


Article

Implementation of a Gamification-Based Metaverse Exhibition: A Case Study of the Farewell Museum

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Abstract: The increasing adoption of metaverse exhibitions aims to overcome the limitations of traditional offline exhibitions by enhancing accessibility and creating imaginative spaces without temporal and spatial constraints. This study explores how incorporating gamification into metaverse exhibitions can leverage the strengths of online and offline experiences. By integrating metaverse elements and gamification, we designed an interactive metaverse space and evaluated its effectiveness through user feedback. Our findings indicate that guiding visitors to complete missions within the metaverse enhances their understanding of the offline exhibition narratives, thereby increasing their engagement with the exhibition themes. Furthermore, online experiences in the metaverse can stimulate interest in offline exhibitions, promoting visitor attendance. The metaverse space also encourages users to contribute personal stories to the exhibition content, fostering continuous content expansion. This approach strengthens the connection between online and offline exhibitions, increases visitor engagement, and promotes repeat visits, thereby addressing the limitations of traditional exhibitions. Additionally, metaverse exhibitions enhance the preservation and accessibility of cultural heritage through digital archiving, offering inclusive participation opportunities and promoting social sustainability. This study underscores the potential of metaverse exhibitions to evolve beyond technological innovation toward contributing to social sustainability.



Citation: Lee, J.; Bae, J.; Bae, Y.

Implementation of a Gamification-Based Metaverse Exhibition: A Case Study of the Farewell Museum. *Sustainability* **2024**, *16*, 6212. <https://doi.org/10.3390/su16146212>

Academic Editor: Darjan Karabašević

Received: 13 June 2024

Revised: 10 July 2024

Accepted: 18 July 2024

Published: 20 July 2024



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Keywords: metaverse; gamification; farewell museum; storytelling; sustainable exhibition

1. Introduction

Museums and art galleries are public spaces that provide knowledge and enjoyment to visitors through meaningful information and emotional exchanges. Utilizing physical spaces to display in-person exhibits grants visitors a unique, irreplaceable experience of directly interacting with artworks, a distinctive feature of offline exhibitions. Moreover, museums and galleries increasingly serve as community spaces that showcase exhibits, educate visitors about culture and art, and encourage various cultural activities [1]. The advancement of digital and information technology has enriched the environments of museums and galleries, enhancing their cultural and artistic spaces' diversity and professionalism [2]. Utilizing various technologies, museums, and cultural heritage sites enhance visitor engagement through dynamic and interactive formats. These technologies enable immersive and meaningful experiences, transforming how cultural heritage is interpreted and communicated [3].

However, despite these advantages, museums' and galleries' temporal and spatial limitations restrict access to exhibitions and how visitors can appreciate exhibits, diminishing their competitiveness against other cultural content and services. Prolonged social restrictions during the COVID-19 pandemic have exposed the vulnerabilities of in-person museum and gallery exhibitions, prompting a shift in exhibition approaches [4]. Since

the pandemic, to adapt to new changes, numerous museums around the world, including the National Museum of Natural History in France, the National Museum of Singapore, and the Art Gallery of Ontario in Toronto, have implemented augmented reality (AR) installations in various ways and introduced gaming elements to provide visitors with diverse exhibition experiences [5].

To overcome offline exhibitions' temporal and spatial limitations, virtual reality-based museum and gallery services have emerged, offering diverse and rich experiences in virtual online environments. This development allows visitors to enjoy exhibitions anytime, anywhere, providing a new method to experience art [6]. In the digital era, flow experience in VR-enhanced museum spaces acts as a mediating factor that forms the psychological basis of visitor engagement and leads to positive outcomes [7].

Integrating online and offline exhibitions in museums enhances visitor engagement and significantly contributes to the sustainability and dissemination of the museum experience [8].

The evolution of metaverse environments and related technologies have created metaverse exhibitions, offering immersive and interactive experiences in virtual spaces.

The integration of the metaverse with museums expands their roles and functions, transcending the limitations of time and space. Metaverse museums are open to the public and provide new digital experiences that are impossible to achieve in an offline setting. The new museum definition approved at the Extraordinary General Assembly of the International Council of Museums (ICOM) in Prague on 24 August 2022, emphasizes the role of museums as permanent, non-profit institutions serving society by researching, collecting, conserving, interpreting, and exhibiting tangible and intangible heritage [9]. This definition mandates that museums be open, accessible, and inclusive to the public. This vision can be further realized through integration with the metaverse, enabling museums to operate virtual exhibitions and interactive educational programs accessible from anywhere in the world. Furthermore, metaverse exhibitions extend beyond traditional offline and online displays, fostering the participation of diverse communities and enhancing the inclusivity and accessibility of museums.

However, challenges remain in ensuring continuous visitor engagement, repeat visits, and enhancing an understanding of exhibition themes in metaverse exhibitions.

This study introduces gamification to address these challenges and create metaverse exhibitions by incorporating elements of gameful experiences and the metaverse. The study evaluates whether such metaverse exhibitions can effectively enhance visitors' understanding of themes, encourage repeat visits, and increase interest in offline exhibitions, thereby strengthening the connection between online and offline exhibitions. The researchers analyzed several hypotheses through user evaluations to determine if the study achieved these goals.

2. Background

2.1. Characteristics of the Metaverse Exhibition Space

The commercialization of 5G technology and advancements in VR/AR technologies have enabled environments where social networking, content sharing, and knowledge exchange can occur in virtual spaces. They offer experiences that are as detailed or even more intricate than reality, sometimes providing otherwise impossible experiences [10]. Virtual exhibition spaces, which recreate real or lost locations using digital technology, allow visitors to appreciate exhibits without time and space constraints. Additionally, VR technology can offer intriguing content and services not possible in physical exhibition spaces, thus playing a new role distinct from traditional offline exhibitions [11].

These changes have led to the emergence of virtual museums as supplementary or alternative spaces to traditional museums, which possess physical facilities, professional staff, and collections [12]. A virtual museum exists in cyberspace and has borne various appellations—including Digital Museum, Electronic Museum, Online Museum, Hypermedia Museum, Web Museum, and Meta Museum—since its initial mention at

the first International Conference on Hypermedia and Interactivity in Museums (ICHIM) in 1991 [13]. The EU-sponsored ViMM (Virtual Multimodal Museum) project defines a virtual museum as a “digital entity that enhances or extends the physical museum through personalization, interactivity, user experience, and rich content” [14].

With the development of metaverse-related technologies, traditional virtual museums have evolved into metaverse exhibition spaces or been created from the ground up on metaverse platforms. The metaverse, defined as a convergence of “virtually enhanced physical reality” and “physically persistent virtual space”, is classified into types such as virtual worlds, augmented reality, mirror worlds, and lifelogging based on internal and external elements, and implementation space and information [15]. It offers 3D virtual worlds that transcend time and space constraints and provide a sense of realism similar to the physical world. As a result, the metaverse emerges in various fields, including education, marketing, entertainment, and industrial sites, and in cultural and artistic sectors, giving rise to Meta-Museums [16].

The Google Arts & Culture project, started in 2012, partners with over 2000 cultural institutions worldwide, offering a non-profit online platform that digitally reproduces existing exhibitions and incorporates VR/AR technology, big data, and AI curation to provide transcendent exhibition experiences, expanding visitors’ sensory experiences as a virtual museum [17]. The VOMA (Virtual Online Museum of Art), opened in September 2020, allows free viewing of artworks from prestigious cultural institutions worldwide, such as the Metropolitan Museum of Art in New York and the Art Institute of Chicago, as a 100% virtual reality museum without a physical offline space. It simulates actual museum visits by creating environments like entrances and exhibit halls with sound effects and weather conditions for immersive experiences. Moreover, it arranges exhibits to enhance viewing efficiency and enjoyment while offering additional services like opinion exchanges and souvenir purchases [18].

User satisfaction surveys for metaverse exhibition spaces reveal that presence, social interaction, and concurrency are vital to providing positive experiences [19]. Presence refers to the degree to which the virtual space elicits psychological responses similar to reality. Social interaction involves creating or strengthening social bonds with other users, and concurrency is the ease of collaboration among multiple simultaneous users. Designing metaverse museums to satisfy these features can transform them from mere exhibit showcases to new exhibition spaces that overcome temporal and spatial constraints, offering accessible and shared experiences at any time [20].

Developing metaverse museums further requires incorporating “Personalization” and “Sharing the contents” features. Allowing visitors to create and share personally meaningful content can enrich the overall content and spread the metaverse’s worldview. The true value of metaverse exhibitions lies not in merely replicating offline exhibits online but in providing new experiences unattainable in the physical world. Metaverses offer infinite spaces, countless objects, and imaginary events, allowing thousands of people to interact simultaneously. Thus, they foster unique shared experiences and promote new relationships, creating a “community of imagination” [21].

Meanwhile, Davis, Murphy, and Owens et al. (2009) identified five core elements that constitute the fundamental basis of the metaverse concept: (1) the metaverse itself, (2) people/avatars, (3) metaverse technology capabilities, (4) behaviors within the metaverse, and (5) outcomes of metaverse behaviors [22]. They argued that ongoing research and experimentation on these five elements are necessary to understand the emergent interactions and potential variability in results between human society and technology. When analyzing metaverse services based on these five elements, we can correlate them with (1) worldview, (2) avatars and characters, (3) implementation of functions such as UI/UX, (4) interactions and missions, and (5) reward systems and long-term sustainability, as well as interactions among users. Therefore, this study organizes the tasks for implementing the *Farewell Museum* in the metaverse based on these five perspectives, as Table 1 shows.

Table 1. Tasks to be implemented in the metaverse *Farewell Museum*.

Category	Description
The metaverse itself	Realization of a worldview that fits the theme
People/avatars	Implementation of appropriate avatars and characters
Metaverse technology capabilities	Implementation of functions that effectively express the theme, including UI/UX
Behaviors	Interactions and missions between visitors and between visitors and NPCs
Outcomes	Formation of community among visitors, reward systems, and long-term engagement and sustainability

2.2. Gameful Experience: The Themes and Overarching Categories

Despite the advantages of metaverse exhibitions, there are limitations in conveying a clear worldview and narrative to online visitors, particularly when the exhibition content privileges these elements rather than the exhibits themselves. Additionally, it is challenging to leverage the metaverse's personalization and sharing features if the exhibition merely replicates an offline exhibition's worldview and narrative. To overcome these limitations, one can introduce gamification elements into the exhibition viewing method within the metaverse space, allowing visitors to perceive the themes or messages more clearly and engagingly through mission-based activities. For these reasons, exhibition planners sometimes incorporate gamification into metaverse exhibitions [23].

The concept of gamification originated from games but has further developed in other fields, such as information systems and psychology. These developments are reflected in its definitions as the "use of game design elements in non-game contexts" [24] and as "a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation" [25]. The emphasis in gamification is on the gameful experience. It denotes a psychological state resulting from the interaction of three psychological characteristics: The perception of presented goals as non-trivial and achievable, the motivation to pursue those goals under arbitrary, externally imposed constraints, and the belief that their actions within these constraints are volitional [26].

For these reasons, considering a gameful experience benefits offline and online exhibitions, particularly those utilizing metaverse platforms emphasizing user experience and interaction. Therefore, it is meaningful to plan and construct the metaverse *Farewell Museum* on a metaverse platform to maximize the effectiveness of the offline *Farewell Museum* exhibition and overcome offline exhibitions' limitations. Specifically, fully utilizing the stories and narratives of the *Farewell Museum* exhibits, enhancing personalized user experiences, and fostering interaction among visitors to create and share diverse exhibition content continuously will yield significant results.

To this end, this paper proposes a method to create synergy between offline and online exhibitions by introducing gamification based on gameful experiences in planning the metaverse *Farewell Museum*, linked to an offline exhibition.

Meanwhile, Nibu John Thomas et al. categorized the gamification's effects into four categories and 11 themes [27]. The 11 themes represent various experiences that game designers aim to create, while the four higher-level categories signify the resulting types of experiences users may have. The four categories are (1) Nudge Experience, (2) Flow Experience, (3) Alternate Reality Experience, and (4) Hedonic Experience. Nudge Experience refers to changing user behavior predictably; Flow Experience denotes users being fully immersed and enjoying an activity; Alternate Reality Experience describes users expanding the meaning of their real space by integrating virtuality; and Hedonic Experience refers to users experiencing positive emotions such as pleasure, satisfaction, and happiness through a gamified platform.

Therefore, it is crucial to evaluate whether the *Farewell Museum* implemented in the metaverse can provide these four types of experiences. Users might change their perception and attitude toward the “farewell” theme through the Nudge Experience and be encouraged to visit the offline exhibition to observe exhibits and learn stories actively. Additionally, assessing whether the metaverse *Farewell Museum* provides an immersive experience that fully engages users with the exhibition content is vital. If this experience is insufficient, users might not feel any significant impact after viewing the metaverse exhibition. Furthermore, the design and composition of the metaverse exhibition space play a critical role in the Alternate Reality Experience, as the implemented space and design concept must reflect the exhibition’s worldview while maintaining thematic consistency despite differing from the real world. Finally, through the Hedonic Experience, visitors should experience a form of emotional catharsis and increased satisfaction with their participation in the exhibition.

The 11 themes identified in this paper provide insights into how gamification designers aim to offer game-like experiences to users and reflect various aspects of what users might encounter in a gamified environment. Table 2 summarizes the meanings of each theme and the necessary tasks to implement in the metaverse *Farewell Museum* concerning these meanings.

Table 2. The 11 themes and tasks to be implemented in the metaverse *Farewell Museum*.

Category	Description	Tasks to Address
Trigger interest	Experiences that capture users’ attention, motivate them, and entice them, making them more interested and wanting to use the platform more frequently.	Did it engage users’ interest in the theme of farewell?
Reward behavior	Experiences where users feel recognized and valued through rewards are essential to reinforce their behavior.	Did visitors feel emotional comfort or empathy after visiting the <i>Farewell Museum</i> ?
Elicit uncertainty and curiosity	Experiences wherein the setting’s and situation’s unpredictability evokes curiosity provide an unexpected thrill and encourage users to explore and discover new things.	Did the missions stimulate curiosity?
Clarify goal	Clear goals provide users with a sense of guidance and the perception that they are on a journey toward a specific objective.	Did the missions make users want to visit the offline <i>Farewell Museum</i> ? Did they want to learn more about the farewell theme?
Highlight progress	Experiences where users can immediately see their progress, understanding what needs improvement and their current status.	Could users easily understand their avatar’s location and situation within the metaverse through the missions?
Progressively challenge	Experiences that start easily and gradually become more challenging, offering opportunities for users to grow and learn through their experiences.	Were the missions structured progressively?
Emulate safety and control	Settings that provide users with a sense of safety, allowing them to try and fail without fear, thus offering freedom to explore.	Did users feel secure without anxiety about failing the missions?
Construct an alternate world	Experiences where users can escape their daily reality to an alternate reality, reducing stress and allowing for discoveries.	Did the worldviews or design experiences feel new and distinct from the real world?
Connect to reality	Connections between gamified environments and real-world activities, making users feel that their experiences are relevant to real-life situations and contexts.	Did the <i>Farewell Museum</i> ’s content feel connected to real-life situations or events? Did users feel that their stories were connected to reality?
Provide fun	Providing enjoyment and entertainment to users, making them more immersed in activities for longer periods.	Was the mission execution process enjoyable?
Ensure happiness	Providing satisfaction, happiness, and positive emotions to users in a gamified environment, increasing their desire to continue engaging.	Did users desire to revisit or add their own stories after experiencing the missions?

These 11 themes demonstrate the spectrum of experiences gamification aims to provide users, each serving as a crucial consideration in the gamification design process to enhance user engagement and satisfaction. This classification offers a framework that can aid in understanding and improving user experiences when designing and evaluating gamification. Additionally, this paper highlights that gamification is influenced by positive

psychology and the metaverse concept, providing insights into how one can integrate concepts and principles from these fields into gamification design and implementation. Specifically, the alternate reality experience links to the metaverse concept, emphasizing how gamified environments can enable users to experience new realities.

The foremost conclusion is that the experiences gamification designers aim to create are vital to enhance user engagement and satisfaction. Additionally, these experiences can promote positive psychological states and behavioral changes. Therefore, it is crucial to consider and apply these experiences in gamification research and practice.

The study by Luarn et al. demonstrates that gamification elements can fulfill users' psychological needs and induce a state of flow, thereby promoting sustained engagement and motivation in the metaverse environment. This theoretical framework allows us to better understand how our metaverse exhibition can provide users with deeper experiences and engagement [28].

When applying the proposed four categories and 11 themes to actual exhibition planning that links offline and online experiences, one may omit or add elements depending on the exhibition's theme and environment. This study aims to analyze the effectiveness of metaverse exhibitions based on gamification by using the example of the online *Farewell Museum* implemented in the metaverse and effectively linked to its offline exhibition.

3. Case Study

3.1. The Background of the Metaverse Farewell Museum

In the second half of 2023, the Citizen Gallery in the Donuimun Museum in Seoul planned an exhibition titled *Farewell Museum*, focusing on the theme of farewells. This offline exhibition collected and displayed items along with the stories of people who experienced farewells for various reasons. These exhibited items were significant personal belongings tied to stories of farewell, and those who owned these items could not often move on from their emotional wounds because they had not properly sorted through these belongings. The exhibition intended to help heal these emotional wounds by sharing the stories behind the items with others and transferring ownership of the exhibited items to others via auction at the exhibition's end.

Therefore, the exhibition aimed not merely to showcase items but to evoke emotional resonance through understanding and empathizing with the farewell stories embedded within them. The individuals who provided objects experienced emotional healing through visitors' comments and shared emotions. According to a piece by nurse Holly Skodol Kelly in *The American Journal of Nursing*, "We intuitively believe to some extent that the pain of parting holds some constructive or therapeutic value" [29]. Items that people keep, discard, destroy, or donate to museums often remind them of their pain but also represent parts of their identity, even those that no longer exist. Emotional sustainability refers to maintaining and enhancing human emotional and mental health. Additionally, visitors to the exhibition learned about others' perspectives on farewells through other visitors' comments, providing a reflective moment to reconsider the true meaning of "farewell". Despite these special advantages, the exhibition could not overcome the limitations of offline exhibitions; it was a one-time visit, and the exhibition might not have fully conveyed its message or intentions, preventing the ongoing activation of the exhibition.

"The purpose of the museum is to give visitors the fun of visiting the museum and to make it an impressive memory by taking advantage of the museum's unstructured environment and non-formal education" [30].

By exhibiting various experiences of "farewell", the offline exhibition envisioned fostering empathy for others' emotions arising from farewells or helping visitors anticipate and prepare for their farewells by understanding others' experiences. The exhibition's content included cherished items that make farewells difficult and videos featuring stories and interviews. While viewing the items and videos in the offline space, visitors could empathize with others' farewells and reflect on how that theme resonated with their experiences (see Figure 1). Although many visitors could relate to the content, there were

limitations on wide distribution due to physical distance constraints. Additionally, the exhibition usually ended with a single visit, resulting in short-lived effects and the potential to remain a temporary event.



Figure 1. Exhibition poster images and scenes from exhibitions.

To overcome such offline exhibition limitations, the exhibition planning team transferred and implemented the exhibition content into the metaverse space, creating an online–offline-linked exhibition that generated synergy by connecting the actual exhibition space with the virtual exhibition space. To this end, the *Farewell Museum* metaverse exhibition space was established on the “Kuntra” platform, an art and culture-dedicated shared space platform built by Tissue Office. However, simply transferring the content of the physical exhibition space to the virtual space does not fully leverage the advantages of the metaverse exhibition space. Therefore, the team restructured content to include game-like missions to enhance visitors’ experiences. In this study, NPCs (non-player characters) guided visitors to complete given missions in the metaverse space, helping them understand the exhibition content more clearly. After completing all the missions, visitors received access to a specially prepared space as a reward, where they could calmly soothe the emotions stirred by farewells (see Figure 2).

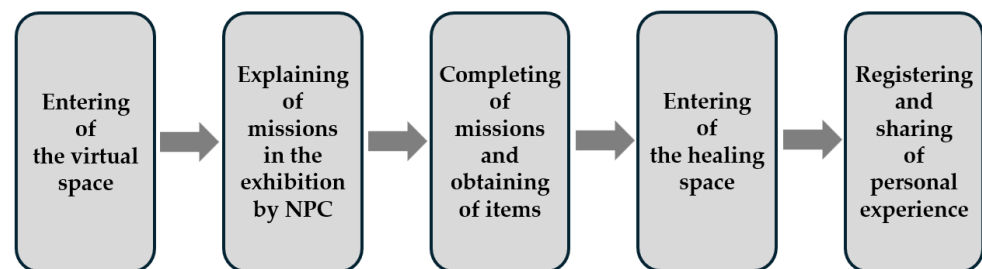


Figure 2. The viewing experience process in virtual space.

The exhibition experience in the virtual space aimed beyond observation: It strove to help viewers understand items and stories related to others’ farewells through simple missions. Visitors were guided to explore the virtual space, find hidden items, and complete missions via the hints the NPCs provided, much like progressing through a game. As they searched for items, visitors naturally learned about them and their associated farewell stories. This gamified approach allowed visitors to discover diverse farewell stories through play rather than deliberate effort, providing indirect farewell experiences and often leading to a deep empathy for these stories. This process also prompted visitors to reflect on their farewell experiences, thoughts, and attitudes toward farewells.

The virtual exhibition space was divided into multiple levels according to different types of farewells. After completing a mission on each level and obtaining an item, visitors moved to the next level. Upon reaching the final stage, completing all missions, and collecting all hidden items, they received access to a hidden healing space at the top. In this final healing space, visitors experienced a symbolic act of placing the items they collected

into a large furnace to burn their long-held painful emotions. Watching the flames, they experienced a sense of catharsis and emotional release. Gazing at the burning flames offered them emotional cleansing and healing.

The *Farewell Museum's* metaverse exhibition is designed to be accessible via mobile phones, the most ubiquitous devices, to ensure that people of various ages and socioeconomic backgrounds can access it. Anyone with a mobile phone can experience the Farewell Museum service as shown in Figure 3.



Figure 3. Images of the implemented virtual showroom.

This approach aligns with several United Nations Sustainable Development Goals (SDGs) [31] by promoting inclusivity and equal access to technology and cultural experiences. In particular, the design approach of the Farewell Museum is related to SDGs 10, 11, and 16.

SDG 10: Reduced Inequalities: By making the metaverse service accessible via mobile phones, the most widely available devices, we reduce inequalities in access to digital content and experiences. This ensures that people from diverse socioeconomic backgrounds can participate equally. The intuitive design of the user interface (UI) and non-playable characters (NPCs) further supports this goal by enabling users with little gaming experience to navigate and enjoy the service easily.

SDG 11: Sustainable Cities and Communities: The friendly appearance of NPCs and the design of both player and NPCs to be racially, age-wise, and gender-neutral ensure that all users can interact without bias or discomfort. This fosters a sense of community and inclusivity within the metaverse, contributing to sustainable and inclusive urban and community development.

SDG 16: Peace, Justice, and Strong Institutions: By designing characters in such a way that their race, age, or gender are not explicitly identifiable, the metaverse promotes social inclusion and reduces the potential for bias and discrimination. This helps to build peaceful and inclusive societies, supports justice, and strengthens institutions by promoting equality and understanding among users.

3.2. Implementation of Metaverse Elements and the Gameful Experience

The designers carefully structured the implementation of the metaverse-based Farewell Museum exhibition to provide an engaging and effective user experience. Table 3 outlines the key categories, solution tasks, and specific implementation details:

The Metaverse Itself: The exhibition space and services aligned with the Farewell Museum's theme, incorporating relevant and immersive environment designs.

People/ Avatars: The developers created appropriate avatars and NPCs to enhance visitor interaction, including gender-neutral avatars.

Metaverse Technology Capabilities: The museum implemented the exhibition experience effectively and seamlessly, focusing on visitor-friendly UI/UX design.

Behaviors: The exhibition guided visitor behaviors appropriately, with missions and interactions providing relevant responses based on visitor actions.

Outcomes: Visitors received suitable rewards and positive experiences, linking positive behaviors to outcomes such as final badges and access to sanctuary areas after completing the missions.

Table 3. Implementation details of the metaverse-based Farewell Museum exhibition.

Category	Solution Task	Implementation Details
The metaverse itself	Did the space and service match the theme of the Farewell Museum?	Relevant and immersive environment design, farewell-themed design
People/Avatars	Were the avatars and NPCs appropriate for diverse exhibition visitors?	Gender-neutral avatars
Metaverse technology capabilities	Was the exhibition experience effectively and seamlessly implemented?	UI/UX design focused on visitor convenience
Behaviors	Were visitor behaviors adequately guided and appropriate responses implemented according to their actions?	Missions that help understand the project
Outcomes	Did the exhibition give visitors appropriate rewards and provide positive experiences, or were positive behaviors connected to positive outcomes?	Final badge and permission to move to the sanctuary after mission completion, healing effects through minor missions and small rewards, provision of features for visitors to share their stories

In addition to these implementation details, the exhibition integrated various themes of gameful experience, as Table 4 summarizes:

Table 4. Components of gameful experiences in the metaverse-based *Farewell Museum* exhibition.

Overarching Category	Theme	Components of the Gameful Experience
Nudge Experience	Trigger interest	Farewell events, various NPCs
	Reward behavior	Gifts for completing NPC missions
	Elicit uncertainty and curiosity	Various projects containing documents, a tree-like space, and various farewell materials
Flow Experience	Clarify goal	NPC guidance (final boss NPC guidance)
	Highlight progress	Shaft structure; elevator guidance for each floor
	Progressively challenge	Themed NPCs provide missions on each floor
	Emulate safety and control	Five-story tree structure space, starting from the 1st floor when leaving the space
Alternate reality Experience	Construct an alternate world	Providing experiences similar to the user's real farewell events
	Connect to reality	Sharing the user's real-life farewell experiences
Hedonic Experience	Provide fun	Opportunities to experience the space with others and communicate; character interactions
	Ensure happiness	Positive emotional processes and healing experiences related to farewells

Nudge Experience: The design included elements to trigger interest through farewell events and diverse NPCs, reward behaviors with items for mission success, and elicit uncertainty and curiosity through various thematic spaces and materials.

Flow Experience: NPC guidance clarified the goals, structured navigation systems highlighted progress, themed missions progressively increased challenges, and well-structured spaces emulated safety and control.

Alternate Reality Experience: The exhibition constructed alternate worlds that reflected users' real-life farewell experiences, enhancing the connection to reality by enabling users to share of these experiences within the metaverse.

Hedonic Experience: The design provided fun through opportunities for social interaction and character engagement and ensured happiness by facilitating positive emotional processes and healing experiences related to farewell.

These structured components and themes were essential in enhancing user engagement and satisfaction, demonstrating the effectiveness of incorporating gameful experiences in the metaverse-based Farewell Museum exhibition.

3.3. Composition and Scenario of the Metaverse Exhibition Space

The metaverse exhibition space of the Farewell Museum is structured around a tree divided into five layers based on different types of farewells (fear, sadness, regret, happiness). Users can upload their farewell stories in the form of "tear fruits" on this tree. As depicted in Figures 4 and 5 (the tree structure and actual implementation in the metaverse space), the tear fruits are archived layer by layer.

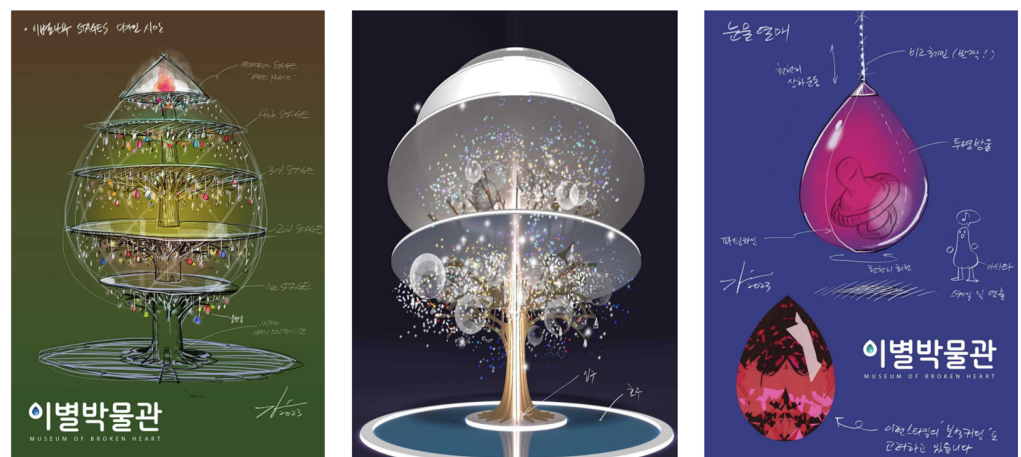


Figure 4. Concept image of the Farewell Museum tree and tear fruits.



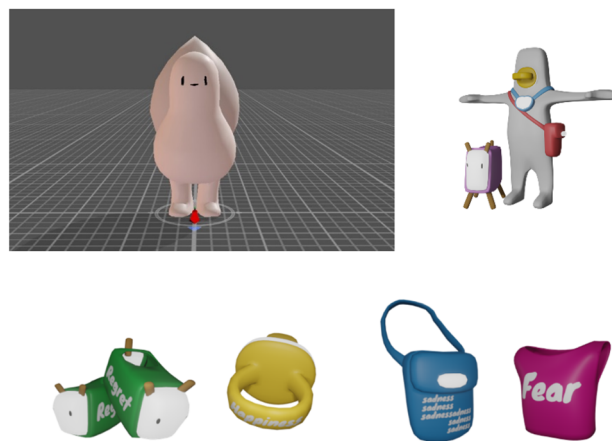
Figure 5. Layered structure and actual implementation of the tree in the metaverse space.

As shown in Table 5 of the scenario, NPCs on each layer are designed to guide users through various game-like missions that allow them to empathize with and immerse themselves in the farewell stories of others.

Table 5. User layer scenarios.

Order	Expected Scenario
1	Upon approaching the vendor position, you see the 'Event Tree'.
2	As you get closer to the event tree and proceed to the first floor, you see the exits of other trees and hear the sound of the lobby faintly.
3	Listen to the explanation about the space and the obtained items from Story NPC_1 and head towards the reception desk.
4	At the central reception desk, you can find Apply NPC_1 and register for the event. When registering for the event (GUL_1), you hear a joyful sound effect.
5	Next to Apply NPC, you can see the snow globe I drew. Ride the lift and go up. After going up, you receive a guide displaying many event booths.

The items, as seen in Figure 6, rewarded for completing missions symbolize objects related to the story's content. Each time visitors complete a mission, they gain an understanding of the offline exhibition's content and develop empathy for the individual who provided the story. This process not only entertains visitors but also increases their interest in the exhibit, sparks their curiosity about other stories, and stimulates their curiosity about the offline exhibit. These are the types of responses exhibit planners aim to elicit when introducing gamification to the metaverse museum exhibit, thereby achieving the goal of connecting online and offline exhibits.

**Figure 6.** Images of the NPC, the avatar, and the rewards.

4. User Evaluation

The implementation of the Farewell Museum metaverse referred to previously involved researching metaverse components and elements of gameful experiences. These components were essential considerations for effectively implementing the metaverse space and services and served as crucial references for achieving the Farewell Museum metaverse's goals. The study evaluated users to assess whether components helped users understand the Farewell Museum metaverse's theme, changed their perceptions, increased their interest in the offline exhibition, and maintained their ongoing interest in the exhibition. This process established five hypotheses that aligned with the exhibition's objectives. Then, it weighed the user evaluation results to determine if these hypotheses were met.

For the usability evaluation, a total of 124 students from the Department of New Media Contents at Dong-Ah Institute of Media and Arts participated in this survey. After excluding 14 responses due to insincerity or errors, 110 valid responses ($n = 110$) were analyzed. The sample consisted of 70.0% females and 30.0% males. Given the characteristics of the survey group, only individuals in their 20s and high school graduates (currently enrolled in university) were included. The percentage of participants with metaverse

experience was 87.3%, which is significantly higher than the 12.7% reported in a recent survey by the Korea Communications Commission [32]. This discrepancy is likely due to the inclusion of metaverse-related courses in the respondents' major curriculum. Among the metaverse users ($n = 110$), 66.1% reported using three main platforms: Minecraft, Animal Crossing, and Zepeto. This distribution is like the findings of the Korea Communications Commission survey.

Based on the survey of 96 students, Minecraft (27.24%) and Animal Crossing (22.59%) were identified as the most popular metaverse platforms. Most users (61.46%) reported having no experience with paid metaverse services, while 30.21% reported attending at least one metaverse event. Usage frequency varied, with 29.17% engaging with the metaverse once or twice every three months.

4.1. Hypotheses

The hypothesis proposed that "the metaverse-based Farewell Museum exhibition significantly influences participants' perceptions of farewell and their interest in the related offline exhibition". User evaluations on the metaverse exhibition considered the 11 elements of gameful experience in four categories.

- H1.** *The metaverse exhibition's design helps visitors understand the space and services well.*
- H2.** *The metaverse exhibition's design helps visitors understand the exhibition theme well.*
- H3.** *The metaverse exhibition's design alters visitors' perceptions related to the exhibition theme.*
- H4.** *The metaverse exhibition's design motivates visitors to participate in the offline exhibition.*
- H5.** *The metaverse exhibition's design encourages visitors' ongoing participation.*

4.2. Evaluation of Hypotheses

A focus group interview with five experts in the game development field evaluated the Farewell Museum's content against the five established hypotheses. Additionally, it assessed usability using a 5-point Likert scale based on game elements, with 124 students from the Department of New Media Content participating in the evaluation. The table below (Table 6) present the results of the user evaluation for the five hypotheses presented.

In Figure 7a, the evaluation results reveal whether users understood their progress in the metaverse space, comprehended the mission, and found the mission rewards appropriate. These results indicate that the spatial configuration, UI/UX design, and appropriate missions and rewards were effectively designed in the metaverse components. Moreover, considering the elements of gameful experiences, one may infer that the exhibition implemented elements of the Nudge Experience well. Consequently, the average evaluation score was above 4, indicating generally positive feedback. The overall structure of the metaverse museum, the arrangement of exhibits, the design of missions, and the explanations provided by NPCs were all implemented in ways that enhance visitors' understanding of the exhibition's progress, missions, and rewards. This approach effectively shifts visitors' attitudes from passive observation to active participation, leading to a positive impact on their subsequent engagement with the museum.

In Figure 7b, the evaluation results present users' interest in the exhibition and their understanding of the theme. The evaluation of whether users gained a better understanding of the exhibition theme and increased interest demonstrates that the designers of actions and outcomes within the metaverse implemented them well, reflecting the Flow Experience elements in the gameful experience. The average scores were above 4, suggesting the appropriate implementation of these elements. The results indicate that the metaverse exhibition enhances visitors' immersion by improving their understanding of the exhibi-

tion's theme. This increased immersion shows that the method effectively conveys the exhibition's objectives and themes as intended by the organizers.

Table 6. Summary of usability evaluation survey results ($n = 110$).

No.	Survey Area	Mean	Std Dev	n	Survey Result	Composition (%)
#01	Appropriateness of Exhibition Design (User Interface/Design Interface /Virtual Space Experience)	3.7055	0.73632	110	Negative	15.65%
					Neutral	10.66%
					Positive	73.70%
#02	Appropriateness of Game Design (NPC/Flow)	3.7691	0.71942	110	Negative	11.27%
					Neutral	23.64%
					Positive	65.09%
#03	Change in Perception (Relatedness, Originality, Usability and Accessibility, Recognition)	3.0182	1.102848	110	Negative	31.52%
					Neutral	33.64%
					Positive	34.85%
#04	Effectiveness in Promoting Offline Exhibitions (Usability, Accessibility)	3.4697	0.84085	110	Negative	20.76%
					Neutral	27.73%
					Positive	51.52%
#05	Effectiveness of Service Sustainability	3.0182	1.102848	110	Negative	31.52%
					Neutral	33.64%
					Positive	34.85%

Figure 7c's assessment data show whether users' perceptions of farewell became more positive after viewing the exhibition. This evaluation indicates the effective implementation of the metaverse components related to user actions and outcomes, as well as the Hedonic Experience elements in a gameful experience. The average scores above 3 testify to the appropriate reflection and implementation of these elements. The results of Figure 7c indicate that the exhibition can lead to changes in visitors' perceptions. This shows that the purpose of museum exhibitions is not merely to convey information or knowledge but also to influence visitors' perceptions and behaviors. In this case, the exhibition effectively prompted a shift in perception, encouraging visitors to view 'farewells' not just as sad and difficult experiences but as positive opportunities for growth and change. This demonstrates the positive impact museum exhibitions can have.

The evaluation data in Figure 7d,e show whether users' interest in and motivation to participate in the offline exhibition increased after viewing the metaverse exhibition and whether this metaverse service can continue. These results consider this study's objectives: The link between the offline exhibition and the metaverse exhibition's sustainability. From the many scores above 3 and 4, it can be seen that the metaverse exhibition implementation largely achieved its objectives. The results of Figure 7d,e indicate that participation in the metaverse exhibition can act as a catalyst for participation in offline exhibitions. Additionally, the willingness of visitors to share their stories or repeatedly visit the metaverse exhibition suggests that this exhibition can be continuously maintained and operated, rather than being a one-time event. This demonstrates the significance of this study in linking offline and online museum exhibitions, showing that both exhibition spaces can positively interact and provide the potential for the museum's sustainable operation.

Figure 8 consolidates these results into a single graph. This graph illustrates that the effects of the metaverse exhibition appropriately implemented the five hypotheses. The results indicate positive evaluations for the first hypothesis regarding effectively implementing the metaverse space and exhibition for user understanding and for the second hypothesis about the metaverse exhibition's efficacy in helping users understand the

exhibition theme. Additionally, the hypotheses concerning positive changes in perceptions of the farewell theme, motivating interest and participation in the offline exhibition, and ongoing participation in the exhibition also received favorable feedback. Consequently, the evaluation of the metaverse exhibition’s efficacy, which incorporated the components of the metaverse and gameful experience, was positive. The following Table 7. summarizes the relationship between the implemented components and the hypotheses.

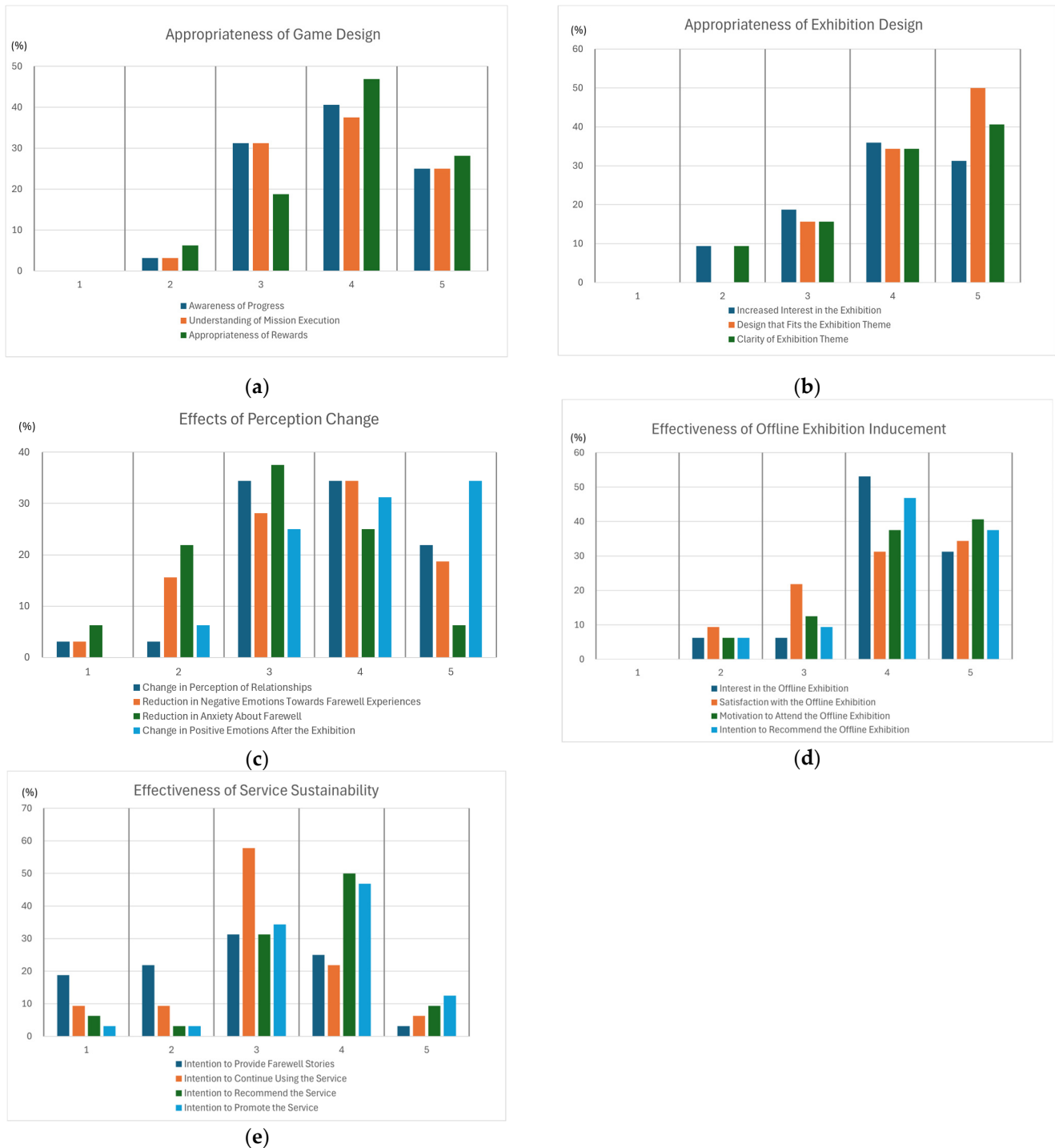


Figure 7. Evaluation results of the five hypotheses: (a) Appropriateness of game design; (b) Appropriateness of exhibition design; (c) Effects of perception changes; (d) Effectiveness of offline exhibition inducement; (e) Effectiveness of service sustainability.

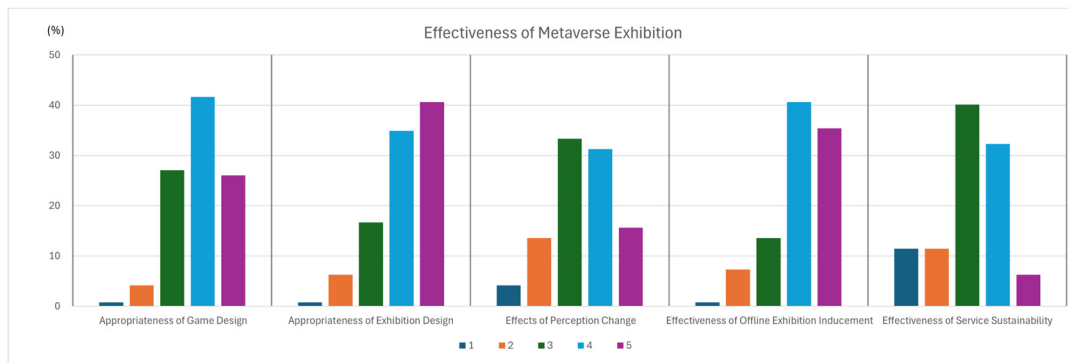


Figure 8. Effectiveness of metaverse exhibition.

Table 7. Relationships between the implemented components and the hypotheses.

Component	Task	Implementation	Hypothesis *	
Metaverse	The metaverse itself	Did the space and service match the theme of the <i>Farewell Museum</i> ?	Contextual and immersive map design for the <i>Farewell Museum</i>	H1
	People/avatars	Were the avatars and NPCs appropriate for diverse exhibition visitors?	Gender-neutral avatars	H1
	Metaverse technology capabilities	Was the exhibition experience effectively and seamlessly implemented?	UI/UX design considering visitor convenience	H1
	Behaviors	Were visitor behaviors adequately guided and appropriate responses implemented according to their actions?	Missions that help understand the stories	H2/H4
	Outcomes	Were appropriate rewards given to visitors, and were positive experiences provided, or were positive behaviors connected to positive outcomes?	Access to the highest level (attic) after mission completion, providing emotional catharsis (healing effects), and the ability to share personal stories as content	H3/H4
Gameful Experience	Nudge Experience	Trigger Interest	Farewell stories, various NPCs	H1
		Reward Behavior	Gifts for completing NPC missions	H1/H2/H5
		Elicit Uncertainty and Curiosity	Various spaces containing stories, a tree-shaped space, and large farewell materials	H2/H5
	Flow Experience	Clarify Goal	NPC guidance (guiding to the final attic space)	H1/H4
		Highlight Progress	Vertical structure; an elevator guiding to different levels	H1
		Progressively Challenge	Tree-themed NPCs provide missions	H1/H5
		Emulate Safety and Control	Spaces with tree structures on the fifth floor; starting again from the first floor after leaving these spaces	H1/H5
	Alternate reality Experience	Construct an Alternate World	Empathy with personal experiences and similar farewell stories	H2/H3/H4
		Connect to Reality	Sharing personal farewell experiences within one's reality	H3
	Hedonic Experience	Provide Fun	Opportunity to interact and communicate with others in the shared space; character interaction	H2/H3/H5
Ensure Happiness		Experience of positive emotions and the healing process regarding farewells	H3	

* Page 12–13, Section 4.1 Numbers corresponding to five hypotheses.

Through the interaction between offline and online exhibitions, offline experiences can drive online participation, and as shown in Figure 9, online experiences can, in turn, lead to visits to offline exhibitions. This positive cyclical structure can significantly contribute not only to the sustainability and dissemination of museums but also to the achievement of

the United Nations' 17 Sustainable Development Goals (SDGs) [31], specifically SDG 11 (Sustainable Cities and Communities) and SDG 16 (Peace, Justice, and Strong Institutions) by 2030. Furthermore, this approach provides a valuable method for revitalizing regions facing the threat of local extinction. By operating offline resources that facilitate visits to cultural heritage sites and implementing these resources within the metaverse for online visits, regional activation can be promoted. This dual approach not only helps prevent local extinction but also provides insights into comprehensive strategies for regenerating local communities.

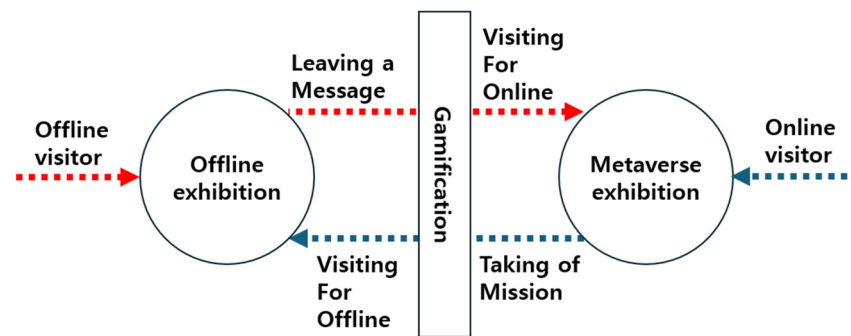


Figure 9. Images of the positive cyclical structure of offline exhibitions and metaverse exhibitions.

5. Conclusions

This study demonstrates the significant potential of implementing a metaverse-based *Farewell Museum* exhibition that incorporates gamification elements to overcome the limitations of traditional offline exhibitions. It integrates the advantages of both online and offline exhibitions to provide visitors with immersive and interactive experiences.

Introducing metaverse exhibitions offers unique advantages by transcending the physical constraints of space and time, significantly enhancing accessibility and reach by allowing visitors to access the exhibition anytime and anywhere. The metaverse components utilized in this study—"the metaverse itself", "people/avatars", "metaverse technology capabilities", "behaviors", and "outcomes"—positively impacted user satisfaction. Visitors felt like they were in a real interactive space within the virtual environment, enriching their experience through personalized interactions and the ability to share and create new content, thus promoting continuous engagement and revisits.

Incorporating gamification elements based on the components of a gameful experience allowed visitors to explore the exhibition more deeply through game-like missions and rewards, facilitating a better understanding of the stories behind each exhibit. It helps visitors understand the narratives related to the exhibition and immerse themselves more deeply in its themes, creating an emotional connection with the content that is often difficult to achieve in traditional exhibitions.

The metaverse exhibition, as implemented, generated a strong synergy with offline exhibitions. The interactive and immersive nature of the metaverse experience stimulated visitors' interest in offline exhibitions, encouraging actual visits. This effect enhanced the *Farewell Museum's* narrative and educational goals more effectively.

The implementation of this metaverse exhibition aligns with the International Council of Museums (ICOM) definition of museums as inclusive spaces that conserve and interpret tangible and intangible heritage. Additionally, it contributes to the achievement of the United Nations' 17 Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities) and SDG 16 (Peace, Justice, and Strong Institutions), by promoting accessibility, education, and cultural sustainability.

This study expects that the metaverse exhibition implemented in this study will significantly promote social sustainability. It enabled the preservation and widespread dissemination of cultural heritage through digital archiving, thereby increasing educational

impact and ensuring long-term sustainability by allowing people from diverse generations and regions to access cultural content.

In conclusion, the *Farewell Museum* exhibition incorporated metaverse and gamification elements and produced positive results in enhancing the visitor experience, improving accessibility to the exhibition, and providing a sustainable cultural experience. This approach suggests that future exhibitions can adopt this innovative and impactful strategy to offer significant cultural experiences. This study emphasizes that metaverse-based exhibitions and gamification elements enhance the effectiveness and sustainability of exhibitions, providing a foundational resource for future research and practice.

Author Contributions: Conceptualization, J.L. and Y.B.; methodology, J.L.; software, Y.B.; validation, Y.B.; formal analysis, J.L.; investigation, J.L. and J.B.; resources, Y.B. and J.B.; data curation, Y.B.; writing—original draft preparation, J.L.; writing—review and editing, Y.B.; visualization, J.L.; supervision, Y.B.; project administration, J.L. and J.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the National Research Foundation of Korea (NRF) grant, funded by the Korean government (MSIT) (No. NRF-2022R1C1C1003594), and this research was supported by “Regional Innovation Strategy (RIS)” through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (MOE) (2021RIS-002).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: The researchers obtained informed consent from all subjects involved in the study.

Data Availability Statement: The data supporting the reported results are available at the *Farewell Museum* service at the following link: [<https://kuntra.kr/>] (accessed on 13 May 2024). The datasets generated and analyzed during the study are publicly accessible.

Acknowledgments: The authors would like to thank the students of the New Media Content Department at Dong-Ah Institute of Media and Arts for their assistance with the survey. We also appreciate the invaluable assistance provided by Tissue Office in the Kuntra app service.

Conflicts of Interest: The authors declare no conflicts of interest.

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