



AN INTERACTIVE GAME FOR ENHANCING VISITOR ENGAGEMENT AND LEARNING IN WORLD FUZHOU HERITAGE GALLERY, SIBU

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ABSTRACT

This study investigates the impact of an interactive game set in a heritage gallery on user experience and learning outcomes. Traditional galleries encounter challenges in engaging diverse audiences due to limited interactivity and perceived relevance in the digital era. The literature review is used to identify gaps and areas for designing interactive games. The game, tailored for teenagers aged 12 years old to 20 years old, employs interactive elements to enable the exploration of gallery exhibits. This study is also applied to focus groups for observation to test the game. The researchers formed two distinct focus groups, each comprising a total of seven participants as the researchers often choose to work with small sample sizes. Data collection involved testing, focus groups, and surveys. This research also uses quantitative methods to achieve the objectives of the study. The application of a quantitative methodology is particularly advantageous in constructing a social-demographic profile of an audience, enabling the exploration of relevant questions related to the identity of virtual visitors. Results indicate that the game group exhibited significantly higher levels of engagement and exhibit content recall compared to the control group.

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Introduction

Engaging visitors and promoting meaningful learning have long been primary goals in educational and gallery experiences. Traditional information-delivery techniques such as static exhibits and guided tours frequently struggle to hold visitors' attention and provide an engaging educational experience. Conventional galleries struggle to keep up with the changing expectations and tastes of contemporary visitors, which lowers engagement, limits their ability to appeal to a wide range of people, and reduces their relevance in a culture that is becoming more digital and interactive (Shaharir & Zanuddin, 2018). The development of interactive technologies, however, has created new opportunities for raising visitor engagement and fostering successful learning outcomes (Kamariotou & Kitsios, 2021). This study

investigates the user experience and educational benefits of an interactive game played in a historical gallery. A digital or physical activity that combines elements of entertainment and education can be referred to as an interactive game.

This type of activity actively engages players in an immersive experience (Azar *et al.*, 2016). Contrary to traditional approaches, interactive games allow users to interact, explore, and decide in a fun and active setting. These experiences encourage visitors to actively participate and devote their attention and cognitive resources by including game dynamics like challenges, prizes, and competitiveness (Damala *et al.*, 2016). This promotes a deeper level of engagement and knowledge acquisition. Due to its capacity to accommodate a range

of learning preferences and encourage active learning, interactive games have drawn a lot of attention in educational settings. Visitors can engage with knowledge in a more individualised and experiential way through interactive games, fostering a stronger connection and comprehension of the subject matter (Shaharir & Zanuddin, 2018). Multimedia components including audio, images, and interactive simulations are added to the game, which heightens its immersive quality and offers a multisensory learning experience. Interactive games have been shown to be useful in the context of museums and galleries for increasing visitors engagement while promoting a deeper comprehension of the exhibits and historical contexts.

Visitors are inspired to explore and learn knowledge in a fun and self-directed way by making the visit into an interactive quest or adventure. As a result of the game's mechanics, visitors are more engaged for longer periods of time and retain more information. In educational and cultural environments, interactive games present a potentially fruitful way to increase visitor engagement and foster successful learning outcomes. These immersive experiences have the potential to attract and educate visitors in ways that conventional approaches frequently find challenging by utilising the power of technology and gaming dynamics.

The World Fuzhou Heritage Gallery, Sibü

The World Fuzhou Heritage Gallery is a museum in the Malaysian town of Sibü, Sarawak (Figure 1). It was dedicated to the history and culture of the Foochow people, an important ethnic minority in China, which was opened in 2009. The gallery is the first gallery dedicated to the preservation and dissemination of Fuzhou culture within the overseas Chinese community. This study focuses on the migratory patterns of the Fuzhou clan to the region of Sibü, as well as the customary lifestyle of the Fuzhou community in Sibü (Hsu, 2012). Over 600 exhibits, including artefacts, photographs, and papers, recount the narrative of the Foochows from their origins in China to their arrival in Sarawak and their subsequent contributions to the state's growth. The main goal of this study is to increase the proportion of younger visitors to the Foochow Gallery.

The researchers suggest using technology as a creative tool to engage tourists and enlighten them of historical knowledge through interactive games in order to accomplish this. Visitors can enjoy learning about the gallery's history by including interactive activities in the experience. With the application of modern innovations such as this interactive game, both residents of the Sibü region and tourists from other areas will be attracted to this gallery. According to Lau V. (2022), the local gallery



Figure 1: World Fuzhou Heritage Gallery, Sibü

becomes a popular tourist destination, allowing visitors an opportunity to gain knowledge about the historical background of Sibul, as well as the larger historical context of Sarawak.

Literature Review

Digitisation in Museum

The introduction of digital technology in museum settings has marked the commencement of the modern period, leading to a significant transformation in the methods employed for the preservation and exhibition of cultural artefacts. The phenomenon of digitisation in museums represents a significant shift in strategy, providing innovative methods for engaging audiences and enhancing accessibility beyond geographical limitations. Numerous chances to improve productivity, engage new audiences, and enable creative presentation formats are presented by digitisation in museums (Doro, 2023). Museums worldwide employ various technologies such as virtual reality, augmented reality, interactive displays, and online databases to provide visitors with captivating digital encounters. Several museums have augmented their physical spaces by incorporating digital technologies.

For instance, a collaboration has been established between the Louvre museum in Paris and Nintendo 3DS to provide an audio guide specifically designed for museum visitors. In addition, Nintendo's 3Ds technology provides users with the ability to access interactive maps, animations, and 3D pictures, enabling them to precisely determine their position within the museum.

Nintendo utilised its expertise to develop inclusive games that cater to individuals of all ages and genders, with the objective of enhancing the visiting experience at the Louvre museum by providing more avenues to engage with the exhibits (Iwata, 2012). Digital experiences are entering a transformation era driven by smartphones and Augmented Reality (AR) technologies. These devices serve as powerful conduits for AR applications, fully integrating

the virtual and actual worlds to present users with enhanced, interactive experiences. The Smithsonian mobile application has introduced AR application named "Smithsonian that Way" with the aim of facilitating tourists in locating the most convenient path to the museum (Bugbee, 2016). The National Gallery in London has recently implemented AR application known as "Smartify" with the intent of displaying the effects of simulation on the actual displayed artworks.

Furthermore, this application presents comprehensive information through the activation of voice reading (Chen Y., 2023). Designed specifically for the Science museum's breathtaking atmosphere interactive gallery, this ground-breaking AR project invites viewers to investigate the components and influences of the Earth's carbon cycle. The player can directly manipulate a visually appealing and active carbon cycle on the screen by interacting with several augmented reality blocks, each representing a different component of the cycle (Styx, 2022).

Museum digitisation has brought about a revolutionary change in how visitors interact with historical and cultural artefacts. By integrating digital technologies, museums can enhance the visitor experience in many different ways. Interactive displays, virtual reality exhibits, and augmented reality applications provide immersive and informative experiences, allowing visitors to delve deeper into the context and value of stuff. It is obvious that digitisation will play an increasingly essential role in museums, making them more accessible and appealing to a wider audience (Doro, 2023).

Interactive Game

Interactive games provide an opportunity for visitors to gain knowledge about history and exhibits through the use of technology, hence, facilitating learning through active participation and engagement. The introduction of the term "interactive game" refers to a dynamic and engaging form of entertainment where players actively participate and make choices,

influencing the unfolding narrative or gameplay. A digital game is an interactive rule-governed system that is powered by computer processing power. “Interactivity” means that the game requires a constant exchange of messages between the game and its participant (Tan & Jansz, 2008).

Interactive games are a dynamic and immersive kind of entertainment, including a wide diversity of digital and analog experiences that actively include people in the unfolding narrative or gameplay. These games demand direct input and decision-making from players, whether through video games, tabletop simulations, or augmented reality experiences, generating a sense of agency and participation. The interactive aspect of these games not only entertains but also serves as a great instrument for education, training, and social interaction. Players overcome challenges, solve puzzles, make meaningful choices, change the path of the game, and often work with others in online situations.

With this study, the researchers concentrated more on young people visiting the gallery. Researchers developed interactive games to persuade young people to visit and learn about the artefacts in the gallery. It also encourages individuals, especially youngsters, to visit the gallery or museum. From the perspective of the learners, using a game for learning can mean a variety of things such as learning while having fun, taking on a challenge and achieving higher scores, trying out different roles, being able to experiment and see what happens, being able to express feelings and reflect on a particular conflict situation, and others (Pivec, 2007).

The Swedish National Museum of Technology hosted an interactive museum exhibition or game called “The Quest”. The exhibition draws inspiration from technology and game-design strategies utilised in escape rooms. Its objective is to adapt this format for museums and science centre, with the purpose of fostering an expanded and immersive interaction as well as generating more engagement in the exhibition (Back *et al.*, 2019).

The MacKenzie Art Gallery opened a new exhibition that featured a selection of artwork displayed as an interactive video game. The installation is completely digital, allowing visitors to explore it from their desktop computers at home. The exhibition titled “There is No Centre” integrates the immersive elements of a first-person video game with the traditional approach of walking around an art display, like a virtual gallery (Kurz, 2023). The main aim of the museum’s management is to achieve the three-fold goals of education, entertainment, and enrichment, also referred to as the 3E approach. Education provides a conceptual framework for visits while entertainment serves to increase the motivation for investigation.

The major objective of holistic operation is to enhance the museum experience by enhancing it (Chang, 2020). Games are incredible educational resources. From a young age, individuals are made aware of this, whether by learning to clean up after themselves or by memorizing multiplication tables. The remarkable aspect of games, however, is that they are not only intended for children, but they may function as highly effective educational tools in a museum exhibition, attracting both adults and children (Styx, 2022).

According to the Science Museum, “games should have a purpose but also be fun”. Educational games are created to impart knowledge in an engaging manner, often without the player’s conscious awareness of the learning process (Patten, 2022). The integration of physical components in digital games is becoming more prevalent. According to Patten (2022), digital games have evolved to have physical components, hence the future of museum games changing towards blended experience.

In the Borneo Cultural Museum, level two features the Children’s Gallery and an Arts and Crafts section, with multiple sections where kids of all ages can be entertained with varied activities. This floor is full of sensory booths that offer a cutting-edge, interactive learning environment that will keep children busy for

hours on end (Kee, 2022). Escape game is also one of the gallery's interactive games suitable for learning. The main purpose is to empower students' knowledge in a more attractive setting. Other goals include encouraging students to improve their intuition and solving innovative challenges in a short period of time. Interactive games respond to these goals while gaining the added value of using the games for educational purposes (Guigon *et al.*, 2018).

In the context of a museum, an escape game provides a creative and immersive learning experience that combines entertainment and teaching. Escape games in museums engage visitors in a dynamic and engaging way, altering the typical learning environment. Participants, often organised in groups, walk through themed locations within the museum, solving riddles, and discovering historical or scientific facts. This hands-on approach not only improves critical thinking and problem-solving abilities but also deepens participants' understanding of the subject matter.

The escape game format provides an alternative way for museums or gallery to impart knowledge and promote active learning, enabling visitors to investigate exhibits in a collaborative and intellectually interesting manner. Museum-based escape games provide a memorable and engaging way for consumers to absorb and remember knowledge while enjoying an innovative and interactive museum experience by seamlessly blending entertainment with educational content.

Visitor Experience on Digitised Gallery

The gallery employs an innovative strategy by integrating art, technology, and interpretation in order to attract visitors' curiosity and encourage them to delve into the museum's permanent collection. As of today, Gallery One stands as the only non-science gallery that predominantly concentrates its efforts on applying cutting-edge technology to improve the visiting experience with a special emphasis on stimulating participation, curiosity, and creativity.

The application of digital technology within museum settings has predominantly revolved around the implementation of linear curatorial interpretation. However, there has been an apparent absence of motivation for visitors to generate their own content (Ross, 2016). Museums are commonly examined through an understanding of the concept of "sense of place", which refers to the emotional and cognitive connection individuals experience towards a specific geographic location due to their familiarity with it. The consumption of museum services entails the appreciation of value from imaginative, emotive, and emotional viewpoints.

Therefore, museum visits can be thought of as a voyage of heritage experience; this sort of consumption can be considered as offering "experiential" products that facilitate sentiments, emotions, and knowledge for visitors (Elgammal *et al.*, 2020). A truly remarkable museum experience is distinguished by a sense of amazement, discovery, and the enrichment of knowledge, leaving visitors with a renewed appreciation for the extensive tapestry of human history and creativity.

An operational definition of a memorable tourism experience is one that is pleasantly recalled and remembered after the event has taken place (Elgammal *et al.*, 2020). Audio guides, computer interactive, multi-layered text labels, and specially trained mediators are assisting in making the museum experience more worthwhile for visitors by connecting the visitor experience with the collection displayed and initiating communication between the visitor and the object (Ahmad, 2015). As museums evolved, technologies like interactive computer, audio tours, multi-layered text labels, and specially trained mediators play a critical role in improving the entire visitor experience.

These technical and instructional aids serve as bridges between the items or exhibits and the viewer, improving the understanding of cultural and historical settings. Visitors can gain more knowledge of the provided goods with the help of audio guides, which offer personal narratives.

Computers interactives add a dynamic and participatory dimension, allowing for a hands-on study of concepts or historical timelines. Multi-layered text labels accommodate a range of methods of learning by providing detailed information for those looking for a more thorough understanding or brief details for those looking for rapid insights. Eligible mediators offer a human touch, fostering discourse and answering questions, creating a more customised and engaging contact. When combined, these resources create a web of connections that enhances the educational value of the museum visit while also leaving a lasting emotional impression on all guests.

Implementing gamification is an effective method for any organisation to instruct and captivate its target demographic. Organisations that are currently engaged in the process of generating ideas for interactive games to deliver to their patrons or website users, Patten offers the following guidance (Styx, 2022). The first element is active involvement with the exhibitions or displays. The second aspect is the acquisition of knowledge or learning derived from comprehending new information and findings. The third factor is the visitors' sense of connection with the exhibitions' settings and contents, the final factor is the significance of their interactions with the exhibits, other visitors, and the displays themselves.

These four components are interconnected in assessing the visitor's museum experience (Othman, 2021). Extending beyond the boundaries of the traditional classroom, museum visits are fascinating, immersive experiences. By stepping out of the classroom and into the curated environment of a museum, individuals can broaden their perspectives, establish connections between different concepts, and build a lifelong enthusiasm for learning that extends far beyond the classroom. Informal learning, which is generally defined as learning that takes place outside of classrooms in places like museums, is distinct from formal education (Altintas & Yenigül, 2020).

Children's curiosity is excited by the fascinating artefacts, engrossing artworks, and engaging interactive displays, which encourage them to think critically, ask questions, and discover connections. Museums often offer hands-on activities and workshops that allow children to relate with art, science, history, and culture in engaging and dynamic ways (Gregoriou, 2023). When children are exposed to the intriguing world of fascinating artefacts, riveting artworks, and engaging interactive displays, their curiosity is sparked and developed. These different features serve as windows into history, culture, and creativity, creating a feeling of wonder and discovery in young minds.

Whether it is a museum loaded with ancient treasures, a gallery showing bright paintings, or a hands-on scientific demonstration, the combination of visual appeal and interactive activities produces a dynamic learning environment. The appeal of finding the unknown, along with the physical and visually stimulating components of these displays, makes children eager to explore, ask questions, and delve further into the huge tapestry of human knowledge. Children's curiosity is not only satisfied but fueled, generating a love for learning and an insatiable desire for knowledge.

Enhancing Visitor to Museum

The use of interactive games within gallery spaces has become a prominent method in the modern cultural environment to augment visitor engagement and enhance the overall museum experience. The objective of this study article is to examine the many tactics employed to enhance the attractiveness and influence of interactive games within gallery environments. The study seeks to explore the interaction of game design, educational objectives, and user experience in order to discover new methods for engaging and maintaining visitor interest. This study aims to investigate the efficacy of utilising advanced technologies, specifically augmented reality and virtual reality, in combination with strategic game mechanics and educational

content to explore strategies for engaging diverse audiences in interactive gaming installations within gallery settings.

This article aims to provide valuable insights into the dynamics of player interaction and the integration of art and technology. Its objective is to inform the development and curation of interactive gaming exhibits, with the aim of fostering a more in-depth and meaningful connection between visitors and the cultural artefacts or themes presented in the gallery space.

Applying digital technology to visit and explore museums is certain to enhance visitors' museum experience. Visitors have the opportunity to fully immerse themselves and actively participate throughout their visit while also being able to access further information on artefacts through the use of digital technologies (Shah & Ghazali, 2018). In order to optimise the visiting experience, particularly for the millennial demographic, it is advisable for the

museum to promote active engagement through the utilisation of smartphones and tablets while also ensuring that the museum's design meets educational objectives (Ferra & Sapia, 2013).

Research Methodology

The research methodology to study interactive games in a gallery setting applies a comprehensive approach to fully comprehend the interactions among visitors, artworks, and interactive gaming experience. Firstly, comprehensive literature research is carried out to gain a deep understanding of the current theories and practices concerning interactive games in cultural venues. The methodologies such as quantitative, testing, and focus group discussions to collect valuable perspectives from both gallery visitors are shown in Figure 2. The quantitative data collection involved using questionnaires and monitoring user interactions to measure the effect of interactive games on engagement and learning.

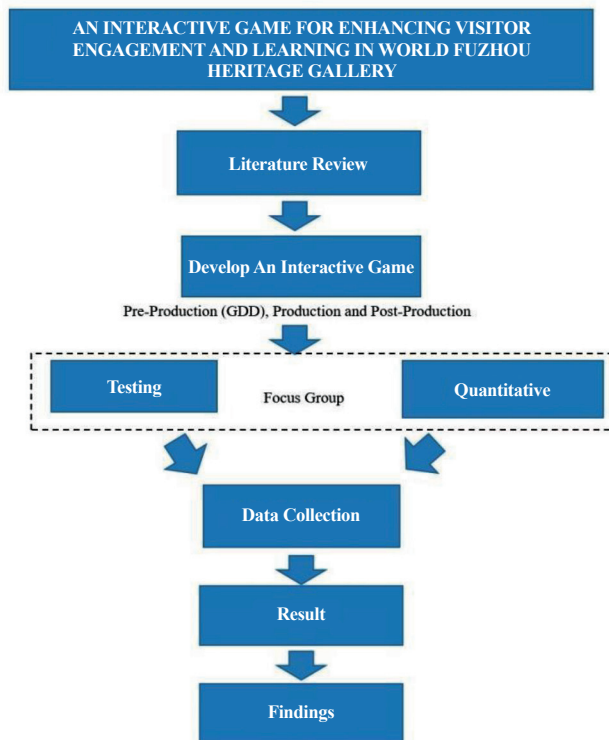


Figure 2: Research methodology

Furthermore, the study includes a thorough examination of several interactive game designs in order to determine the most effective strategies and possible areas for enhancement. This study seeks to gain a comprehensive understanding of how interactive games may enhance the gallery experience and create a stronger connection between audiences and artworks. Mixed-methods approach was used to achieve this goal.

Focus Group

The focus of this study is to enhance visitor engagement at the gallery through the integration of interactive games. This research was conducted at the World Fuzhou Heritage Gallery located in Sibiu. The researchers have chosen a sample of participants consisting of teens between the ages of 12 and 20. The study integrates interactive games to facilitate the examination of gallery displays. During data collection, focus group discussions are applied to this study. A focus group typically consists of six to 12 individuals, led by an interviewer or moderator who poses questions related to a specific topic (Smithson, 2007). In this study, the researchers formed two distinct focus groups, each comprising a total of seven participants. In order to facilitate effective management, researchers often choose to work with small sample sizes. A focus group is a qualitative research technique that entails a limited number of persons with varied backgrounds engaging in a directed discussion facilitated by a moderator.

This approach is extensively employed in several domains, especially product development to collect valuable perspectives and viewpoints on a certain subject. The moderator's involvement should diminish as participants engage in sharing experiences, debating ideas, and expressing opinions (Kruger & Casey, 2002). The participants were instructed by the researchers to engage in testing the interactive game. The participants engage in the testing and exploration of the various artefacts discovered within the interactive game. During the game testing phase, the researchers conducted direct interaction with the players, asking for their input and opinions.

Quantitative Method

This research also uses quantitative methods to achieve the objectives of the study. The application of a quantitative methodology is particularly advantageous in constructing a social-demographic profile of an audience, enabling the exploration of relevant questions related to the identity of virtual visitors, their geographical origins, and the specific population segments they represent (Grincheva, 2018). The use of a quantitative approach for surveying interactive games in a gallery context entails the utilisation of structured questionnaires and the analysis of numerical data to provide valuable insights into visitor preferences and experiences.

The main aim of this study is to methodically assess and quantify many factors, including the degree of involvement, favoured interactive components, and the overall influence of these games on the gallery visitation. The results obtained from this methodology offer an evidence-based comprehension of the efficacy of interactive games in art galleries, hence, influencing choices pertaining to the design, curation, and techniques for engaging visitors. This approach facilitates a methodical examination of the numerical aspects of the visitor's engagement with interactive games in galleries, offering useful perspectives to improve the overall cultural and recreational encounter.

Quantitative data points to the social strength and power of museums or galleries as social institutions that are capable of attracting local and international audiences. However, this dataset does not adequately assess the attributes of online visitors' experiences, including their motives, interests, and values (Grincheva, 2018). Certain groups attain this stage rapidly, while others never achieve it. The use of quantitative methodologies aims to elicit comments regarding the interactive features inside the game as well as insights regarding the user experience. Prior to answering the survey questions, participants were asked to play several games. Along with these quantitative strategies, qualitative techniques were also

used to obtain feedback in order to improve the game's overall quality.

Sampling

This sampling is specifically targeted towards individuals in the age range of 12 to 20 years, who belong to the younger generation. According to the National Statistics Museums UK Government (2020), in the year 2019 and 2020, the most common age groups to visit a museum or gallery were between 25 years old and 74 years old (54%-55%) whilst 45% of those aged 16 to 24 years visited at least once in the last 12 months. These age groups were significantly more likely to visit than those aged 75 and older (36%). This data indicates that, in comparison to the adult age group, teenagers are among the age groups who visit museums less frequently.

During data collection process by means of focus group discussion in this study, the participants were divided into two different groups. There were seven members in each focus group. The participants were given instructions on how to engage with the interactive game first before responding to the survey questions. Through interactive games, these players had the opportunity to look into the items in the museum's exhibit. Participants must give accurate answers to the questions when the avatar is positioned in front of the exhibit in this interactive game.

The question relates to the purpose or designation of the artefact. If the response provided was accurate, the participant could proceed with the subsequent investigation of other artefacts. In the event that the response was incorrect, the game's system would provide a warning identifying an incorrect answer and allow extra options to correct the answer. In the case that all the answers provided were incorrect, the participant was required to continue the game until they reached a level where all answers were accurate. With that, the avatar would successfully escape from the exhibit. After that, participants were expected to respond to the survey provided.

Testing the Interactive Game

Throughout the area of game development, the testing phase plays a crucial role in ensuring the smooth integration of diverse components and the delivery of an optimal gaming experience. The process of comprehensive game testing involves an integrated methodology that encompasses a wide range of tests, including core functional testing and intricate performance evaluations. For instance, the feasibility testing of the computer-based game prototype in Indonesia was conducted using a one-group pre- and post-test design (Wiguna, 2021). Functional testing is a critical evaluation process that analyses the mechanics, controls, and general functionality of a game, with the aim of verifying its alignment with the desired design and user experience. In contrast, performance testing tests the responsiveness of the game in several scenarios, including stress tests and assessments of scalability, in order to ensure reliable performance across a range of hardware setups and network situations.

Compatibility testing, on the other hand encompasses the complex interaction between the game and various platforms, guaranteeing consistent and error-free user experience for users. An interactive game created for a gallery must undergo a thorough review process in order to determine its functionality, usability, and overall effectiveness in providing visitors with an enjoyable and informative experience. Functional testing is done to ensure that all game mechanics, features, and interactions work as intended.

Special emphasis is placed on testing the responsiveness and fluidity of controls, user interface elements, and interactive elements. In order to ensure alignment with the gallery's exhibits and educational goals, the content review focuses on evaluating the game's material's correctness, relevance, and educational value. Additionally, testers assess how well the game engages players and efficiently communicates the required instructional objectives.

Interactive Game Design Process

The literature review functions as a fundamental source for the creation of an interactive game, providing a thorough investigation of current information and research related to game design, user engagement, and interactive technologies. Through the analysis of scholarly articles, academic papers, and industry reports, developers acquire valuable knowledge regarding successful game mechanics, narrative frameworks, and user experience concepts. The literature review meets the purpose of not only establishing the historical background of interactive games but also identifying gaps and areas that require innovative solutions. The availability of information enhances the development of design strategies, enabling developers to comprehend the preferences and expectations of their intended audience. Additionally, referencing the literature research guarantees that the interactive game complies with accepted ideas and industry standards.

Preproduction

The researchers developed strategies for concept development, drafted a thorough Game Design Document (GDD), produced the concept art, and the precisely outlined the technical elements essential to the game design process during the early phase. The first step in the process of creating a game idea and developing digital games is the creation of a Game Design Document (GDD). The Game Design Document (GDD) should provide a comprehensive description of all aspects of the game, ranging from the narrative structure to the detailed technological specifications (Raulino & Burlamaqui, 2019).

To guarantee the best possible compatibility with the targeted target group, the researchers skillfully selected the most suitable game genre, gaming mechanics, and setting during the concept creation process. Additionally, the researchers carefully chose particular artefacts from the collection with the goal of creating immersive 3D models out of them, thereby enhancing

the content of the interactive game. The main purpose of a Game Design Document (GDD) is to optimise communication among teams. This document should encompass all aspects and the details of the game being developed, ensuring a comprehensive and cohesive project overview. Additionally, it serves as a storage for all planning documentation, allowing easy access and reference at any given time (Raulino & Burlamaqui, 2019).

The Game Design Document (GDD) serves as a comprehensive and detailed document that provides a thorough delineation of diverse facets inherent to a game, encompassing game mechanics, narrative elements, character development, level design, artistic representation, and auditory components. This meticulously crafted GDD functions as an invaluable guidepost for the development team, furnishing them with a clear roadmap for the game's creation and implementation. Establishing the game's art direction is given careful consideration throughout the preproduction stage. This crucial task includes the formulation of the game's general aesthetic, identification of a unifying visual style, and the creation of concept art, character designs, and environmental elements as shown in Figure 3. It is noteworthy that the researchers have included components with roots in Chinese culture, which are evident in areas like interface design and 3D assets. In order to create the right tone and atmosphere within the game, the art direction is crucial.

After that, when designing the environment and including game features, the researchers followed a similar conceptual framework. The technical planning phase is when the development team conducts a thorough evaluation of the platforms, tools, and technologies required to bring the game to life. In this context, researchers have used the software Unity as the main tool for creating this interactive game while Blender is used to create artefacts in the form of 3D asset shapes and environmental components. While



Figure 3: Exhibition environment in interactive games

creating a plan for the game's architecture, the researchers diligently detected and handled technical difficulties.

Production

Integrating creative components by creating visual assets such as the detailed 3D modelling of artefacts, characters, environment design, and animations, is an important part of the production phase. The designers have efficiently created elaborate 3D models that were inspired by the artefacts on display in the exhibition environment. Programming and gameplay implementation cover the essential function that programmers and developers play in creating the basic code that forms the game's framework. This complex procedure entails the thorough integration of gaming mechanics, controls, physics systems, networking functions, and several other technical elements necessary for the best possible gameplay experience.

Post Production

The phase of the game creation process that takes place after the initial development and production stages are finished is called post production in the game design field. It entails refining, finishing, and getting the game ready

for distribution to the test. The User Interface (UI) and User Experience (UX) design must be carefully examined and improved during the post-production process with the goal of boosting usability, clarity, and accessibility, which is shown in Figure 4. The main goal is to create a user-friendly, visually appealing interface that enhances navigation, and enables smooth player engagement.

Results

The process of data analysis from surveys and focus groups conducted through interactive games at a gallery involved several important elements. Initially, raw data were collected through well-designed surveys and interactive focus group sessions, collecting participants' responses and thoughts into their experiences with the gallery's interactive activities. This dual-method approach enables full understanding of audience perceptions, preferences, and complaints connected to the interactive game within the gallery. The data produced from this method can assist decision-making processes for gallery curators, aiding in the advancement of the overall visitor experience and the refinement of interactive exhibitions.

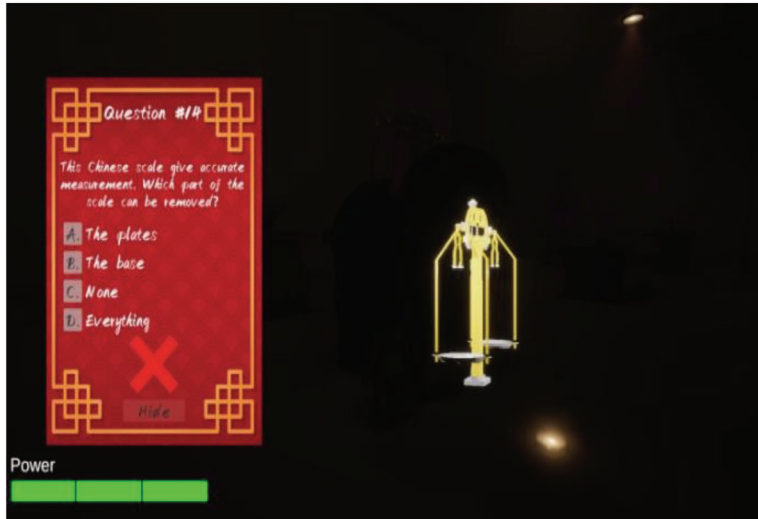


Figure 4: The User Interface (UI) in the interactive game

Table 1: Demographic of respondents

Profile	Frequency (N)	Percentage (%)
Age group (years)		
12-13	2	14
14-15	4	28.6
16-17	3	21.4
18-19	4	28.6
20	1	7.6
Total	14	
Gender		
Male	7	50
Female	7	50
Total	14	

Table 1 shows the demographics of the participants who participated in the focus group and answered the survey form. There are two participants within the age range of 12 to 13 years and four participants within the age range of 14 to 15 years. Three of the respondents are within the age range of 16 to 17 years while an additional four respondents fall within the age group of 18 to 19 years. One participant in the study is 20 years old. The sample consists of seven male respondents and seven female respondents. The sample size for this study

consisted of 14 participants, divided into two groups, who participated in focus group sessions and were subsequently evaluated on the interactive game.

The survey’s findings showed that, although the remaining 50% of participants said they had not visited the gallery, 50% of respondents had visited the World Fuzhou Heritage Gallery as illustrated in Figure 5. The survey data revealed that a significant majority of respondents, comprising 92.9% of the participants, expressed their acknowledgment that the incorporation of game elements such as interactive games, within the gallery setting facilitates visitors in comprehending and recognising the exhibited content.

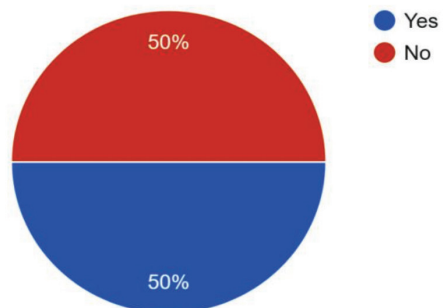


Figure 5: Respondents who visited World Fuzhou Heritage Gallery

In the question whether interactive games help visitors to understand the gallery content, a minor proportion of 7.1% of respondents disagreed with this notion as shown in Figure 6. Apart from that, according to the research’s findings, an impressive 92.9% of participants agreed that including interactive games can motivate visitors by attracting their interest and fostering a desire to participate actively in the exhibition on display in the gallery environment.

The results of the survey clearly demonstrated an unanimity of opinion, as 100% of the participants, or all respondents, stated that the use of interactive displays and technology is essential for creating an immersive and enjoyable environment for visitors to experience within the context of a gallery as shown in Figure 7. Interactive gaming interface design in galleries plays a key role in promoting

visitor engagement, education, and enjoyment. Gallery may produce more powerful and lasting interactive experiences by solving current issues with user-centered strategy, streamlined UI, uniform visual language, personalisation, and multimodal engagement. The interface design of interactive games in museum galleries can be continually improved with additional study and evaluation, which will ultimately improve the overall gallery visitation experience.

Findings

The incorporation of game elements has become a significant factor in defining visitor engagement and interaction within the always changing gallery setting. The results obtained from an extensive survey investigating the effects of gaming elements in gallery provide valuable insights into the diverse ways in which interactive activities structure the overall visitor experience. One interesting result relates to the significant contribution of gaming elements to helping visitor understanding and retention of gallery information.

The participants repeatedly expressed that interactive games were effective in their role as teaching tools, facilitating their comprehension and retention of intricate historical and artistic knowledge. The integration of gamification in gallery content has demonstrated itself as an interesting and effective approach in converting potentially complicated or demanding subject matter into a readily accessible and enjoyable educational experience.

The integration of digital technology in galleries has significantly enhanced the influence of gamification, transforming conventional exhibits into dynamic and interactive environments. The respondents of the survey emphasised that the incorporation of gaming elements in digitised galleries not only generated a greater sense of curiosity towards the exhibits but also stimulated their exploration with more passion. The interactive aspect of these games fostered a sense of agency, enabling visitors to actively engage in the process of learning.

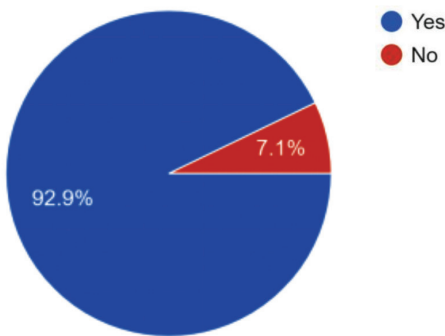


Figure 6: Interactive games help visitors to understand the gallery content

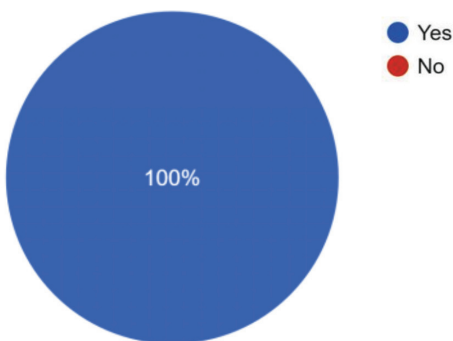


Figure 7: The digitised gallery integrates technology and interactivity to offer visitors immersive experience during their visit to the gallery

The transition from passive observation to active engagement was significantly more prominent among younger audiences, indicating that the incorporation of gaming components has considerable potential in fostering intergenerational connections in gallery participation. The integration of educational information with play in the digitalised environment has resulted in a transformative and engaging experience during gallery visits. In addition to examining individual engagement, the survey provided insights into the social aspect of gallery visits, revealing that game experiences serve as drivers for heightened interaction among visitors. The participatory aspect of the activities not only served to improve the individual experiences of visitors but also offered possibilities for socialisation within the limits of the gallery environment.

The participants in the study mentioned that the inclusion of collaborative activities or games that promoted friendly competition resulted in the initiation of talks among individuals who were previously unfamiliar with one another. This contributed to the development of a sense of community inside the confines of the gallery. The integration of interactive gaming in the social context introduces an additional dimension to the gallery visit, transforming cultural institutions from mere storage facilities of knowledge into dynamic environments that foster communal interaction and facilitate shared experiences. The survey findings emphasised the major subject of integrating technology and interactive displays, the significance of innovation in the development of immersive and engaging museum experiences.

The participants conveyed their appreciation that the gallery adopted technological advancements such as interactive exhibits, Virtual Reality (VR), and Augmented Reality (AR), in order to enrich the entire gallery experience. The utilisation of technology was perceived as a strategy to connect the disparity between historical artefacts and the modern-day visitor, resulting in a dynamic and individualised exploration of time and culture. Galleries

that offer digitalised experience, incorporate advanced technology and interactive exhibits, have been regarded as more captivating and appropriate, mirroring an increasing societal trend of embracing progress in the digital domain.

The findings of the survey also showed that the use of technology and gaming elements resulted in engaging and enjoyable experiences that not only attracted visitors but also enhanced their comprehension and admiration of the subject matter. Instead of regarding technology as insignificant, participants recognised its capacity as an important instrument for situating and clarifying intricate narratives. The inclusion of interactive elements enhanced the visitor's engagement with the content, reducing obstacles to understanding and promoting a lasting appreciation for the historical and cultural importance of the exhibitions.

The results of the survey highlighted the significant influence of game elements within gallery settings, particularly in the context of digitalised environments. Interactive games have become essential elements of the contemporary gallery experience, serving various purposes such as enhancing comprehension and retention of knowledge, fostering curiosity, motivation, and facilitating socialisation. The integration of technology in gallery not only enhances the immersive and entertaining aspects of visits, but also acts as a means to connect tradition with innovation.

Recommendation

The integration of interactive games and digitisation methods into gallery experiences offers a transformation strategy for enhancing visitor engagement across all age groups, using the power of technology to create dynamic, instructive, and immersive environments. Gallery can use interactive games that combine entertainment and learning to appeal to a wide range of demographics while providing a unique and fascinating approach to teaching. Leveraging digital technology such as Augmented Reality (AR) or Virtual Reality (VR) may provide

visitors with an entirely new perspective, allowing them to interact with exhibits in ways that break traditional limits, especially for local people who want to visit the World Fuzhou Heritage Gallery in Sibiu.

Implementing interactive games that adapt to different age groups is one of the most important recommendation. For younger visitors, educational games can be devised to convey basic concepts in a playful and participatory manner, developing early interest in history, science, or art. These games may contain storytelling themes, attractive visuals, and simple obstacles to make learning both interesting and informative. For senior citizen age groups, more complicated games can be designed, diving into detailed aspects of historical events, scientific occurrences, or creative movements. Such interactive experiences not only take the attention of visitors but also allow an improved understanding of the subject matter through active participation.

Implementation of the digitisation gallery through the production of virtual gallery experiences is another recommendation. By embracing technology, galleries may extend their reach beyond physical limits, reaching worldwide audiences and enabling virtual access to exhibits. Virtual gallery tours, which can be made available through websites or dedicated applications, allow individuals to explore collections from the comfort of their homes. This technique is particularly advantageous for those who may suffer geographical constraints, health difficulties, or time restraints.

On top of that, adding 3D models, interactive maps, and detailed multimedia content may reproduce the gallery's experience in a digital format, delivering a rich and educational encounter that transcends standard static displays. Galleries can implement technology-based programme that appeal to visitors with varied levels of technological knowledge for a genuinely inclusive approach. Incorporating user-friendly interfaces, clear directions, and on-site support may ensure that visitors of all ages and backgrounds can comfortably engage

with interactive games and digital displays. Additionally, providing accessible resources such as video tutorials or e-guides helps visitors to go through the technological components easily, generating an effective and inclusive experience for everyone.

To enhance visitor engagement with modern technologies, museums might embrace the gamification of exhibits, turning standard displays into interactive challenges. For instance, visitors could use augmented reality applications to discover hidden information or solve challenges relating to specific items in question. Gamified aspects not only give an element of excitement but also stimulate frequent visits as players try to meet various challenges. This approach encourages immersive learning and actively incorporates visitors in the discovery the cultural and historical of Foochow in Sibiu.

To ensure the success of these projects, museums should aggressively solicit input from visitors, employing questionnaires, focus groups, or Internet platforms to analyse the impact of interactive games and digital experiences. Continuous development based on user input ensures that the technology-enhanced elements correspond with the expectations and preferences of the broad audience. This iterative strategy also allows museums to be alert of changing technologies, enabling them to adapt and incorporate the latest innovations into their offerings.

The strategic integration of interactive games and digitisation approaches offers gallery an effective way to enhance visitor engagement across all age groups. By embracing technology, gallery can offer dynamic, inclusive, and educational experiences that appeal to varied preferences and learning styles. From interactive games that merge enjoyment with learning to virtual gallery experiences that transcend physical limits, technology provides a gateway to a more immersive and accessible cultural discovery. As galleries adopt these revolutionary ideas, they not only adapt to the digital age but also build a deeper and more meaningful connection with their audiences.

Conclusions

In conclusion, as one considers the present condition of interactive games inside gallery settings and their consequential effects on the experience of visitors, it becomes apparent that there is plenty of potential for additional investigation and development in the future. Future research in this field should aim to explore deeper dimensions of interactive gaming, examining the particular components that generate the strongest response from a wide range of audiences.

For instance, from young audiences to adult audiences, it is important to develop a comprehensive understanding of the psychological, behavioral, and educational consequences associated with various gaming mechanics. Their distinct impacts on individuals of different age groups, cultural backgrounds, and learning styles can yield valuable insights for enhancing interactive experiences. In addition, doing research on the enduring effects of these interactive interventions on visitors' knowledge retention and cultural involvement would make a substantial contribution to the academic conversation. The critical aspect of integrating research findings into gallery settings is of greatest significance in order to effectively bridge the divide between theoretical knowledge and practical application.

By integrating data-driven insights into the design and interactive exhibitions, galleries have the ability to modify experiences in order to better align with the tastes and learning requirements of their varied audiences. The feasibility and usefulness of interactive games in galleries should be further enhanced through collaborations with game developers, educational psychologists, and technological specialists. The collaborative method is consistent with the current trend of multidisciplinary efforts within the cultural sector, promoting an integrated connection between technology, education, and the arts.

Furthermore, the incorporation of feedback loops and adaptive technology has the potential to enable interactive exhibitions to dynamically

evolve in real-time, taking into account user participation and preferences. This would result in a personalised and dynamic experience for each visitor. The potential of interactive games in galleries for enhancing cultural and educational experiences, as well as influencing the future of museum interaction in an era characterised by technological advances and interactivity is substantial. The opportunities to create truly immersive, inclusive, and transformative cultural events appear endless as scholars and practitioners collaborate to navigate this unexplored place.

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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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