure 65

Icons Used in the Huizhou Cultural Tourism Gamified Digital Tool

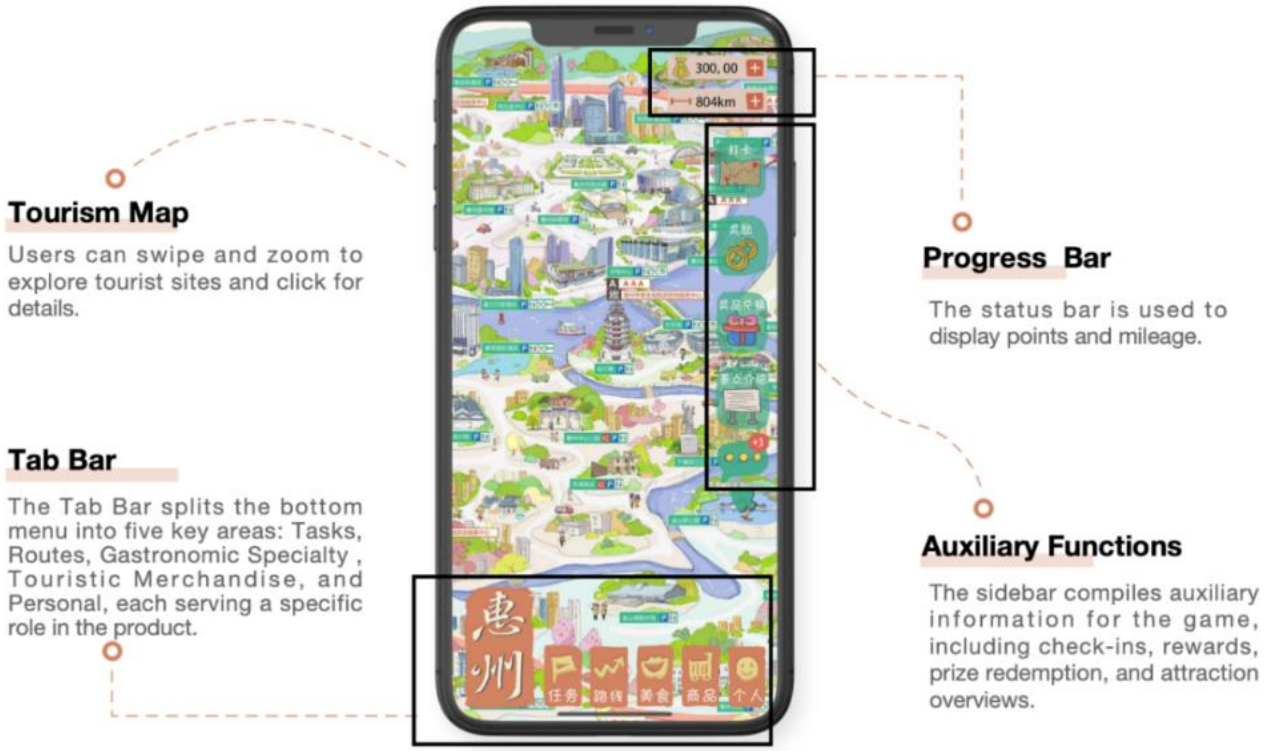
Source: Created by the author

5.4.4 INTERFACE LAYOUT

The researcher considered the needs of tourists when traveling when creating he interface for the Huizhou cultural tourism gamified digital tool. User habits of operation while on the move were addressed, especially the convenience of browsing information with one hand on a mobile device. The design adopts an ergonomically based layout strategy. The interface's interactive elements and navigation controls are within easy reach for one-handed use, ensuring users can operate effortlessly and quickly in the travel context. The interface of the Huizhou cultural tourism gamified digital tool can be divided into the following four areas (Figure 66):

Figure 66

Interface Layout of the Huizhou Cultural Tourism Gamified Digital Tool



Source: Created by the author

1) Tourism Map

This section features an interactive design, allowing users to freely explore various tourist attractions through swiping and zooming gestures. Each attraction is

clickable, offering detailed information with the intention of fostering a deeper understanding of Huizhou's cultural landscape through user-friendly interaction.

2) Tab Bar

The tab bar at the bottom of the interface consists of five key functional areas: task (Figure 67), route (Figure 68), gastronomic specialty (Figure 69), touristic merchandise (Figure 70), and personal center (Figure 71). Each area has been thoughtfully designed to meet different aspects of the gamified experience, thus providing entertainment while reinforcing the purpose of cultural education.

3) Auxiliary Functions

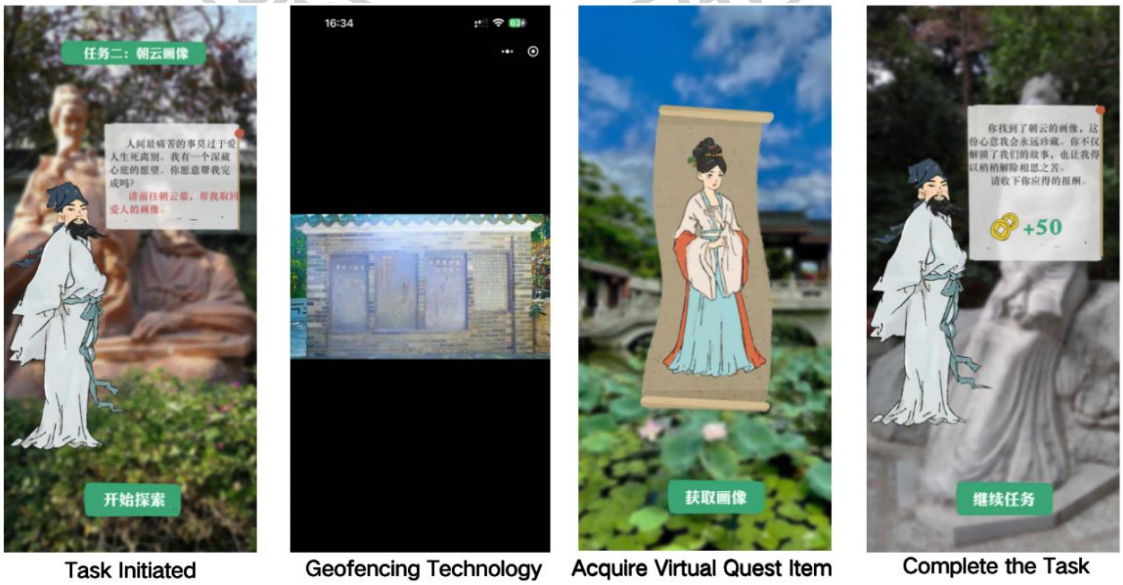
The sidebar is an auxiliary information hub, encompassing features such as check-ins, rewards, prize redemption, and an overview of attractions. The integration of these functions aims to provide a seamless user experience, ensuring visitors can easily access the program's various features and reward systems.

4) Progress Bar

The researcher has integrated a progress bar within the status bar to display the points and travel mileage of visitors in real time. This gamified element increases user engagement and is an intuitive way for tourists to measure their travel achievements and exploration progress.

Figure 67

Interface of the Task Module



Source: Created by the author

Figure 68

Interface of the Rount Module

Source: Created by the author

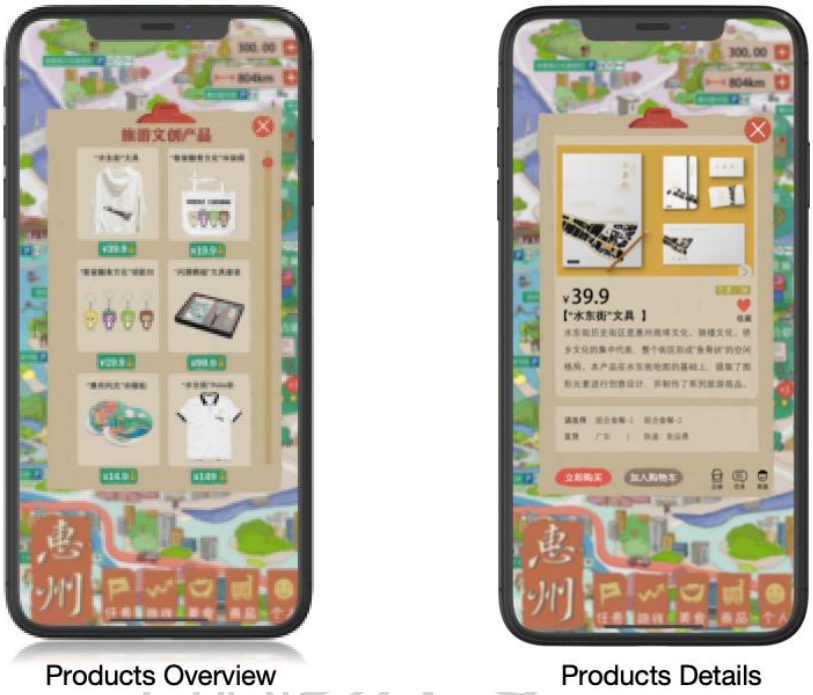
Figure 69

Interface of the Gastronomic Specialty Module

Source: Created by the author

Figure 70

Interface of the Touristic Merchandise



Products Overview　　Products Details

Source: Created by the author

Figure 71

Interface of the Personal Center

Source: Created by the author

5.5 INTERACTIVE DESIGN

To minimize the learning curve and enhance the ease of interaction, single-touch and multi-touch gestures—two touch modalities that users are familiar with—have been selected for effective interaction between the user and game interface. The Huizhou cultural tourism gamified digital tool uses a combination of "interactive actions," "application scenarios," and "logical response mechanisms" to create interactive prototypes (Table 28).

Table 28

Interactive Touch Modalities and Response Mechanisms

Touch Type	Interaction Action	Application Scenario	Logical Response Mechanism
Single-finger	Single Click	Used to activate various elements within the gamified digital tool, including, but not limited to, menu options and tourist spot icons. Upon clicking, the system displays relevant information or navigates to a submenu.	The system recognizes single-click behavior by the user at specific coordinates and matches it with predefined interactive elements to trigger corresponding events or information display.
	Double Click	Involves two rapid clicks in the same screen area, used for quickly zooming the map or entering a detailed information page for a tourist spot.	The system recognizes the rapid double-click behavior within the same area and activates preset functions for map zooming or detailed information display.
	Swipe	The user touches the screen with a single finger and performs a swipe action. Used for map navigation or interface scrolling.	The system recognizes the swipe behavior of a single finger and navigates the map or scrolls the interface based on the finger's movement path and speed.
Multi-finger	Pinch	Involves bringing two fingers together or moving them apart on the screen. Used for zooming the map.	The system recognizes the pinch action of two fingers and adjusts the map's zoom level based on the fingers' movement distance and direction.

Source: Compiled by the author

Single-touch interactions include tap, double-tap, and swipe modes. In tap mode, the design allows users to activate various interface elements within the game, including, but not limited to, menu options and specific tourist attraction icons. When users tap on certain points, the system matches them with the interactive elements already set up, starting with the functions or information displays that go with those coordinates. The double-tap mode is designed for rapid map zooming or accessing detailed information pages. The system can recognize and respond to a user's consecutive double-taps within the same screen area, activating predetermined zooming or information display functions. Swipe mode is primarily used for map navigation and interface scrolling, with the system adjusting navigation or scrolling based on the user's finger movement trajectory and speed.

Regarding multi-touch gestures, the research focuses on implementing the pinch gesture. This gesture allows users to zoom in and out on the map by pinching or spreading two fingers on the screen. The system employs highly precise gesture recognition technology to dynamically adjust the map's zoom level based on the movement distance and direction of the user's fingers.

5.6 ENVIRONMENT SETUP DEVELOPMENT

5.6.1 DEVELOPMENT PLATFORM

The researcher selected the WeChat Mini Program as the development platform. This is a lightweight application embedded within the WeChat ecosystem, characterized by its accessibility without downloading, occupying no phone storage, and can be used directly through WeChat. Users particularly favor this digital tool for various specialized applications, including tourism. The advantages of using the WeChat Mini Program as the development platform for the Huizhou cultural tourism gamified digital tool are as follows:

1) User Experience

On the WeChat Mini Program platform, tourists can access the game directly without downloading and installing it, significantly lowering the barrier to entry. Additionally, WeChat's status as a social platform facilitates the integration of social elements into the gamified digital tool, such as sharing and inviting friends. Users always have access to the latest version of the game without manual updates.

Leveraging WeChat's user data, the game can also make personalized recommendations, increasing user retention.

2) Resource Integration and Platform Sharing

Huizhou's existing cultural tourism public service platform is also based on WeChat Mini Programs. This newly developed gamified digital tool can easily integrate resources and share data with this platform, thus aiding the integration of the Huizhou Cultural Tourism Pass and the Huizhou cultural tourism gamified digital tool, providing more comprehensive and personalized services.

3) Technical Architecture

The WeChat Mini Program provides comprehensive technical support for the cultural tourism gamified digital tool in realizing its functions. Developers can rely on WeChat's extensive development documentation and tools for development. WeChat also offers a wealth of API support, including location, camera, gyroscope, and payment, all of which can be used in the diversified functional development of the gamified digital tool. Additionally, WeChat Cloud provides backend services such as databases and storage, significantly reducing backend development pressure on the researcher.

4) Marketing and Promotion

The WeChat Mini Program platform offers powerful marketing and promotional capabilities for the cultural tourism gamified digital tool. WeChat's active monthly users of 1.327 billion offer a vast potential user base. Users can easily share the Huizhou cultural tourism gamified digital tool with WeChat friends or groups, significantly reducing marketing costs. WeChat also provides detailed user behavior analysis tools, helping developers to understand user needs and optimize the product further.

5) Network Security

Regarding personal privacy data, a particular concern of users, WeChat Mini Programs have strict measures in place. Data encryption technology ensures the security of user data and transaction information. Through WeChat's permission management system, the researcher can precisely control which data and functions are open to users. All mini programs that go live must pass a security review by WeChat, increasing the application's credibility.

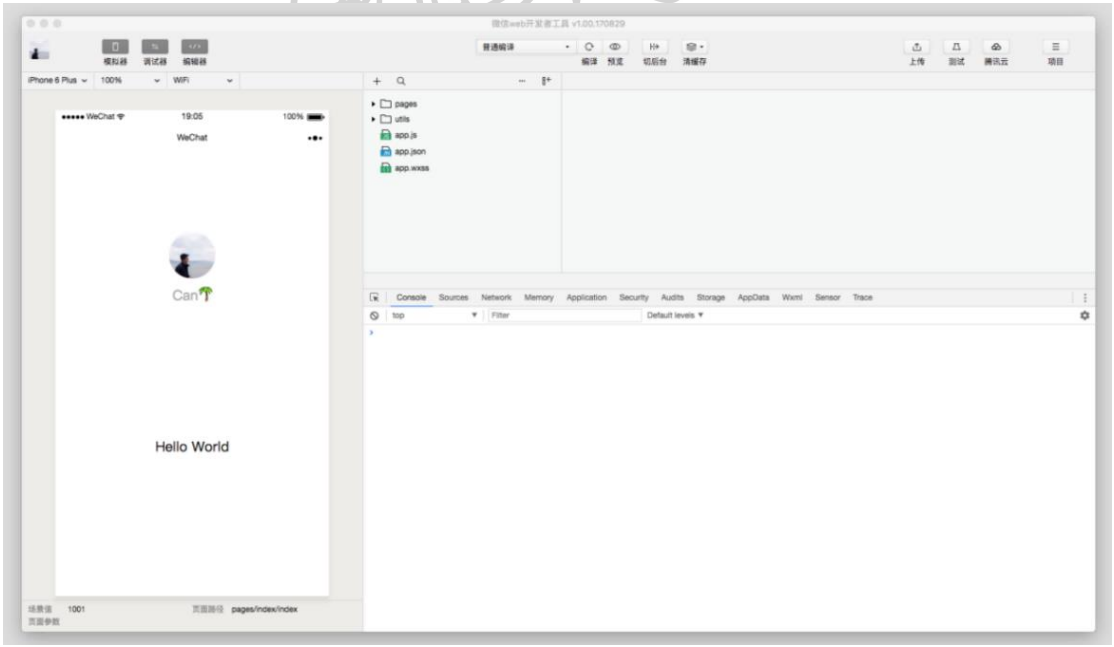
5.6.2 DEVELOPMENT TOOLS

1) WeChat Developer Tools

WeChat Developer Tools is a comprehensive development environment provided by the official WeChat team, meticulously designed to develop WeChat Mini Programs (Figure 72). This suite of tools offers a wealth of development and debugging features, including real-time preview, code editing, performance optimization, and debugging tools, greatly simplifying the process for developers to create, test, and deploy WeChat applications, with the aim of delivering an enhanced user experience. Additionally, the tool extensively supports various programming languages and frameworks, offering developers significant flexibility and convenience, enabling them to undertake highly customized development based on specific project requirements.

Figure 72

Interface of the WeChat Developer Tool



Source: Screenshot by the author

2) Visual Studio Code

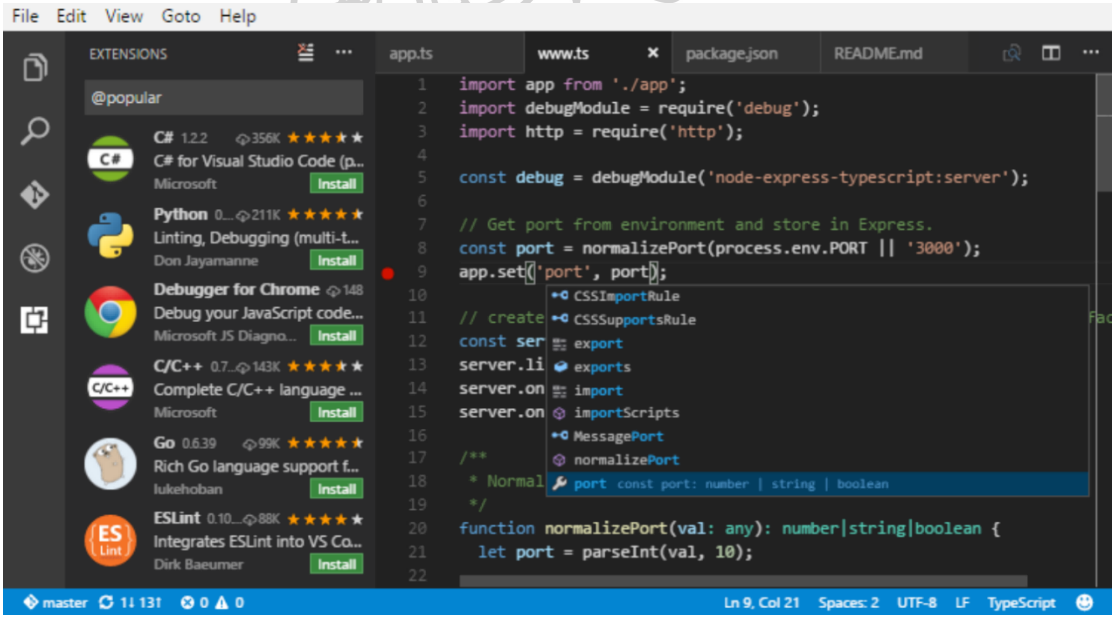
The Visual Studio Code (VSC), developed by Microsoft, is a free and open-source advanced code editor that is popular among developers for its lightweight and

cross-platform characteristics (Figure 73). VSC offers a range of powerful programming features, including but not limited to syntax highlighting, intelligent code completion, custom shortcuts, bracket matching, code snippet insertion, and integrated version control functionalities like Git. These features increase coding efficiency and simplify the code management process.

For the development of WeChat Mini Programs, VSC provides a comprehensive set of tools and extension support, enabling it to easily meet the various needs encountered in Mini Program development. Developers can download and install the appropriate version of VSC from the official download page based on their operating system. For this project, the researcher chose to install the version of VSC suitable for the Windows 64-bit system to ensure the stability and compatibility of the development environment.

Figure 73

Interface of the Visual Studio Code



Source: Screenshot by the author

5.6.3 PROGRAMMING LANGUAGE

Following an in-depth technical evaluation and needs analysis involving developers, coupled with a deep consultation with industry experts, and considering the project's technical feasibility and future maintainability, the researcher ultimately

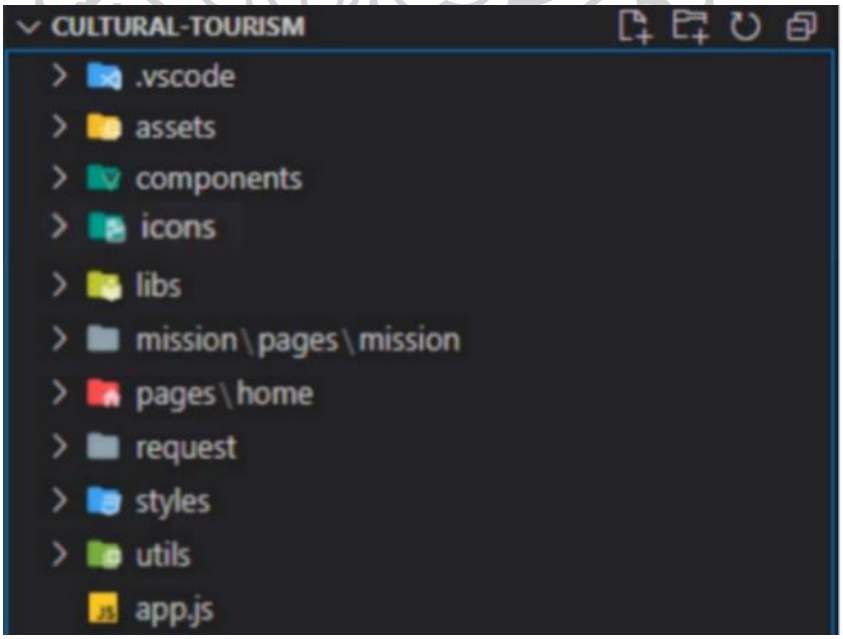
decided to use JavaScript as the core programming language for this project. The choice of JavaScript is based on its cross-platform capabilities and extensive support within the WeChat Mini Program development environment. The official development framework for WeChat Mini Programs provides a rich set of APIs, allowing efficient interaction between JavaScript and WeChat's native interfaces, ensuring smooth application operation and a positive user experience.

Furthermore, JavaScript's event-driven and non-blocking I/O model performs exceptionally well in handling high concurrency in user interactions and network requests, which is particularly important for tourism mini programs that require rapid response to user operations. Additionally, the active JavaScript community and the wealth of third-party library resources provide convenience for the rapid development and feature expansion of Mini Programs. For example, the renowned date-handling library Moment.js can be utilized to process and display time information for tourism activities or use the SDK of map APIs to implement geolocation-related functionalities.

5.7 PROGRAM STRUCTURE

Figure 74

Program Structure



Source: Screenshot by the author

As per the official WeChat guidelines, the Huizhou cultural tourism gamified digital tool comprises a set of files and directories that work together to ensure the Mini Program is run correctly and kept up to date. The specific structure of the project is as follows (Figure 74):

1) Assets

This directory stores static resource files, including images (such as PNG, JPG, and SVG formats), videos, and audio files. These resource files are fundamental to constructing the user interface and providing visual and auditory feedback to the user.

2) Components

All custom components, such as tourist spot information cards, interactive pop-ups, and user feedback forms, are designed to achieve cross-page reuse, maintain consistency of the interface elements, and enhance development efficiency.

3) Icons

Dedicated to storing icon resources, these include bottom navigation bar icons and icons representing functions like sharing and bookmarking. Unified management of icons helps maintain the visual coherence of the interface.

4) Libs

Third-party libraries like the SDK for map APIs and date-handling libraries like Moment.js provide extended functionality and an enhanced user experience.

5) Missions

Missions bear the responsibility of managing components related to gamified tasks, a core part of the project. These include critical parts such as task logic, user interface, data handling, and resource management.

6) Pages

All page files, such as the homepage, tourist spot detail page, and personal center page, have a corresponding JSON configuration, WXML template, WXSS style, and JS script.

7) Requests

These include all backend server interaction requests, such as obtaining tourist spot information, submitting user feedback, querying event details, and other API requests. These encapsulated requests improve the maintainability and reusability of the code.

8) Styles

Common style files defining the visual style of the entire application, including theme colors, font styles, buttons, and margins, are stored to ensure the consistency of the application's design language.

9) Utils

Various utility functions are contained in utils, such as date and time formatting, geographic location processing, points calculation, and providing necessary functional support for the Mini Program.

The above structure exemplifies how modularity and systematization make the Mini Program code easier to read, maintain, and scale while ensuring that the user interface is consistent and all functions are available.

5.8 KEY FUNCTION IMPLEMENTATION

5.8.1 GEOFENCING

In the gamified task "Seeking the Image of Dynasty Cloud," geofencing technology is ingeniously utilized to promote the integration of on-site experiences with digital content. Specifically, when a visitor's mobile device enters a geofenced area set by the researcher, the system automatically provides digital media content related to the love story of Dynasty Cloud, enhancing the educational and entertainment value of the game.

The researcher defined the geographical coordinates of Dynasty Cloud's tomb (longitude 114.395972, latitude 23.09352) as the center point of the geofence. Based on these coordinates, a geofenced area with a radius of 20 meters was established. The system monitors the user's Global Positioning System (GPS) data. Once it detects that the user's device is within 20 meters of the center coordinates, it triggers the logic for entering the geofence. The system then activates and displays digital media content associated with that geofence. The application of this technology not only enhances the game's interactivity but also provides a new mode of engagement for the digital experience of cultural tourism. The specific code implementation is as follows:

```
// Import WeChat Mini Program API for geolocation monitoring
const geolocation = wx.getStorageSync('geolocation');
// Set the geofence center point coordinates
```

```
const geofenceCenter = {latitude: 23.09352, longitude: 114.395972};

// Define the geofence radius as 20 meters
const geofenceRadius = 20;

// Monitor changes in the user's location
wx.onLocationChange(function(res) {
  // Calculate the distance between the user's current position and the geofence center
  let distance = calculateDistance(res.latitude, res.longitude, geofenceCenter.latitude, geofenceCenter.longitude);

  // If the user's position is within the geofence range, trigger the corresponding behavior
  if (distance <= geofenceRadius) {
    // The user has entered the geofence area
    console.log('User has entered the geofence area');
    // Activate the display of related digital media content
    activateContent();
  } else {
    // The user has not entered the geofence area
    console.log('User has not entered the geofence area');
  }
});

// Function to calculate the distance between two points
function calculateDistance(lat1, lng1, lat2, lng2) {
  // Earth's radius in meters
  const earthRadius = 6371000;
  // Convert degrees to radians
  function toRadians(degree) {
    return degree * Math.PI / 180;
```

```
  }

  let deltaLat = toRadians(lat2 - lat1);
  let deltaLng = toRadians(lng2 - lng1);
  let a = Math.sin(deltaLat / 2) * Math.sin(deltaLat / 2) +
      Math.cos(toRadians(lat1)) * Math.cos(toRadians(lat2)) *
      Math.sin(deltaLng / 2) * Math.sin(deltaLng / 2);
  let c = 2 * Math.atan2(Math.sqrt(a), Math.sqrt(1 - a));
  let distance = earthRadius * c;
  return distance;
}

// Function to activate content
function activateContent() {
  // Implement the logic to activate content within the geofence
}
```

5.8.2 API INVOCATION

To precisely implement the key functions of the Huizhou cultural tourism gamified digital tool, the researcher and the development team collaborated to build a comprehensive technical implementation plan. This plan integrates multiple functionalities of mobile device hardware interfaces and software services, including positioning, navigation, camera, and audio playback. There follows a brief overview of the implementation of these core technical functions:

1) Positioning Invocation

The positioning function relies on the invocation of the WeChat Mini Program APIs to accurately capture the user's real-time geographic location information. This function is the cornerstone of the geofencing trigger mechanism and a key element in tourism route planning. The specific code implementation is as follows:

```
// On a certain page of the Mini Program
Page({
  data: {
```

```
    latitude: 0,
    longitude: 0,
    speed: 0,
    accuracy: 0
  },
  onLoad: function() {
    var that = this;
    // Call the WeChat API to get geographic location information
    wx.getLocation({
      type: 'wgs84', // Returns latitude and longitude that can be used with wx.openLocation
      success(res) {
        const latitude = res.latitude
        const longitude = res.longitude
        const speed = res.speed
        const accuracy = res.accuracy
        // Update data
        that.setData({
          latitude: latitude,
          longitude: longitude,
          speed: speed,
```

2) Navigation Invocation

The navigation function, integrated with a map API, provides users with route planning and walking navigation services from their current location to the target attraction, thereby optimizing their travel navigation experience. The code implementation is as follows:

The camera function utilizes the mini program camera API, allowing users to take photos or scan QR codes while executing gamified tasks, facilitating interaction with the digital content within the application. The code implementation for taking photos and selecting from the album is as follows:

3) Camera Invocation

The code implementation for the QR code scanning function is as follows:

```
Page({
  scanCode: function() {
    wx.scanCode({
      success: (res) => {
        console.log(res);
        // res.result is the scanning result
      },
      fail: (err) => {
        console.error(err);
      }
    });
  }
});
```

4) Audio and Video Invocation

Through the built-in audio player and recording device, the audio and video playback function allows users to play historical story narrations related to specific geographic locations or provide audio feedback during specific interactive tasks. The code implementation for invoking the recording function is as follows:

```
<audio
  id="myAudio"
  src="Audio file address"
  controls="true"
  autoplay="false"
  loop="false"
  initial-time="0"
  bindplay="handlePlay"
  bindpause="handlePause"
  bindtimeupdate="handleTimeUpdate"
  bindended="handleEnded">
</audio>
```

```
<video
  id="myVideo"
  src="Video file address"
  controls="true"
  autoplay="false"
  loop="false"
  initial-time="0"
  bindplay="handleVideoPlay"
  bindpause="handleVideoPause"
  bindended="handleVideoEnded"
  bindtimeupdate="handleVideoTimeUpdate"
  poster="Video cover image address">
</video>
```

5.9 PROTOTYPE TESTING

5.9.1 TESTING OBJECTIVES

This test aims to comprehensively evaluate the user experience and effectiveness of the Huizhou cultural tourism gamified digital tool. Specifically, the test will assess the following dimensions:

1)User Experience

a. Usability: Assess the tool's ease of use and accessibility from the perspective of user-friendliness and accessibility.

b. Narratives: The quality of narrative elements within the task module.

c. Play Engrossment: Measure the user's sense of immersion and engagement while using the tool.

d. Enjoyment: Evaluate the user's fun and satisfaction during the interaction.

e. Creative Freedom: Examine whether the tool provides enough space for users to engage in creative expression and personalized experiences.

f. Audio Aesthetics: Assess how the audio design, including music, sound effects, and their harmony with cultural content, impacts the user experience.

g. Personal Gratification: Study the sense of personal achievement users feels when reaching game objectives or learning new knowledge.

h. Social Connectivity: Analyze how the tool facilitates social interaction among users.

i. Visual Aesthetics: Evaluate how visual elements such as graphics, color, and layout attract users.

2) Effectiveness of Use

a. Tourism Engagement: Assess how the gamified digital tool increases user participation in Huizhou cultural tourism activities.

b. Satisfaction: Measure the user's willingness to continue using the tool and recommend it to others.

c. Cultural Perception: Evaluate whether the gamified digital tool enhances the user's perception and understanding of Huizhou cultural tourism.

5.9.2 TEST PARTICIPANTS

To ensure the universality of the study's results and their alignment with the characteristics of the target user group, namely digital natives (Generation Y and Z), the researcher adopted the principle of uniformity in recruiting experimental participants. This principle ensured the sample's representativeness, effectively allowing the study's findings to reflect this demographic's behavioral patterns and preferences. To minimize bias from prior experience, the recruitment criteria explicitly required that participants have not previously visited the tourist areas involved in the test.

In implementing a diversity strategy to enhance the study's external validity, the researcher posted recruitment notices in Huizhou's central business district and nearby higher education institutions. In total, 30 non-local test participants were recruited, consisting of 18 males and 12 females. These participants all owned personal smartphones and frequently used them in their daily lives. They came from diverse professional fields, comprising white-collar workers, educators, and university students, ensuring the broad applicability of the study results and deep insights into the behavioral patterns of different user groups. This diverse participant composition helped comprehensively assess the gamified tool's application effects across different user demographics.

To get a good idea of how well the Huizhou cultural tourism gamified digital tool raised visitors' cultural awareness, the researcher also brought 30 tourists from outside Huizhou to the site to act as a control group. This group participated in a test of their Huizhou cultural tourism knowledge. The data collected from them were compared with the test group's results to analyze the potential impact of the Huizhou cultural tourism gamified tool on enhancing cultural perception.

5.9.3 TEST TASKS

The researcher carefully created two test tasks to fully understand how the Huizhou cultural tourism gamified digital tool works and how it can help raise cultural awareness.

The first task of this study focused on evaluating the interaction experience between participants and the various modules in the gamified digital tool. Specifically, participants were asked to use the tool's task module to complete a series of carefully designed interactive tour tasks that closely integrate Su Dongpo cultural elements. In real travel scenarios, users' participation and cultural experience are enhanced through gamification methods. In this process, users are guided to deeply experience the functions and effects of gamified digital tools in the actual travel environment, thus facilitating subsequent user experience evaluation. In addition, this task also aims to explore how gamification elements affect users' travel enthusiasm and evaluate its enhancing effect on the cultural tourism experience.

The second task consisted of a cross-group comparison study. People in both the experimental and control groups were asked to complete questionnaires to ascertain their knowledge of Huizhou cultural tourism. The comparison consisted of 30 participants in each group: one group who had used the Huizhou cultural tourism digital tool (experimental group) and another group of ordinary tourists who had not used the tool (control group). The aim of this phase was to explore the role of the gamified digital tool in enhancing users' understanding of Huizhou cultural knowledge. By comparing the performance of the two groups, the researcher was able to assess the tool's effectiveness in promoting the dissemination of local cultural knowledge and deepening users' cultural awareness.

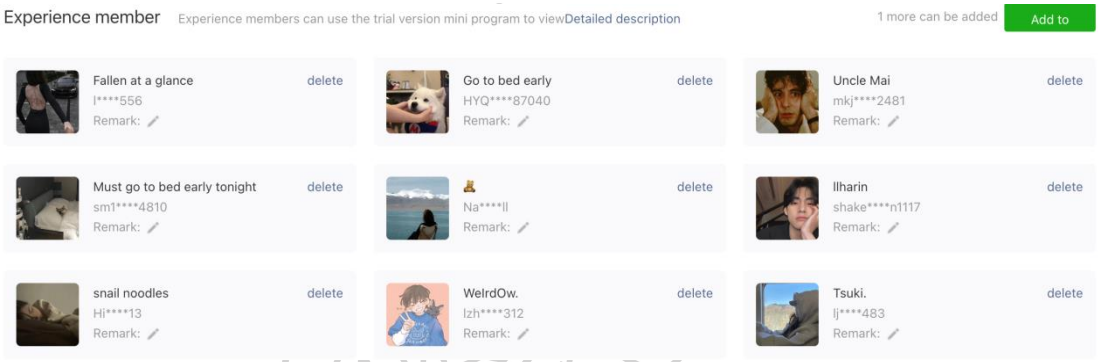
5.9.4 TEST PROCEDURE

1) Test Preparation

a. The researcher facilitated test user permissions for the experimental group members in the WeChat Mini Program backend, ensuring they could access the gamified digital tool without barriers (Figure 75).

Figure 75

Facilitating Test User Permissions for Accessing the Mini Program Experience



Source: Screenshot by the author

Figure 76

Demonstration Video Showing the Operation of the Huizhou Cultural Tourism Gamified Digital Tool

Source: Screenshot by the author

b. The researcher created a specialized demonstration demo and ensured all experimental group members had previewed and learned it prior to the formal test (Figure 76).

c. Test Venue: The tourist sites involved in the Su Dongpo Cultural Tour series of tasks included Huizhou West Lake, Hejiang Tower, and Su Dongpo Shrine (Figure 77). The tour started from Huizhou West Lake and ends at Su Dongpo Shrine, forming a complete tourist route. This setup was designed to simulate a real travel experience while evaluating the suitability and effectiveness of the gamified digital tool in different locations.

Figure 77

Attractions along the Way to Su Dongpo Cultural Tour Series Mission

Source: Created by the author

2) Test Implementation

a. Test Participants: Since the Mini Program's experience user limit is 15 people, the 30-person experimental group was divided into two groups, each with nine males and six females, tested separately in the morning and afternoon sessions.

b. Test Venue: The tourist sites involved in the Su Dongpo Cultural Tour series of tasks. On the day of the test, the researcher carefully arranged a display session of gamification digital tools at the starting point of Huizhou West Lake, Huizhou (Figure 78). This link has two purposes: first, it shows the features, how to use it, and safety precautions of the tool in detail to the people taking the test so that they can perform it

correctly; second, it presents the results of this research to the public to raise awareness and increase its social impact.

Figure 78

Demonstration of the Huizhou Cultural Tourism Gamified Digital Tool to Test Participants and General Visitors

Source: Photo by the author

After the demonstration, test users began to experience the tool (Figure 79). At this stage, they personally manipulated the gamified digital tool to complete the tasks and challenges integrating the essence of Huizhou culture and the historical relics of Su Dongpo. This was not only a test of Anhui cultural knowledge but also the practicality of the tool. To ensure the accuracy and reliability of the test results, each user's operation process was carefully observed, including interaction methods, task completion, and direct feedback from the tool. These useful data will be explored in greater depth in the research evaluation to gain a comprehensive understanding of how gamified digital tools can improve cultural tourism experiences.

Figure 79

Test Participants Using and Experiencing the Huizhou Cultural Tourism Gamified Digital Tool

Source: Photo by the author

Based on careful observation of the user testing process involving the Huizhou cultural tourism gamified digital tool, the researcher found that most participants were able to effectively complete the set tasks, reflecting that the user interface and interaction design of the tool aligns with universal user needs and operating habits. However, technical problems were also exposed during the test, especially regarding data reading and software performance.

5.10 EVALUATION

5.10.1 EXPERT EVALUATION

The Huizhou cultural tourism gamification digital tool was subjected to an expert evaluation through quantitative data (Figure 80). The expert evaluation form utilizes the Likert five-point scale assessment method, whereby the answers to each question are set on a scale from 1 to 5 based on the user's experience (5=highest, 4=high, 3=medium, 2=low, and 1=lowest). Finally, the researcher calculated the

average score for each question in the assessment. A score exceeding 3 indicates that the user's feedback is positive, while a score below 3 suggests that the user's feedback is negative.

Figure 80

Experts' Evaluation

Source: Photo by the author

Table 29

Experts' Evaluation

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q1. The program's usability.	0	0	0	3	6	4.67
Q2. The fantasy or story provided by the task module in the program.	0	0	0	4	5	4.56
Q3. The program adversely affects the real travel experience of tourists.	7	1	0	1	0	1.44
Q4. The program is fun.	0	0	0	5	4	4.44
Q5. Users employ their creativity in the program.	0	0	3	3	3	4
Q6. The audio effect in the program.	0	0	1	4	4	4.11
Q7. The personal satisfaction that the program brings to the user.	0	0	0	2	7	4.78
Q8. The social connectivity of the program.	0	2	1	3	3	3.78
Q9. The program's visual aesthetics.	0	0	0	1	8	4.89
Q10.The program can promote a sense of experience for visitors to participate in.	0	0	0	3	6	4.67

Note: The table presents evaluations from expert judges using a 5-point Likert scale.

Source: Compiled by the author (N = 9)

The results indicate that the tool received high marks from the experts for usability, narrative immersion, entertainment value, audio aesthetics, and visual design (Table 29). These dimensions are crucial for assessing whether a digital application can successfully enhance user experience.

However, the experts' views regarding social connectivity performance were divergent. Some experts observed that the design of the Huizhou cultural tourism gamification digital tool tends toward functionality rather than sociability; they argue that since the tool's primary purpose is to provide information and guidance, social connectivity is not its core value. Other experts held the opposite view, emphasizing the importance of social connectivity and suggesting that enhancing the tool’s social features could improve user experience and strengthen the promotion and outreach of Huizhou cultural tourism.

5.10.2 EXPERT OPINIONS

1) Advantages

a. The visual design cleverly integrates traditional Chinese aesthetic elements with a modern cartoon style, appealing to the new generation of users.

b. By incorporating Huizhou's attractions and historical stories into game tasks, the tool is entertaining and educational.

c. The digital tool is user-friendly and intuitive.

d. The incentive mechanism helps guide users to continue using the tool.

e. As a cultural tourism digital tool, it is very interesting in terms of design concepts.

2) Areas for Improvement

a. For users who do not favor gamified interfaces, this could be a barrier to participation.

b. The tool's visual presentation primarily uses static images, lacking dynamic elements.

c. The content of tasks should be more diverse to attract a broader range of user participation.

d. The smoothness of the tool's operation.

3) Suggestions

a. Integration with the commercial ecosystem of the tourism area, such as dining and shopping.

b. Diversified tasks can guide tourists to explore lesser-known attractions, thereby achieving tourism promotion.

c. Consider developing specific exploration tasks for teenage educational tour groups.

Overall, the experts gave positive feedback on the gamified digital tool designed in the research, recognizing its innovation and appeal in integrating Huizhou's cultural content and tourism experience. This prototype, developed based on theoretical and knowledge frameworks, provides a reference for the future integration of on-site and digital experiences in cultural tourism.

5.10.3 TEST USER EVALUATION

Table 30 presents the basic demographic characteristics of the test participants. Regarding gender distribution, males accounted for 60% and females 40%. The age structure indicated that users aged 13 to 27 were the majority, representing 56.67%, while those aged 28 to 43 accounted for 43.33%. Regarding educational level, over half the individuals had an associate degree, while bachelor's degree holders accounted for 40% and master's degree holders 3.33%.

Table 30

Demographic Characteristics of the Test Participants

Category	Option	Frequency	Percentage
Gender	Male	18	60.00%
	Female	12	40.00%
Age	13–27 years old Generation Z	17	56.67%
	28–43 years old Generation Y	13	43.33%
Educational Attainment	High School and below	2	6.67%
	Associate degree	15	50.00%
	Bachelor's degree	12	40.00%
	Master's degree	1	3.33%

Source: Compiled by the author (N=30)

The user evaluation form utilizes the Likert five-point scale assessment method, with the answers to each question set on a scale from 1 to 5 based on the user's experience (5=highest, 4=high, 3=medium, 2=low, and 1=lowest).

According to the descriptive statistical results (Table 31), the measured variables all show skewness and kurtosis values with absolute values less than 3, indicating that the distribution of each indicator does not significantly deviate from the normal distribution. There were no outliers in the dataset, allowing for straightforward descriptive analysis based on average values.

Table 31

Descriptive Statistical Results

Item	Min Value	Max Value	Average	Std. Deviation	Median	Kurtosis	Skewness
Q4	2	5	4.233	1.104	5	-0.625	-0.991
Q5	2	5	4.2	0.997	5	-0.505	-0.878
Q6	2	5	4.1	0.885	4	-0.736	-0.525
Q7	2	5	4.2	0.961	4.5	-0.189	-0.928
Q8	1	5	2.8	1.495	3	-1.42	0.101
Q9	2	5	4.233	0.898	4.5	-0.465	-0.804
Q10	2	5	4.267	0.868	4.5	-0.08	-0.906
Q11	1	5	2.2	1.297	2	-0.577	0.719
Q12	1	5	4.1	1.094	4.5	0.57	-1.057
Q13	1	5	4.167	1.053	4.5	1.459	-1.304
Q14	3	5	4.367	0.809	5	-0.978	-0.792
Q15	3	5	4.467	0.819	5	-0.553	-1.095
Q16	1	5	4.067	1.112	4.5	0.224	-0.945
Q17	3	5	4.4	0.814	5	-0.866	-0.889
Q18	1	5	4.3	1.022	5	2.106	-1.49
Q19	2	5	4.367	0.89	5	0.167	-1.14
Q20	2	5	4.433	0.858	5	0.891	-1.356
Q21	2	5	4.433	0.898	5	0.476	-1.319
Q22	1	5	4.333	1.124	5	1.339	-1.501
Q23	2	5	4.433	0.898	5	0.476	-1.319
Q24	3	5	4.4	0.855	5	-0.999	-0.908
Q25	1	5	4.3	1.022	5	2.106	-1.49
Q26	3	5	4.5	0.777	5	-0.207	-1.182
Q27	3	5	4.4	0.814	5	-0.866	-0.889
Q28	2	5	4.267	0.98	5	-0.093	-1.054

Source: Compiled by the author

USER EXPERIENCE EVALUATION

1) Usability Evaluation Analysis

According to a comprehensive analysis of the survey data (Table 32), the respondents expressed high satisfaction with the usability of the Huizhou cultural tourism gamified digital tool. This suggests that the tool's user-friendliness and interactive efficiency are well-recognized.

Q4: The average score was 4.23, with most users (21/30) rating above 3 and the most frequent rating being 5. This indicates that users found the program intuitive and easy to navigate, with an interface that effectively meets their needs.

Q5: The average score was 4.2, showing that users generally found the program interface simple and user-friendly. Most users rated it 4 or 5, indicating ease in locating the necessary functions and information.

Table 32

Usability Evaluation

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q4. The ease of controlling this program.	0	3	6	2	19	4.23
Q.5 The ease of navigating the program interface.	0	2	6	6	16	4.2

Note: The table uses a 5-point Likert scale

Source: Compiled by the author (N = 30)

2) Narrative Evaluation Analysis

According to the collected survey data (Table 33), users generally affirmed the narrative content of the task modules, suggesting that storytelling positively enhances user experience. Specifically, respondents appreciated the stories enhancing the travel experience, including their attractiveness and richness. These results underscore the potential value of integrating engaging narratives into digital tourism tools.

Q6: The average score was 4.1, demonstrating general satisfaction with the story content in the task modules. Most ratings were 4 or 5 (22/30), indicating recognition of the quality and appeal of the narrative content.

Q7: The average score was 4.2, as in Q6, suggesting that users found the stories engaging and enjoyed them. Most users (23/30) gave positive ratings of 4 or 5, further reinforcing the positive role of narrative content in user experience.

Table 33

Narrative Evaluation of the Task Modules

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q6. How much did the stories in the task module of this program appeal to you?	0	1	7	10	12	4.1
Q7. How much did you like the stories provided by the task module in this program?	0	2	5	8	15	4.2

Note: The table uses a 5-point Likert scale

Source: Compiled by the author (N = 30)

3) User Engagement Evaluation

Table 34

User Engagement Evaluation of the Huizhou Cultural Tourism Gamified Digital Tool

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q8. How disconnected did you feel from the real travel experience during the program?	9	4	6	6	5	2.8
Q9. How much did you care about the reality of the travel experience during the program?	0	1	6	8	15	4.23

Note: The table uses a 5-point Likert scale.

Source: Compiled by the author (N = 30)

Based on the collected survey data (Table 34), the results suggest that respondents experienced a relatively low disconnect between the travel experience and the real-world experience when using the Huizhou cultural tourism gamified

digital tool. This phenomenon can be attributed to the gamification strategies successfully blending on-site and digital experiences. Notably, respondents highly valued the actual on-site experience during their travels.

Q8: This question was reverse-scored. Most respondents (19) gave lower ratings (1 to 3), indicating a relatively small disconnect between their travel experience using the tool and the real-world experience.

Q9: Most respondents (23) gave higher ratings (4 or 5), with an average score of 4.23, showing they highly valued the on-site experience within the program.

4) Enjoyment Evaluation

According to the survey data (Table 35), most respondents reported that the program was engaging and seldom boring. This finding highlights the program's effectiveness in maintaining user interest and reducing monotony, providing preliminary evidence of a positive correlation between user engagement and program retention.

Q10: The average score was 4.27, indicating that users enjoyed the program. Most respondents (24/30) rated it 4 or 5, showing positive feedback.

Q11: This question was reverse-scored. The average score was relatively low at 2.2, suggesting that some users did not find the program boring. Most respondents (18/30) gave lower ratings of 1 or 2, indicating that aspects of the program continually engaged this user group.

Table 35

Enjoyment Evaluation of the Huizhou Cultural Tourism Gamified Digital Tool

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q10. How interesting do you think this program is?	0	1	5	9	15	4.27
Q11. How bored did you get when using the program?	13	5	7	3	2	2.2

Note: The table uses a 5-point Likert scale

Source: Compiled by the author (N = 30)

5) Creative Freedom Evaluation

The collected survey data (Table 36) suggests a positive trend, with the Huizhou cultural tourism gamified digital tool fostering users' creative thinking and imagination. This design enhances the interactive experience and may improve their understanding and retention of cultural content.

Q12: The average score was 4.1, indicating that users felt free to exercise their imagination. Most users (21/30) gave higher ratings of 4 or 5, suggesting that most found the program provided a good imaginative space.

Q13: The average score was slightly higher than for imagination, at 4.17, indicating that users felt creative freedom while using the program. Like the imagination rating, most users (23/30) gave positive ratings (4 or 5), highlighting the tool's effectiveness in stimulating user creativity.

Table 36

Creative Freedom Evaluation

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q12. How much did the program allow you to use your imagination?	1	1	7	6	15	4.1
Q13. How creative did you feel using the program	1	1	5	8	15	4.17

Note: The table uses a 5-point Likert scale. Compiled by the author (N = 30).

6) Audio Aesthetics Evaluation

According to the collected survey data (Table 37), the audio design application in the Huizhou cultural tourism gamified digital tool successfully and positively enriches and enhances the user experience. The audio quality positively influences users, playing a significant role in deepening immersion and enhancing the interactivity of the cultural tourism experience.

Q14: The average score was 4.37, showing a generally positive attitude toward the audio effects. The distribution indicates that a significant portion of respondents (17/30) rated it the highest, with a total of 13 respondents giving medium (3) and high

(4) ratings. This data suggests that most users were satisfied with the audio quality, which likely contributed positively to the overall experience.

Q15: The average score of 4.47, slightly higher than the audio effects rating, indicates high audio quality, significantly enhancing the overall user experience. Most users (20/30) gave the highest rating, reflecting a consensus on the importance of audio in enhancing the gamified experience.

Table 37

Audio Aesthetics Evaluation of the Huizhou Cultural Tourism Gamified Digital Tool

Item	Distribution of Responses					Average
	1	2	3	4	5	Score
Q14. Please rate the audio effects in the program.	0	0	6	7	17	4.37
Q15. How much did the program's audio enhance the experience?	0	0	6	4	20	4.47

Note: The table uses a 5-point Likert scale.

Source: Compiled by the author (N = 30)

7) Personal Gratification Evaluation

According to the collected survey data (Table 38), the Huizhou cultural tourism gamified digital tool satisfies users' expectations for personal performance to some extent, potentially enhancing user engagement and the program's appeal. While users generally care about their performance in the program and strongly desire to perform well, improving performance in gamified tasks may not be the primary concern for some.

Q16: The average score of 4.07 reflects a certain level of concern among users about performing well in the gamified elements. The distribution shows that most respondents (15/30) gave high ratings (5), while a small portion (eight people) gave medium ratings (3). This suggests that while most users were concerned about their performance when using the tool, a portion may not have been particularly focused on it. This could be due to varying interests or motivations in gamified challenges among users or their perception of achievement and feedback mechanisms.

Q17: An average score of 4.4 indicates a stronger pursuit among users for good performance in the program. Most respondents (18/30) expressed a strong desire (rating of 5), implying that the program can stimulate user engagement and a sense of achievement; key goals of gamified design.

Table 38

Personal Gratification Evaluation of the Huizhou Cultural Tourism Gamified Digital Tool

Item	Distribution of Responses					Average
	1	2	3	4	5	Score
Q16. How much did you care about your performance in the program?	1	1	8	5	15	4.07
Q17. How badly did you want to do as well as possible in the program?	0	0	6	6	18	4.4

Note: The table uses a 5-point Likert scale.

Source: Compiled by the author (N = 30)

8) Social Connectivity Evaluation

Based on the collected survey data (Table 39), the findings indicate that the Huizhou cultural tourism gamified digital tool shows high user satisfaction regarding social connectivity. Most respondents acknowledge its effectiveness in promoting social interaction among users and are willing to share this experience with others. This positive indicator of social participation is clear evidence of the successful application of gamification elements in the digital cultural tourism tool, contributing to enhancing the overall user experience.

Q18: The distribution shows that most respondents (23) gave higher ratings (4 or 5), indicating they believe the program excels in supporting social interaction among users. The average score of 4.3 suggests respondents hold a positive view of the tool's social interaction capabilities.

Q19: According to the distribution, most respondents (24) gave higher ratings (4 or 5), indicating a strong willingness to use the program with others. The average

score of 4.37 shows that, overall, respondents view using the Huizhou cultural tourism gamified digital tool with others positively.

Table 39

Social Connectivity Evaluation

Item	Distribution of Responses					Average
	1	2	3	4	5	Score
Q18. How well does this program support social interactions between users?	1	0	6	5	18	4.3
Q19. How willing are you to use this program with others?	0	1	5	6	18	4.37

Note: The table uses a 5-point Likert scale.

Source: Compiled by the author (N = 30)

9) Visual Aesthetics Evaluation

As indicated by the respondents' ratings (Table 40), the Huizhou cultural tourism gamified digital tool has succeeded from the visual design perspective. High ratings for graphics and visual appeal point to the professionalism of the design and effective communication with the target user group. This feedback emphasizes the importance of visual design in the user experience of digital tools and provides positive signals for future design iterations.

Table 40

Visual Aesthetics Evaluation

Item	Distribution of Responses					Average
	1	2	3	4	5	Score
Q20. Please rate the program graphics.	0	1	4	6	19	4.43
Q21. Please rate the program's visual appeal.	0	1	5	4	20	4.33

Note: The table uses a 5-point Likert scale.

Source: Compiled by the author (N = 30)

Q20: An average score of 4.43 indicates a very positive view of the program's graphic quality among respondents. No respondents chose the lowest score (1), and most ratings (19/30) were high (5). This suggests that the quality of graphic design is considered high and likely aligns with the visual preferences of the target user group. Although a small portion of ratings fell into the middle range (1 rated 2, 4 rated 3), this does not significantly impact the overall positive impression.

Q21: The average score of 4.33, slightly lower than the program graphics rating, still reflects a high level of user satisfaction. Most ratings (20/30) were also high, indicating that users generally find the program visually appealing. Like the program graphics rating, a small portion of middle-range ratings (1 rated 2, 5 rated 3) may point to areas for improvement in visual design or the unique visual preferences of individual users.

EVALUATION OF USAGE EFFECTIVENESS

1) Evaluation of the Effect on Enhancing Tourist Experience

The collected survey data (Table 41) shows a positive response skew, with average scores ranging from 4.27 to 4.43. Such scores reflect generally positive acceptance of the digital tool by users. Specifically, respondents believe it significantly enhances the tourist experience, including increasing attractiveness, prolonging stay duration, providing well-planned routes, and stimulating visitors' motivation to explore. Additionally, respondents expressed a willingness to continue using the program.

Q22: Feedback distribution and an average score of 4.33 indicate that the program effectively attracts tourists. Most feedback is concentrated at the higher end (21/30), suggesting a positive experience in terms of user engagement. A single low-end response might represent an outlier or warrant further investigation to understand the dissatisfaction.

Q23: With no respondents choosing the lowest two scores and a high average score of 4.43, the program successfully promotes interest in attractions. It may reflect the tool's effectiveness in presenting cultural information engagingly or encouraging exploration.

Table 41

Evaluation of Huizhou Cultural Tourism Gamified Digital Tool's Effect on Enhancing Tourists' Experiences

Item	Distribution of Responses					Average Score
	1	2	3	4	5	
Q22. The program made your journey more engaging.	1	1	6	1	21	4.33
Q23. The program made you more interested in the attractions.	0	1	5	4	20	4.43
Q24. The program made you visit the attraction for a longer time.	0	0	7	4	19	4.4
Q25. Following the task guide in the program can help to plan the tour route effectively.	1	0	6	5	18	4.3
Q26. The tasks in the program motivated you to visit more sites.	0	0	5	5	20	4.4
Q27. You are willing to share the cultural content of the program with others.	0	0	6	6	18	4.4
Q28. You would like to continue to use the program.	0	2	5	6	17	4.27

Note: The table uses a 5-point Likert scale.

Source: Compiled by the author (N = 30)

Q24: Feedback on the program's impact on the duration of attraction visits is strong (average score of 4.4). The absence of responses in the lowest two categories indicates the generally positive effect of the tool, though seven respondents gave neutral ratings. This suggests that while the tool influences visit duration, there might be a threshold effect or diminishing returns beyond a certain point.

Q25: An average score of 4.3, with 18 ratings at the highest point, indicates that the program is a valuable aid in planning tour routes. However, a single low-end response and a moderate clustering in the middle range imply room for improvement in making the tool more intuitive or better aligned with user route planning preferences.

Q26: With no low-end feedback and an average score of 4.4, the gamified tasks effectively stimulate users' interest in exploring more attractions. This suggests

that the gamification elements are well-designed, offering incentives and rewards that resonate with tourists' interests and encourage further exploration.

Q27: A high average score of 4.4 indicates that many users (24/30) are willing to share the program's cultural content with others. The absence of 1 or 2 ratings suggests strong appeal in the cultural content of the program, deeming it share-worthy by users.

Q28: An average score of 4.27, also high, shows that most users (23/30) have a positive attitude toward continuing to use the program. This suggests that the program attracts users for initial use and has good user retention effects.

EVALUATION OF THE TOOL'S EFFECT ON ENHANCING TOURISTS' CULTURAL TOURISM PERCEPTION AND KNOWLEDGE

To thoroughly evaluate the effect of the Huizhou cultural tourism gamified digital tool on improving users' ability to absorb and understand knowledge in this field, an independent statistical analysis was conducted on the experimental group using the gamified digital tool and the control group that did not. The scores of the two groups were compared to measure the effectiveness of the gamified digital tool in enhancing users' awareness of Huizhou cultural tourism.

According to the data analysis (Table 42). the experimental group's average score (49.33) was significantly higher than that of the control group (27.17). In the experimental group, over 83% of participants (25) scored over 50 points, while in the control group, only about 7% of participants (two people) reached this score range. The standard deviation of the experimental group was 12.02, and that of the control group was 10.96, with slightly higher score variability in the experimental group. The standard error was 2.97, and the estimated value was relatively precise. The T-statistic was 7.47, and the P-value was significantly less than 0.05, indicating a statistically significant difference between the two groups. This result confirms that gamified digital tools significantly enhance tourists' understanding and memory of historical and cultural knowledge in relation to scenic spots.

This significant difference in results indicates that the experimental group surpassed the control group's overall knowledge in questionnaire performance. After using the Huizhou cultural tourism gamified digital tool during their travels, the

experimental group showed higher average scores and more high-scoring participants for Huizhou cultural tourism knowledge. This suggests that the digital tool may positively impact tourists' perception and understanding of cultural tourism.

The high-scoring rate in the experimental group may reflect the positive role of the gamified learning environment in enhancing users' learning motivation and engagement, aiding in more effective absorption and comprehension of cultural knowledge. Additionally, integrating gamification elements might have enhanced users' cultural perception, leading to a deeper understanding and memory of Huizhou's cultural content.

Table 42

Questionnaire Scores of the Experimental and Control Groups on the Knowledge of Huizhou Cultural Tourism

Metric	Experimental Group（N=30）	Control Group（N=30）
Mean Score	49.33	27.17
Standard Deviation	12.02	10.96
Mean Difference	22.17	
Standard Error	2.97	
T-Statistic	7.47	
P-Value	5.07×10^{-10}	

Note: The table presents the test results of the experimental and control group members on their knowledge of Huizhou cultural tourism. The test consisted of 12 questions, with 5 points awarded for each correct answer and no points for incorrect answers.

Source: Compiled by the author

5.11 CHAPTER SUMMARY

In the prototyping and development of the Huizhou cultural tourism gamified digital tool, the researcher needed to integrate multidisciplinary knowledge, encompassing information on architectural design, gamification task design, incentive mechanism construction, art direction, interface design, interaction design, and

program development, as well as the various digital media technologies involved in promoting tourists' interaction between digital experiences and the real environment.

During the design process, the core concept for the researcher was to use digital tools as interactive platforms, employing gamification strategies to enhance tourists' engagement in cultural tourism and their perception of cultural knowledge at attractions. The essence of this methodology lies in optimizing the overall cultural tourism experience by enhancing tourists' interactive experiences and cultural cognition. It involves the on-site environment, cultural content of attractions, tour routes, on-site experiences, digital experiences, gamified interactive scenarios, and various digital media technologies that promote tourists' interaction between digital experiences and the real environment.

The testing and evaluation results indicate that integrating gamification concepts into digital tools can positively enhance user experience, with users demonstrating a high willingness to continue using these tools. In improving the tourism experience, gamified digital tools have heightened tourists' interest in attractions and extended their visiting duration. Additionally, these tools have played a significant role in deepening users' perceptions and memories of their cultural knowledge of the attractions.

CHAPTER 6
CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

This research focused on the development of digital tools for cultural tourism using the concept of gamification. This mixed-method research involved the collection of relevant literature and data from experts in various fields and target groups (Generation Y and Z). The data collected was used to design and develop creative works, resulting in a WeChat Mini Program prototype to test and disseminate the research findings. The primary conclusion drawn from the study of gamification is that it can motivate the target audience to engage in behaviors and activities aligned with predetermined objectives. These findings can guide the design of digital tools for cultural tourism, with the aim of enhancing user willingness, strengthening the dissemination of content and unique stories about attractions, and highlighting the characteristics of cultural tourism areas. The highlight of the cultural tourism gamification digital tool lies in the balance between functionality and enjoyment, which requires a balance between functionality and fun. The knowledge discovered from the research and the process of transforming the findings into creative works can be summarized according to the research objectives as follows:

6.1 CONCLUSIONS

6.1.1 CONCLUSIONS ACCORDING TO THE RESEARCH OBJECTIVES

Objective 1: To explore the concept of gamification and the use of gamified digital tools in enhancing the tourism experience in Huizhou's cultural tourism.

The results of the literature review focus on gamification and its application in enhancing the cultural tourism experience in Huizhou. First, the literature review defines the concept of gamification in detail and how it differs from traditional games. It introduces the key elements of gamification, such as point systems, reward mechanisms, and challenge tasks. Applying these elements to cultural tourism can enhance tourists' sense of participation and learning effects by guiding them to interact with the cultural content. In addition, the literature review explores the advantages of gamification in digital tools for cultural tourism, especially for

improving user engagement, extending tourists' stay time, and enhancing cultural heritage understanding. These functions are of great significance in the design of digital tools for cultural tourism in Huizhou. The literature review introduces two important gamification design frameworks, Octalysis and MDA. The former evaluates user engagement through eight core drivers, while the latter emphasizes the role of mechanism, dynamics, and aesthetics in gamification design. These frameworks provide structured guidance in the design of digital tools for cultural tourism in Huizhou, helping to develop a more attractive and immersive user experience. In addition, the user experience analysis in the literature review further emphasizes that when designing gamified digital tools, the application effect of gamification in cultural tourism can be improved by optimizing the user experience and proposing relevant evaluation methods. These results provide rich background information and theoretical support for objective 1. From analyzing gamification concepts to optimizing design theory and user experience, they systematically explore how to enhance various aspects of the Huizhou cultural tourism experience through gamified digital tools. These results will aid the construction of gamification digital tools suitable for Huizhou cultural tourism and enhance their effectiveness in cultural communication and tourist participation.

The researcher has studied gamification concepts and design methods to understand their principles and proposed gamification goals, including stimulating users to use digital tools, enhancing tourism participation and awareness of cultural sites, and ultimately improving the overall cultural tourism experience. In designing digital tools for cultural tourism gamification, it is crucial to use gamification elements that respond to the tourism behavior of the target group. Such a design strategy promotes deep interaction between users and digital tools and achieves gamification goals through continuous use.

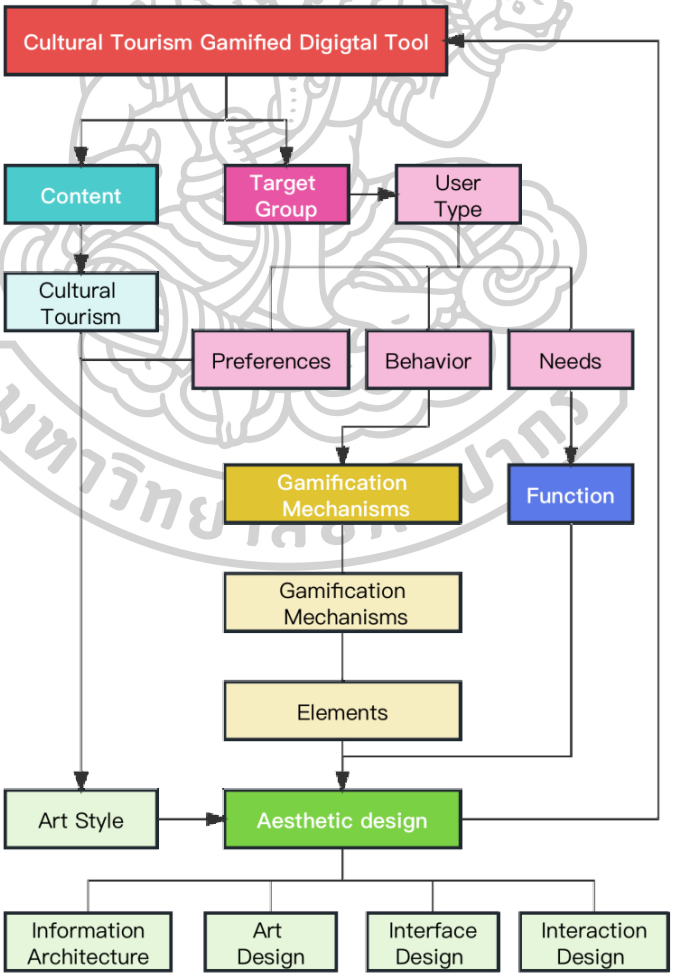
Objective 2: To propose guidelines for the design of digital tools for cultural tourism gamification.

Effectively meeting the needs of user groups and their expectations are key factors in the success of gamification. Ensuring the design meets user needs requires a comprehensive assessment of mechanisms, dynamics, and aesthetics. The first thing to focus on when implementing gamification in cultural tourism is the mechanism

design. This requires in-depth user research to accurately capture the preferences and needs of the target group. Based on these insights, game rules can be designed to encourage participation and engagement. Secondly, the analysis and optimization of game dynamics are crucial, involving the evaluation and adjustment of game mechanics to increase user engagement and satisfaction. Finally, aesthetic design should fully consider the emotional experience and cultural relevance. Designers must ensure that visual elements harmonize with the user's emotional needs and cultural background. Carefully designing and adjusting these three aspects is the key to creating an engaging gaming experience that meets user needs.

Figure 81

Cultural Tourism Gamification Digital Tool Model



Source: Created by the author

Through observation, interviews, and analysis of the questionnaire data on the target group, the researcher identified three main user types: cultural learner, entertainment seeker, and tourist explorer. Researchers have adopted corresponding design strategies according to users' motivations, needs, and preferences. Another important aspect of the cultural tourism gamified digital tool is its aesthetic appeal. The user interface serves as the key medium between the user and the digital tool, and the importance of its visual effects cannot be ignored. Researchers aim to improve users' favorability and engagement with digital tools by looking for aesthetic design methods based on the target group's preferences, such as artistic style choices, as demonstrated by the research model in Figure 81.

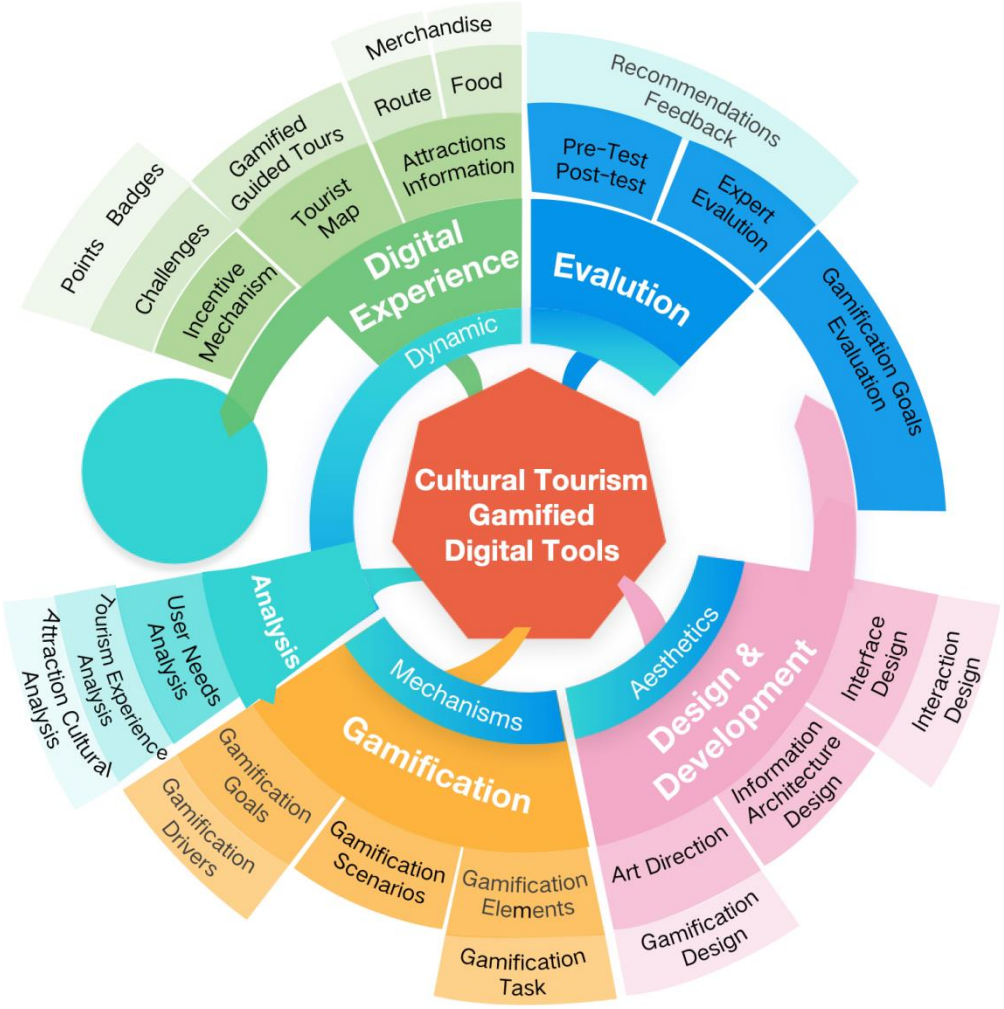
Objective 3: To develop and evaluate a Huizhou cultural tourism gamified digital tool.

This study aims to enhance the cultural tourism experience of tourists, focusing on the needs, preferences, and gamification goals of the target group. The researcher has developed and evaluated a digital cultural tourism tool prototype that combines functional information services with gamification elements. While providing traditional tourism information services such as attraction introductions, route planning, exceptional food, and product recommendations, the tool incorporates gamification mechanisms (tasks such as points and badges). By studying Huizhou cultural tourism data, the story of the attraction can be presented as a leisure task based on geolocation interaction, with the tour tasks related to the attraction issued through virtual characters (NPCs) to guide users to explore the attractions in real life. While completing these tasks, users can unlock the video content related to the attraction, thereby deepening their understanding and enhancing their sense of participation. After completing the tasks, tourists can earn points and badges, further stimulating their interest in participation and desire to explore.

Figure 82 presents details of a prototype cultural tourism game designed using the gamification concept based on the operating methods and research results. The model includes four steps: analysis, gamification, design and development, and evaluation. First, in the analysis stage, the historical and cultural content of the scenic spot is thoroughly interpreted, and the behavior, needs, and preferences of tourists are analyzed. Secondly, in the gamification stage, the gamification goals are clarified.

Challenges, feedback, rewards, and other elements are used to motivate users, gamification scenarios that match the importance and popularity of the scenic spot selected, with tasks such as virtual tours designed. The design and development stage includes architectural information, art design direction, interactive design, and interface design. The digital product is then developed after completion of the concept model and prototype. Finally, in the evaluation stage, the effectiveness of these tools in enhancing the cultural tourism experience is verified through observation, interviews, experimental evaluation, and other methods. This process model systematically plans the development and evaluation of gamified digital tools, emphasizing the deep integration of user experience and cultural content.

Figure 82
Model of Gamified Digital Tool for Cultural Tourism



Source: Created by the author

6.1.2 SUMMARY OF HYPOTHESES

Through testing and evaluation of the Huizhou cultural tourism gamified digital tool prototype by the target user group, the research hypotheses were validated as follows:

Hypothesis 1: The introduction of gamification elements can stimulate users' motivation to use the Huizhou cultural tourism digital tool, enhancing their willingness to use it.

The hypothesis was proven by looking at how test users traveled and the evaluation data. The gamification elements made users more likely to keep using and recommending the cultural tourism gamified digital tool.

Hypothesis 2: The Huizhou cultural tourism gamified digital tool can increase users' participation in tourism activities.

Observations of test users and analysis of the questionnaire data on time spent at tourist sites showed that participation increased significantly in the gamified environment, proving this hypothesis.

Hypothesis 3: The Huizhou cultural tourism gamified digital tool can effectively enhance users' perception and memory of cultural knowledge about the sites.

Putting gamified tasks in context and telling stories about them helped people better process and remember information, leading to better learning and the retention of cultural knowledge. The experimental group (people who used the Huizhou cultural tourism gamified digital tool) did better on quizzes while traveling than the control group (people who did not use the tool). This demonstrated that the experimental group learned and remembered more about the culture, adding to the evidence that the hypothesis was correct.

6.1.3 FINDINGS

From the steps of research, design, and development to the testing and evaluation steps, including data collection, the following knowledge points can be summarized:

1) When designing and developing prototypes, it is crucial to pay attention to the travel behavior of the target group to accurately identify the main user types of

cultural tourism gamification digital tools. This process involves an in-depth analysis of user behavior and a comprehensive understanding of their needs and preferences. This approach ensures that the overall design of a gamified digital tool, both functional design and gamification mechanics, matches the characteristics and expectations of the target users.

2) Gamification strategies need to optimize the efficiency and method of information dissemination through digital tools. In the traditional model, users typically employ these tools when they have a clear need, but gamification changes this dynamic. Task challenges, interactive elements, and feedback inspire active user participation. This change is particularly prominent in disseminating cultural information on scenic spots. Users have changed from simply receiving information to actively exploring and learning. The gamification approach not only improves the attractiveness and accessibility of information but also enhances users' understanding and interest in cultural content. This active learning method is more conducive to deepening users' understanding of cultural heritage, thus promoting their in-depth experience of cultural tourism and the inheritance of cultural values.

3) The intervention of gamification digital tools should consider the occupation of users' time. The study found that although gamification elements can increase the fun and interactivity of travel, excessive game tasks and complex operations may cause tourists to spend too much time on digital tools, thus affecting the actual travel experience. Therefore, when designing gamified digital tools, it is necessary to carefully balance the number and complexity of tasks to ensure that tourists can enjoy the fun without missing out on real-life tourist attractions and activities.

6.1.4 LIMITATIONS OF THE RESEARCH

1) Sample Representativeness and Scope Limitations

The sample size of test users is limited (N=30), which may restrict the generalizability and applicability of the study's results. Moreover, the testing primarily focuses on specific tourist attractions and a particular type of visitor, potentially limiting its broader application in cultural tourism.

2) Reliance on Qualitative and Insufficient Quantitative Data

The study relies heavily on qualitative data, such as user satisfaction and the effectiveness of cultural learning. However, there may be an inadequacy in the collection and analysis of quantitative data, such as the frequency of digital tool usage and detailed duration of user stays at various tourist spots.

3) Economic and Resource Constraints

The project's budget and resources have constrained the scope and quality of tool development. Additionally, investing in and maintaining gamified digital tools for cultural tourism presents a challenge for small cultural sites or non-profit organizations.

4) Long-term Effects and Sustainability

The study focuses on short-term user experience and engagement, with a potentially insufficient evaluation of the long-term impact of gamified tools on cultural tourism. Furthermore, maintaining and updating digital tools to preserve their attractiveness and educational value present long-term challenges.

6.2 DISCUSSION

6.2.1 COMPARATIVE ANALYSIS OF RESEARCH OBJECTIVES AND RESULTS

1) The results show that the literature review explores the concept of gamification in-depth and clarifies how it differs from traditional games. By defining the key elements of gamification in detail, such as point systems, reward mechanisms, and challenge tasks, the study reveals the potential for these elements to be applied in cultural tourism. These applications can effectively enhance tourists' sense of participation and learning effects, thereby improving the interactivity of cultural content. In addition, the literature review results show that gamification has significant advantages in improving user engagement, extending tourists' stay time, and deepening their understanding of cultural heritage. These advantages provide a significant reference in the design of digital tools for cultural tourism in Huizhou.

The results also explore two important gamification design frameworks, Octalysis and MDA, and their applications in cultural tourism. Octalysis evaluates user engagement through eight core drivers, while MDA emphasizes the role of

mechanisms, dynamics, and aesthetics in gamification design. These frameworks provide structured guidance in the design of digital tools for cultural tourism in Huizhou, helping to develop more attractive and immersive user experiences.

In summary, the research results achieved the expectations of goal 1, laying a solid theoretical foundation for designing gamified digital tools for cultural tourism in Huizhou through systematic analysis.

2) In terms of the gamified design guide for cultural tourism, the research results highlight that comprehensive evaluation of user needs, in-depth research on mechanism design, analysis and optimization of game dynamics, cultural relevance of aesthetic design, and consideration of emotional experience are key elements in the successful design of gamified digital tools for cultural tourism. The study identified three main user types through observation, interviews, and questionnaire data analysis of the target group, adopting corresponding design strategies based on the motivations, needs, and preferences of these users.

The study also emphasizes the importance of aesthetic appeal in digital tools, pointing out that the visual effects of the user interface, as a key medium connecting users and digital tools, play an essential role in improving user favorability and engagement. These research results provide comprehensive theoretical support for the gamified design guide for cultural tourism digital tools and are highly consistent with the expectations of goal 2.

3) The third goal of the study was to develop and evaluate gamified digital tools for cultural tourism in Huizhou. The prototype tool developed in the study combines functional information services with gamification elements such as task points and badge mechanisms. Through the study of Huizhou cultural tourism data, the researcher designed leisure tasks based on geographical interaction to guide users to explore attractions in real life and published relevant tasks through virtual characters.

The evaluation results for the prototype demonstrate that through task completion and content unlocking, tourists can enhance their sense of participation and deepen their understanding of cultural heritage. The process model proposed in this study systematically plans the development and evaluation of gamification digital tools and emphasizes the deep integration of user experience and cultural content.

Overall, the research results fully achieved the expectations of goal 3 and provided effective methodological support in developing gamification digital tools for Huizhou cultural tourism.

6.2.2 COMPARISON AND REFLECTION ON RELATED STUDIES AND THEORIES

1) This study systematically explored the impact of gamified digital tools based on the MDA framework on the cultural tourism experience of digital natives. The results revealed that participants in the experimental group who used gamified digital tools experienced higher motivation and engagement during the test. Most participants stated that the gamified cultural tourism experience was more interesting than the conventional cultural tourism experience and generally recognized the significant improvement in interactivity and overall enjoyment provided by gamified digital tools. Gamification also promoted users' use of other tool functions (navigation, information query). This finding confirms the view of Brigham (2015) that gamification elements can significantly enhance users' positive experience and intrinsic motivation. This driving force is also effective in the field of cultural tourism. Through personalized guided tours and interactive experiences, gamification can enrich tourists' travel experiences and make them more diverse and interesting (Coghlan & Carter, 2020). The average tour time of the experimental group was 45.1 minutes longer than that of the control group, consistent with the research conclusion of Xin et al. (2023) that gamified experiences usually made tourists spend more time on the tour.

2) The research maintains consistency with traditional cultural tourism gamification projects in its core concepts and implementation strategies, aiming to optimize the tourist experience by enhancing interaction and participation. The project effectively promotes active engagement and interest among tourists by integrating gamified elements such as task challenges and interactive feedback mechanisms. This approach, deeply researched in game theory and user experience design, centers on creating an immersive and dynamic interactive environment. Unlike traditional cultural tourism gamification projects that often focus on interactive experiences at a single site, this project expands its scope to encompass the entire Huizhou region,

attempting an organic interconnection among multiple cultural sites. This regional gamification strategy enhances tourists' overall perception of the cultural destinations and promotes the comprehensive utilization of cultural tourism resources.

In traditional tourism models, tourists often experience a discontinuity in engagement when transitioning between sites. However, this project cleverly maintains tourist involvement and interest through digital tools, achieving a seamless integration of on-site and digital experiences. This strategy not only elevates the overall quality of the tourist experience but also demonstrates the potential applications of digital technology in cultural tourism.

3) The research's gamification design extensively draws upon the principles of the MDA Framework: Mechanics, Dynamics, and Aesthetics. The cultural tourism gamified digital tool utilizes gamification mechanics to create dynamic user experiences and pleasurable aesthetic perceptions. The MDA framework primarily focuses on the internal structure of game design, emphasizing the interplay between mechanics, dynamics, and aesthetics to create engaging game experiences. In contrast, the design philosophy of Huizhou's cultural tourism gamification tools shows significant differences. Its core purpose is not limited to the entertainment value of gamified elements but is more deeply concerned with how gamification can enhance the tourist experience. Within this design framework, game elements are seen as tools to enrich and enhance tourists' cognition and experience of cultural heritage. Therefore, Huizhou's cultural tourism gamification tools demonstrate their uniqueness in practical application and goal setting, especially in combining gamification strategies with enhancing cultural tourism experiences. The application of MAD theory in game design primarily focuses on enhancing the entertainment value of games and increasing user participation. Its core goal is to elevate the game's attractiveness through well-designed reward mechanisms, challenging tasks, and storylines that stimulate users' intrinsic motivation, thereby fostering deeper engagement and interaction.

In contrast, the design philosophy of Huizhou's cultural tourism gamification tool shows significant differences. Its primary objective extends beyond the entertainment value of gamification elements to a deeper focus on enhancing tourists' experiences through gamified means. Within this design framework, gamification

elements are seen as tools to enrich and enhance tourists' understanding and experience of cultural heritage. Thus, Huizhou's cultural tourism gamification tool demonstrates its uniqueness in practical application and goal setting, especially in combining gamification strategies with enhancing cultural tourism experiences.

6.3 RECOMMENDATIONS

1) Testing should be conducted multiple times to address areas for improvement and development, aiming to optimally satisfy the behavioral preferences and interests of the target player group.

2) It might take a considerable time to track data to see if players learn cognitive or memory skills from gamified tasks.

3) To determine if gamification makes people more likely to use digital tools for cultural tourism, it may be necessary to develop more detailed interactive metrics, like how much time people spend using the tools, how often they use them, and how much they interact with gamified tasks.

4) Gamified tasks should not be limited to interactions between users and tourist spots but also explore cultural and artistic activities. Integrating these tasks with site touring activities can promote a more profound experiential engagement.

5) Cultural tourism gamified digital tools are not merely applicable for providing information services to tourists; they can also serve as effective means for marketing and promoting cultural tourism destinations. These tools can attract and maintain tourists' interest through gamified elements, creating additional destination promotional opportunities.

6) The gamification elements should be further optimized to cater to different types of cultural tourists, such as developing specific tour tasks for the unique needs of the youth group in educational travel activities.

6.4 CHAPTER SUMMARY

This research aims to highlight the innovative application of gamification in digital tools for cultural tourism, emphasizing its practicality and adaptability. By integrating gamification elements such as task challenges, incentive mechanisms, interactive components, and feedback systems, this strategy not only enhances visitor

engagement and depth of experience at cultural tourism sites but also offers a pleasurable and educationally valuable learning experience. This gamified approach to tourism tools goes beyond mere entertainment and informational services. It innovatively combines digital experiences with traditional on-site tourism experiences, enriching cultural tourism's essence. This shift plays a significant role in enhancing the appeal of regional cultural tourism, deepening visitors' experiences, and strengthening the comprehensive utilization of cultural tourism resources.

มหาวิทยาลัยศิลปากร

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APPENDIX

ที่ อว 8610 / 2508

คณะมัณฑนศิลป์ มหาวิทยาลัยศิลปากร
31 ถนนหน้าพระลาน แขวงพระบรมมหาราชวัง
เขตพระนคร กรุงเทพฯ 10200

13 มิถุนายน 2566

เรื่อง ขอเชิญเป็นผู้ตรวจคุณภาพเครื่องมือวิจัย

เรียน รองศาสตราจารย์ ดร.เกรียงศักดิ์ เขียวมั่ง

ด้วย Mr.Fankai NIE รหัสประจำตัว 630430036 นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาการออกแบบ คณะมัณฑนศิลป์ มหาวิทยาลัยศิลปากร หัวข้อดุษฎีนิพนธ์ เรื่อง Gamification-based digital tool for Huizhou cultural tourism by mobile game โดยมี ผู้ช่วยศาสตราจารย์ ดร.อติเทพ แจ้ดนาลาว เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์ นั้น

ในการนี้ คณะมัณฑนศิลป์ จึงขอเรียนเชิญท่านเป็นผู้เชี่ยวชาญตรวจเครื่องมือวิจัยให้กับนักศึกษา เพื่อนักศึกษาจะได้นำข้อเสนอแนะที่ได้ไปปรับปรุงคุณภาพเครื่องมือการวิจัยให้มีความเหมาะสมต่อไป

จึงเรียนมาเพื่อโปรดพิจารณา คณะฯ หวังเป็นอย่างยิ่งว่าจะได้รับความอนุเคราะห์จากท่าน และขอขอบพระคุณเป็นอย่างสูงมา ณ โอกาสนี้

ขอแสดงความนับถือ

(อาจารย์ ดร.ธนาทร เจียรกุล)
คณบดีคณะมัณฑนศิลป์

สำนักงานคณบดี
โทร 0-2221-5832
โทรสาร 0-2225-4350

ที่ อว 8610 / 2509

คณะมัณฑนศิลป์ มหาวิทยาลัยศิลปากร
31 ถนนหน้าพระลาน แขวงพระบรมมหาราชวัง
เขตพระนคร กรุงเทพฯ 10200

13 มิถุนายน 2566

เรื่อง ขอเชิญเป็นผู้ตรวจคุณภาพเครื่องมือวิจัย

เรียน ศาสตราจารย์เกียรติคุณวัฒนะ จูฑะวิภาต

ด้วย Mr.Fankai NIE รหัสประจำตัว 630430036 นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาการออกแบบ คณะมัณฑนศิลป์ มหาวิทยาลัยศิลปากร หัวข้อดุษฎีนิพนธ์ เรื่อง Gamification-based digital tool for Huizhou cultural tourism by mobile game โดยมี ผู้ช่วยศาสตราจารย์ ดร.อติเทพ แจ้ดนาลาว เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์ นั้น

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ขอแสดงความนับถือ

(อาจารย์ ดร.ธนาทร เจียรกุล)
คณบดีคณะมัณฑนศิลป์

สำนักงานคณบดี
โทร 0-2221-5832
โทรสาร 0-2225-4350

No.8610/. 2514

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

13th June, 2023

Subject: Invitation to be an inspector of research tool quality

Dear Professor Dr. Miyoung Seo

Mr.Fankai NIE is a graduate student ID 630430036 in Design Program at Graduate School, Silpakorn University. Currently, he is conducting his thesis study entitled: Gamification-based digital tool for Huizhou cultural tourism by mobile game. In this regard, Graduate School, Silpakorn University would like to invite you to inspect the quality of research tools for the student.

Your kind assistance and academic contribution is much appreciated.

T. Jiarakun

(Dr. Thanatorn Jiarakun)
Dean of Faculty of Decorative Arts,
Silpakorn University

Contact to : info.decsu@gmail.com
Tel. +662-221-5874, +662-221-5832

Questionnaire for Visitors

Part I General Information

1. Your gender is:

○A. Male

○B. Female

2. Your age:

○A. Under 18 years old

○B. 18-25 years old

○C. 26-35 years old

○D. 36-45 years old

○E. 46-60 years old

○F. Over 60 years old

3. Your level of education:

○A. High school and below

○B. College

○C. Bachelor's degree

○D. Master's degree

○E. Doctorate and above

4. On a scale of 1-5, how interested are you in cultural tourism?

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

5. On a scale of 1-5, how interested are you in using gamified digital tool to enhance the cultural tourism experience?

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

Part II Visitor perceptions of cultural tourism in Huizhou

6. Please rank the following purposes of cultural tourism according to their importance in your opinion: [Please fill in the numbers in the middle bracket in order] *

[ ] A. To learn about history, culture, and related knowledge

[ ] B. To broaden one's horizons and enhance one's experience

[ ] C. Relaxing and relieving stress

[ ] D. Visiting friends and relatives and making new friends

[ ] E. For work and study

[ ] F. To improve cultural and aesthetic skills

7. Please select your favorite three cultural tourist attractions in Huizhou and rank them according to their importance. [Please fill in the numbers in the middle bracket in order]

[ ] A. Huizhou West Lake

[ ] B. Luofu Mountain

[ ] D. Dongpo Ancestral Hall

[ ] E. Shuidong Street

[ ] F. Zhu House Lane

[ ] G. Ye Ting's Former Residence

[ ] H. Hop River House

[ ] I. Binxing Pavilion

[ ] J. Science and Technology Museum

[ ] K. Hakka Po Scenic Area

8. On a scale of 1 to 5, how well do you know the cultural resources carried by Huizhou cultural tourism attractions?

○A. 1 ○ B. 2 ○ C. 3 ○ D. 4 ○D. 5

Part III Factors that inspire you to use the Huizhou cultural tourism gamified digital tool

9. Please rank the functions of the following cultural tourism digital tools according to their importance, in your opinion. [Please fill in the numbers in the middle bracket in order] *

[ ] A. Scenic area refinement navigation

[ ] B. Tourist route planning recommendations

[ ] C. Cultural information on attractions

[ ] D. Recommendation of nearby restaurants and accommodation

[ ] E. Scenic area tourism products purchase

[ ] F. Social sharing

10. Please rank the following factors that inspire you to use Huizhou's cultural tourism gamified digital tool according to their importance. [Please fill in the numbers in the middle bracket in order] *

[ ] A. Enhancement of the tourism experience

[ ] B. Fun of the game

[ ] C. Material rewards (tourism souvenirs, derivative cultural and creative products)

[ ] D. Virtual achievements (badges, titles)

[ ] E. Coupons (scenic spot tickets, food, and beverage, accommodation)

[ ] F. Social sharing

11. Reasons that affect your use of digital tools. [Please fill in the numbers in the middle bracket in order] *

[ ] A. Takes up too much memory

[ ] B. consumes too much mobile data traffic

[ ] C. Difficulty of operation

[ ] D. Design style

[ ] E. Fun and interactive

[ ] F. Reduced travel experience

12. On a scale of 1-5, what is your ideal task difficulty?

○A. 1 ○ B. 2 ○ C. 3 ○ D. 4 ○D. 5

13. On a scale of 1-5, do you want to increase your cultural perception of cultural tourism sites through gamified digital tool?

○A. 1 ○ B. 2 ○ C. 3 ○ D. 4 ○D. 5

14. On a scale of 1-5, would you like to use gamified digital tool to help you plan your travel route more rationally?

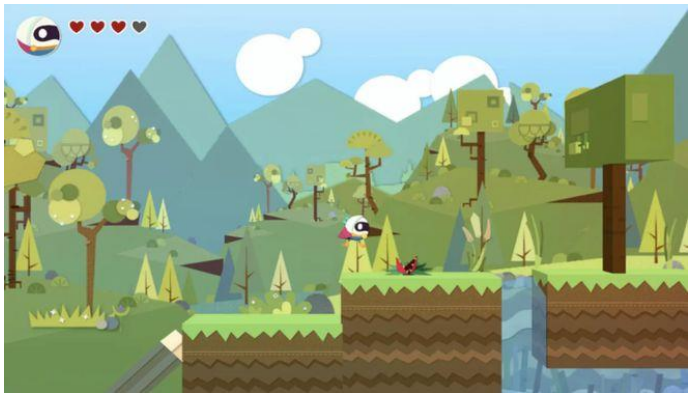
○A. 1 ○ B. 2 ○ C. 3 ○ D. 4 ○D. 5

15. On a scale of 1-5, do you find it interesting that "the tasks in gamified digital tool interact with real-life excursions"?

○A. 1 ○ B. 2 ○ C. 3 ○ D. 4 ○D. 5

Part 4 Artistic style and color scheme of the gamified digital tool

16. Which art styles would you like to see used in the Huizhou Cultural Tourism gamified digital tool? [Select up to 3] *



□ A. Minimalist style

The minimalist style emphasizes clean, geometric graphics, often featuring bright

colors and clear lines. This style often represents game worlds and characters through simple geometric shapes and abstract imagery.

□ B. Pixel Style

The pixel style is a dot-based graphics style that mimics the graphic presentation of early computers and game consoles. The refinement of the image characterizes it into a collection of pixel dots, each representing a unit in the picture, and the whole concept is rendered through the arrangement of different colored pixel dots.

□ C. Cartoon style

The cartoon style is a cartoon or comic book style of game visual presentation. This style usually has bright and vibrant colors, exaggerated character shapes, and humorous elements and is often used to represent cute, funny, or exaggerated images and stories.

□ D. Q(Cute) style

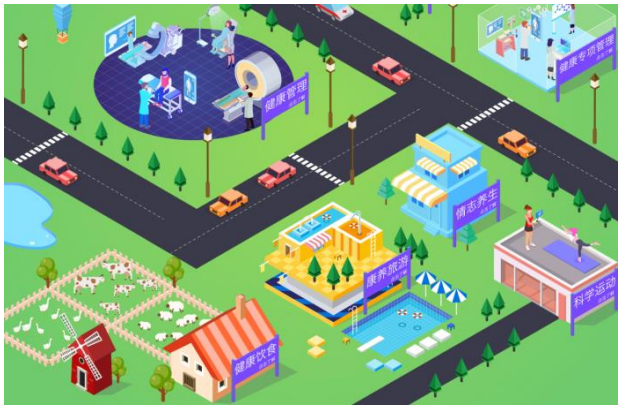
The Q style is a cartoonish and exaggerated drawing style characterized by simplified and enlarged image features. This style is often used to represent cute, humorous, or funny characters and scenes and is highly recognizable.

□ E. Traditional Chinese line drawing style

The Traditional Chinese line drawing style refers to using line drawing techniques and styles of traditional Chinese painting in games. This style usually includes delicate lines, unique compositions, and graphic expressions rich in traditional cultural elements.

□ F. Illustration style

The illustration style is usually hand-drawn, presenting bright, vivid, and imaginative images. This style focuses on color, often using a vibrant palette to highlight contrast and create a lively and cheerful atmosphere. And it is often combined with light-hearted, joyful gameplay to create an enjoyable gaming experience.



□ G. 2.5D Style

The 2.5D style uses 3D modeling and rendering techniques in a game or animation, but the final presentation has a 2D visual effect. It combines 2D and 3D elements to create a graphics presentation between 2D and 3D.

□ H. 3D Comic Style

The 3D Comic Style is a type of drawing that combines a flat anime style with 3D technology. It models flat comic characters and scenes as 3D models and uses rendering techniques and special effects to present a three-dimensional and realistic picture effect.

□ I. Realistic style

The Realistic style is a style of drawing that seeks realism and a high level of detail, aiming to create visual effects similar or close to the real world to provide a more realistic gaming experience.

17. The colors scheme you think is suitable for the Huizhou culture tourism gamified digital tool. [Select up to 3] *

□A

□B

□C

□D

□E

□F

□G

□H

□I

□J

□K

□L

18. Your suggestion for the development of Huizhou cultural tourism gamified digital: If you have no suggestions, please fill in "none."

_____

Interview Questionnaire for Expert

Interview Time:

Interview Location:

Name: Gender: Age: Research area:
Part I: Open-ended questions on cultural tourism in Huizhou. 1. What are the characteristics of cultural tourism in Huizhou? 2.Please introduce the popular cultural tourist attractions in Huizhou and choose three of them that you think are the most important. Please introduce the well-known cultural symbols in Huizhou and choose the three of them that you think are the most important. 4. Please talk about the feasibility of combining cultural tourism with gamified digital tool in Huizhou. 5. Please tell us what elements of Huizhou's cultural tourism are suitable for integration into gamified digital tool design. Part 2: Open questions, methods, and techniques on gamification design for cultural tourism 6. What is the contribution of gamification to cultural tourism? 7. What are the current examples of successful gamification in the cultural tourism sector? 8. What are the gamification experiences in cultural tourism? 9. Please talk about the feasibility of gamification design for cultural tourism in Huizhou. 10. What should be the focus of gamification design for cultural tourism in Huizhou? Part3: Open-ended questions about gamified digital tool design for cultural tourism in Huizhou. 11. What gamified digital tool about cultural tourism are currently available? Please describe what makes them successful. 12. Is it feasible to promote cultural tourism experience for tourists through gamified digital tool?

13. What is the process of designing and developing a cultural tourism gamified digital tool?

14. What should I pay attention to when choosing the art style and color scheme of a cultural tourism gamified digital tool?

15. What are the mainstream gamified digital tool development technologies? Please introduce them.

16. What factors need to be considered in designing and developing cultural tourism gamified digital tool focus?

Part 4: Open-ended suggestions for the design and development of gamified digital tool.

17. What is your suggestions for the design and development of a gamified digital tool for cultural tourism in Huizhou?

Interview Questionnaire for Visitor

Interview Time:

Interview Location:

Name: Gender: Age:
Part I: Open-ended questions about Huizhou cultural tourist attractions. 1. How long do you plan to visit Huizhou? 2. What attractions have you already visited? 3. what other attractions would you like to visit? 4. What is the purpose of your participation in Huizhou cultural tourism? Part 2: Open-ended questions on using Huizhou's cultural tourism digital tools. 1. Have you used the digital tools provided by the attractions? 2. What suggestions do you have for optimizing the Huizhou cultural tourism digital tools? 3. What are the three most important functions of cultural tourism tools? Part 3: Suggestions on designing and developing mobile games for cultural tourism in Huizhou.

Interview Questionnaire for Scenic Staff

Interview Time:

Interview Location:

Name: Gender: Age:
Part I: Open-ended questions about Huizhou cultural tourist attractions. 1. How many visitors are there in your scenic spot every day? (answer by weekdays, double holidays, and holidays) 2. Does your scenic spot provide interpretation services for visitors? If so, please tell us about it. 3. Based on your everyday observations, how long do you estimate the length of a visitor's visit to a tourist attraction? 4. Please tell us about the recommended itinerary. 5. Do most visitors follow the same route as recommended by the tourist attraction? 6. Does your area provide digital tools for visitors? Part 2: Suggestions on designing and developing gamified digital tool for cultural tourism in Huizhou.

Evaluation Form for Expert

Part 1 User experience and utilization effect evaluation

On a scale of 1-5, please rate the program's usability.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

2. On a scale of 1-5, please rate the fantasy or story provided by the task module in the program.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

3. The program adversely affects the real travel experience of tourists.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

4. On a scale of 1-5, please rate the program's fun.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

5. On a scale of 1-5, please rate users use their creativity in the program.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

6. On a scale of 1-5, please rate the audio effect in the program.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

7. On a scale of 1-5, please rate the personal satisfaction that the program brings to the user.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

8. On a scale of 1-5, please rate the social connectivity of the program.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

9. On a scale of 1-5, please rate the program's visual aesthetics.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

10. The program can promote a sense of experience for visitors to participate in.

○A. 1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

Part 2 Open-ended suggestions for the gamified digital tool improvement

11. Your suggestions for improving the program. If you have no suggestions, please fill in "none."

_____

Evaluation Test Questionnaire (Pre-Test)

Part I Low Difficulty Test Questions

1. Is Huizhou a national historical and cultural city?

○A. Yes

○B. No

2. Do Huizhou's tourism resources include "mountains, rivers, lakes and seas"?

○A. Yes

○B. No

3. Did Su Dongpo, a famous writer of the Northern Song Dynasty, serve as a magistrate in Huizhou?

○A. Yes

○B. No

4. Is Huizhou West Lake a national 4A-level scenic spot?

○A. Yes

○B. No

Part II Intermediate difficulty test questions

5. How many lakes currently make up the West Lake Scenic Area of Huizhou?

○A. 6

○B. 7

○C. 8

○D. 9

6. At the confluence of which two rivers is the Hop River Tower located?

○A. Pearl River and Dongjiang River

○B. Pearl River and Xizhi River

○C. Dongjiang and Danshui River

○D. Dongjiang and Xizhi River

7. What kind of architectural style is used in Shuidong Street?

○A. Ming and Qing architectural style

○B. Waterfront residential architecture

○C. Lingnan Riding House style

○D. Hakka House style

8. Su Dongpo's house in Huizhou was:

○A. Built at his own expense.

○B. Lent to him by the government.

○C. Built with the help of a friend.

○D. Built with the help of a friend.

Part III Advanced Level Test Questions

9. In which dynasty was the city of Huizhou built?

○A. Sui Dynasty

○B. Tang Dynasty

○C. Northern Song Dynasty

○D. Southern Song Dynasty

10. In Huizhou West Lake scenic area financed by Su Dongpo was built?

○A. Su Causeway and Jiuqu Bridge

○B. Jiuqu Bridge and Junti Temple

○C. Junti Temple and Su Causeway

○D. Su Causeway and Xixin Bridge

11. Huizhou is located in the center of the Pearl River Delta and is influenced by which of the following cultures?

○A. Guangfu culture

○B. Hakka culture

○C. Hailufeng culture

○D. Chaoshan culture

12. Which of the following poems was not written by Su Dongpo for Huizhou?

○A. If I could eat a lot of fresh lychees every day, I would like to be a Lingnanite forever.

○B. The landscape is lush and green, at the confluence of the two rivers stands a vermilion building.

○C. When someone asks if Lingnan is a good place to live, I just want to say: this place that puts me at ease is my hometown.

○D. On a sunny day the lake ripples and glistens; when it rains, the distant mountains are shrouded in smoke and rain, appearing and disappearing.

Evaluation Test Questionnaire (Post-Test)

Part I Low Difficulty Test Questions

1. Is Huizhou a national historical and cultural city?

○A. Yes

○B. No

2. Do Huizhou's tourism resources include "mountains, rivers, lakes and seas"?

○A. Yes

○B. No

3. Did Su Dongpo, a famous writer of the Northern Song Dynasty, serve as a magistrate in Huizhou?

○A. Yes

○B. No

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○A. Yes

○B. No

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○C. When someone asks if Lingnan is a good place to live, I just want to say: this place that puts me at ease is my hometown.

○D. On a sunny day the lake ripples and glistens; when it rains, the distant mountains are shrouded in smoke and rain, appearing and disappearing.

Evaluation Questionnaire for Users

Part 1 General Information

1. Your gender is

○A. Male

○B. Female

○C. Transgender

2. Your age:

○A. Under 18 years old

○B. 18-25 years old

○C. 26-35 years old

○D. 36-45 years old

○E. 46-60 years old

○F. Over 60 years old

3. Your level of education:

○A. High school and below

○B. College

○C. Bachelor's degree

○D. Master's degree

○E. Doctorate and above

Part 2 Program user experience evaluation

4. On a scale of 1-5, please rate the ease of controlling this program.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

5. On a scale from 1-5, please rate the ease of navigating the program interface.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

6. On a scale of 1-5, how much do the stories in the task module of this program appeal to you?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

7. On a scale of 1 to 5, how much do you like the stories provided by the task module in this program?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

8. On a scale of 1 to 5, how disconnected do you feel from the real travel experience during the program?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

9. On a scale of 1 to 5, how much do you care about the reality of the travel experience during the program?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

10. On a scale of 1 to 5, how interesting do you think this program is?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

11. On a scale of 1 to 5, how bored do you get when you use the program?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

12. On a scale of 1-5, how much the program allows you to use your imagination?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

13. On a scale of 1-5, how creative do you feel you are in the program?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

14. On a scale of 1 to 5, please rate the audio effects in the program.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

15. On a scale of 1 to 5, how much the program's audio enhances the using experience?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

16. On a scale of 1 to 5, how much do you care about your performance in the program?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

17. On a scale of 1 to 5, how badly do you want to do as well as possible in the program？

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

18. On a scale of 1 to 5, how well does this program support social interactions between users?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

19. On a scale of 1 to 5, how willing are you to use this program with others?

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

20.On a scale of 1 to 5, please rate the program graphics.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

21. On a scale of 1 to 5, please rate the program's visual appeal.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

Part 3 Evaluation of the effect of program to enhance the cultural tourism experience

22. On a scale of 1 to 5, use the program to make your journey more engaging.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

23. On a scale of 1 to 5, the program makes you more interested in the attractions.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

24. On a scale of 1 to 5, the program made you visit the attraction for a longer time.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

25. On a scale of 1 to 5, following the task guide in the program can plan the tour route reasonably.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

26. On a scale of 1 to 5, the tasks in the program motivate you to visit more sites.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

27. On a scale of 1 to 5, you are willing to share the cultural content of the program with others.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

28. On a scale of 1 to 5, you would like to continue to use the program.

○A.1 ○B. 2 ○C. 3 ○D. 4 ○E. 5

Part 4 Open-ended suggestions for program improvement

29. Your suggestions for improving the program.

If you have no suggestions, please fill in “none."

_____

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Questionnaires to Collect Information from Visitors

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/					/			/	-1	-0.33	Amend
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
8	/			/			/			3	1	Appropriate
9	/			/			/			3	1	Appropriate
10	/			/			/			3	1	Appropriate
11	/			/			/			3	1	Appropriate
12	/			/			/			3	1	Appropriate
13	/			/			/			3	1	Appropriate
14	/			/			/			3	1	Appropriate
15	/			/			/			3	1	Appropriate
16	/			/			/			3	1	Appropriate
17	/			/			/			3	1	Appropriate
18	/			/			/			3	1	Appropriate
Total score 54										50		
Reliability Index										0.93		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Interview to Collect Information from Experts

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/			/			/			3	1	Appropriate
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/				/		/			2	0.67	Amend
8	/				/		/			2	0.67	Amend
9	/				/		/			2	0.67	Amend
10	/			/			/			3	1	Appropriate
11	/			/			/			3	1	Appropriate
12	/			/			/			3	1	Appropriate
13	/			/			/			3	1	Appropriate
14	/			/			/			3	1	Appropriate
15	/			/			/			3	1	Appropriate
16	/			/			/			3	1	Appropriate
17	/			/			/			3	1	Appropriate
Total score 51										48		
Reliability Index										0.94		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Interview to Collect Information from Visitors

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/			/			/			3	1	Appropriate
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
8	/			/			/			3	1	Appropriate
Total score 24										24		
Reliability Index										1		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Interview to Collect Information from Scenic Staff

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/			/			/			3	1	Appropriate
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
Total score 21										21		
Reliability Index										1		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Evaluation to Collect Information from Experts

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/			/			/			3	1	Appropriate
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
8	/			/			/			3	1	Appropriate
9	/			/			/			3	1	Appropriate
10	/			/			/			3	1	Appropriate
11	/			/			/			3	1	Appropriate
Total score										33		
Reliability Index										1		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Pre-test Questions to Collect Information from Users

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/			/			/			3	1	Appropriate
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
8	/			/			/			3	1	Appropriate
9	/			/			/			3	1	Appropriate
10	/			/			/			3	1	Appropriate
11	/			/			/			3	1	Appropriate
12	/			/			/			3	1	Appropriate
Total score 36										36		
Reliability Index										1		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Post-test Questions to Collect Information from Users

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/			/			/			3	1	Appropriate
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
8	/			/			/			3	1	Appropriate
9	/			/			/			3	1	Appropriate
10	/			/			/			3	1	Appropriate
11	/			/			/			3	1	Appropriate
12	/			/			/			3	1	Appropriate
Total score 36										36		
Reliability Index										1		

Index of Questionnaire Validity (IOC: Index of item objective congruence)

for Evaluation form to Collect Information from Users

Item	Expert 1			Expert 2			Expert 3			Total	IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1			
1	/					/	/			1	0.33	Amend
2	/			/			/			3	1	Appropriate
3	/			/			/			3	1	Appropriate
4	/			/			/			3	1	Appropriate
5	/			/			/			3	1	Appropriate
6	/			/			/			3	1	Appropriate
7	/			/			/			3	1	Appropriate
8	/			/			/			3	1	Appropriate
9	/			/			/			3	1	Appropriate
10	/			/			/			3	1	Appropriate
11	/			/			/			3	1	Appropriate
12	/			/			/			3	1	Appropriate
13	/			/			/			3	1	Appropriate
14	/			/			/			3	1	Appropriate
15	/			/			/			3	1	Appropriate
16	/			/			/			3	1	Appropriate
17	/			/			/			3	1	Appropriate
18	/			/			/			3	1	Appropriate
19	/			/			/			3	1	Appropriate
20	/			/			/			3	1	Appropriate
21	/			/			/			3	1	Appropriate
22	/			/			/			3	1	Appropriate
23	/			/			/			3	1	Appropriate
24	/			/			/			3	1	Appropriate
25	/			/			/			3	1	Appropriate

26	/			/			/			3	1	Appropriate
27	/			/			/			3	1	Appropriate
28	/			/			/			3	1	Appropriate
29	/			/			/			3	1	Appropriate
Total score 87										85		
Reliability Index										0.98		

VITA

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PUBLICATION	Nie, F., & Chaetnalao, A. (2024). Analyze the Gamification Application User Target Group and Formulate Design Strategies for Cultural Tourism: Case Study of Huizhou. Journal Of Community Development Research (Humanities And Social Sciences), 17(2), 91-105. doi:10.14456/jcdr-hs.2024.15 Nie, F., & Chaetnalao, A. (2025). Cultural Tourism Experience in the Digital Age: Design of Gamified Digital Tool for the Younger Generation. Journal of the Pacific Institute of Management Sciences (Humanities and Social Sciences). Accepted for publication. Expected publication in January - April 2025.