

**ORIGINAL ARTICLE**

Designing Interactive Games to Enhance Visitor Engagement and Learning in Heritage Galleries: A Literature Review Focused on the World Fuzhou Heritage Gallery, Sibü.

*Vanden Michael, Jaibi Sabian and Mohamad Suffian Abdul Kadir

School of Computing and Creative Media, University of Technology Sarawak, 96000 Sibü, Sarawak, Malaysia

ABSTRACT - This study examines the potential of interactive games to enhance visitor engagement and learning outcomes at the World Fuzhou Heritage Gallery in Sibü. Traditional heritage galleries often struggle to engage younger audiences due to outdated presentation methods and a lack of interactive experiences. This study designed an interactive game tailored to teens aged 12–20, aiming to foster deeper connections with gallery content while improving educational outcomes and enhance visitor engagement. The paper aims to identify the challenges and design interactive game for cultural heritage through a comprehensive literature review. The research employs a mixed-methods approach, qualitative and quantitative techniques to evaluate user engagement and learning. Conclusions of this study will potentially guide future approaches for using interactive game in heritage sites, enhancing dynamic and inclusive cultural experiences.

ARTICLE HISTORY

Received: 02 Jan 2025

Revised: 12 May 2025

Accepted: 24 Feb 2026

KEYWORDS

*Interactive game,
Digitized Gallery,
User experience,
Exhibit,
Design.*

INTRODUCTION

Heritage galleries serve as vital repositories of cultural knowledge, preserving historical artifacts and narratives for future generations to appreciate and learn from. Engaging with multiple audiences can be challenging, particularly in attracting young people to cultural events or involving them in the management of cultural heritage [1]. However, many traditional galleries face significant challenges in engaging modern audiences, particularly younger demographics who are accustomed to dynamic, interactive, and technology-driven experiences. The World Fuzhou Heritage Gallery in Sibü, like many similar institutions, is grappling with declining visitor numbers and waning interest from teens aged 12–20, a demographic crucial for fostering cultural awareness and continuity. The millennial cohort is particularly significant to the future of conservation due to their current age range [2].

The rapid advancement of digital technologies has transformed the way individuals consume information and interact with their surroundings. Younger audiences increasingly expect immersive, participatory experiences that go beyond passive observation. This shift presents both a challenge and an opportunity for heritage galleries. By embracing innovative approaches such as interactive games, galleries can transform static displays into dynamic, engaging environments that resonate with contemporary visitors. It enhances the whole gallery experience by integrating digital storytelling and providing an immersive engagement with cultural heritage exhibits [3]. Interactive games, grounded in principles of gamification and experiential learning, offer a promising solution to these challenges. Such games not only captivate users but also provide meaningful opportunities for education and cultural exploration. Gamification has the potential to serve as a powerful intermediary between users and cultural heritage, thereby fostering a deeper understanding and broader dissemination of cultural heritage [4].

Heritage galleries, including the World Fuzhou Heritage Gallery in Sibü, are struggling to engage younger audiences, particularly teens aged 12–20, due to outdated and static presentation methods that

*Corresponding Author: Vanden Michael. University of Technology Sarawak (UTS), email: vanden@uts.edu.my

fail to meet modern expectations for interactivity and immersion. These sites need to adapt to attract the attention of millennials and Gen Z, who need immersive and engaging experiences that provide the perfect [5]. This disconnect has led to two critical issues: low engagement and reliance on conventional methods. Younger visitors often perceive heritage galleries as unengaging, irrelevant, and disconnected from their digital-first lifestyles. This perception results in declining attendance and minimal interaction with gallery content, undermining the institution's ability to fulfil its cultural and educational mission. Moreover, conventional methods of presenting heritage content, such as static displays, result in restricted learning. As a result, visitors, especially teens, exhibit poor content retention and limited understanding of the cultural narratives being presented. Heritage is carefully structured into an integrated narrative, presenting visitors with an interactive and visually engaging experience of the heritage [6].

This study aims to address the challenges faced by heritage galleries, such as the World Fuzhou Heritage Gallery in Sibiu, in engaging younger audiences, particularly teens aged 12–20. The research seeks to identify the key barriers that hinder effective engagement, including outdated presentation methods and a lack of interactivity. Additionally, the research focuses on to designing and evaluation of an interactive game specifically for the target audience, analyzing its effects on visitor engagement, content retention, and cognitive skill development. Through these objectives, the research aims to provide actionable insights into revitalizing heritage spaces and ensuring their relevance for younger generations.

LITERATURE REVIEW

Heritage galleries serve as curators of cultural memory, providing essential insights into historical narratives, artistic traditions, and societal development. Despite their significance, these institutions are increasingly faced with challenges in attracting and retaining younger audiences, whose involvement is crucial for the sustainability of cultural preservation initiatives. Research highlights an increasing disparity between the static, often educational exhibition methods employed by heritage galleries and the dynamic, participatory inclinations of younger generations, particularly Millennials and Gen Z. However, a traditional museum is essential for providing visitors with an authentic experience, and it must also adopt contemporary communication platforms to attract a broader range of visitors [7]. Heritage galleries often struggle to compete with highly engaging digital platforms and entertainment sectors that appeal to shorter attention spans, leading to physical cultural places failing to establish their significance in an increasingly digitized environment. Efforts to bridge this engagement gap have spurred scholarly discourse on adaptive strategies, though challenges persist. Emerging research highlights the potential of technology driven solutions, such as augmented reality (AR) exhibits, gamified learning modules, and social media integration, to align heritage content with the digital habits of younger audiences. Augmented Reality (AR) used in museums can fully reflect the cultural heritage and humanistic connotations of the collections, while also enhancing the quality of the experience and educational effect from the individual user's standpoint [8]. The static exhibits that are frequently emphasized in traditional historical galleries, such as glass-encased objects, placards with a lot of text, and static graphic layouts, do not appeal to younger generations who were brought up in an atmosphere that is dominated by technology. A study found that children are more engaged with interactive museum exhibitions than static exhibits [9]. Studies suggest that prolonged exposure to passive viewing can lead to diminished attention spans and disinterest, as these formats fail to stimulate curiosity or emotional connection. According to an international association for children's museums, museums should encourage children's imagination and curiosity [10].

Interactive games have emerged as a powerful tool for education and engagement, offering galleries a unique opportunity to captivate visitors and enhance their learning experiences. Unlike traditional static displays, interactive games provide dynamic and immersive environments that encourage active participation, making the learning process more enjoyable and memorable. The fundamental components: Three fundamental ideas form the foundation of gamification: competition, rewards, and objectives [11]. By incorporating elements such as storytelling, problem-solving, and rewards, these games

tap into intrinsic motivators that drive user interest and sustained engagement. For younger audiences, who are often more responsive to technology-driven experiences, interactive games serve as a bridge between cultural heritage and modern expectations, transforming passive observation into an active exploration of history and art. Gaming techniques employed in cultural heritage studies offer the potential to create digital learning environments and pathways centered on significant historical themes, enabling visitors to engage in cultural heritage education [12]. Furthermore, the adaptability of interactive games allows galleries to tailor content to diverse audiences, ensuring inclusivity and accessibility while fostering a deeper understanding of complex narratives. In line with the aim of museum organizations to preserve cultural heritage, a module for digital conservation and reconstruction was designed [13]. As a result, interactive games not only attract more visitors but also leave a lasting impact, promoting both education and appreciation for cultural heritage. However, traditional galleries often rely on static displays that limit the depth of engagement, leaving visitors as mere observers rather than active learners. By integrating interactive elements such as games, augmented reality (AR), or hands-on activities, galleries can align their offerings with the principles of ELT and foster deeper connections with visitors. Experiential Learning Theory (ELT), developed by David Kolb in 1984, posits that learning is a continuous process grounded in experience. Kolb's theory defines experiential learning as a four-stage process: concrete experience, reflective observation, abstract conceptualization, and active experimentation [14]. Concrete experience is engaging directly with an activity or situation. Reflective observation is reflecting on the experience to identify patterns, insights, and areas for improvement. Abstract conceptualization involves formulating new ideas, concepts, or theories through reflection. Active Experimentation is applying these concepts to new situations, testing their validity, and refining understanding through practice. The theory of experiential learning states that learning emerges in two interconnected phases. Engaging in activities, accomplishing tasks, contemplating them, reflecting on the experiences, and applying the acquired knowledge [15]. The concrete experience (CE) facilitates the learner's progression to the reflective observation (RO) stage, when the learner contemplates the experience and engages in abstract conceptualization (AC) to formulate abstract notions that will subsequently be evaluated through active experimentation (AE) [16].

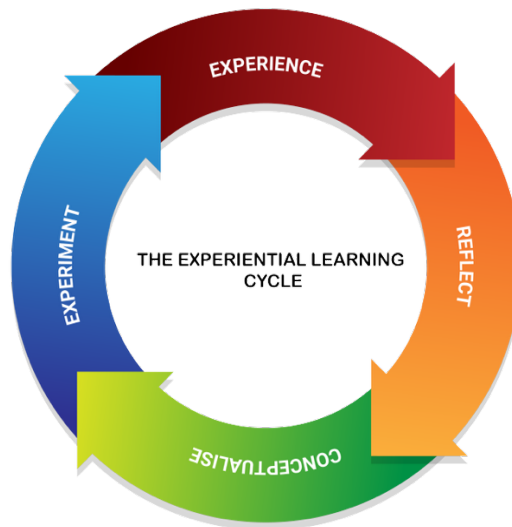


Figure 1. The experiential learning cycle

Successful interactive games in heritage settings adhere to specific design principles that ensure they are both engaging and educational, while also being culturally meaningful. The concept of integrating games into the educational process has existed for a considerable duration, particularly with adventure games [17]. First and foremost, cultural relevance is critical, and games must incorporate elements that

resonate with the local audience and authentically represent the heritage being showcased. It is crucial to consider incorporating local culture and cultural features when developing game software for a specific user group with a distinct cultural background [18]. For instance, integrating traditional stories, artifacts, or rituals into gameplay can create a sense of connection and pride among visitors, particularly those from the community. Secondly, accessibility plays a significant part in ensuring inclusivity. According to a review study on gamification in education and learning, the most common components are points, challenges, badges, and leaderboards [19]. To motivate users to remain active with the app, consider providing short-term rewards [20]. Thirdly, usability ensures that the game is intuitive and easy to navigate, thereby minimizing frustration and maximizing user engagement. Clear instructions, visually appealing interfaces, and seamless interactions are essential components of a user-friendly design. A user interface that is visually appealing and responsive to the user's wants and preferences is becoming increasingly significant, as it often enables personalized information processing, making interaction easier [21].

CONCEPTUAL FRAMEWORK

The conceptual framework for this study is grounded in experiential learning theory (ELT) and the principles of gamification. ELT posits that learning occurs through direct experience and reflection, making it particularly relevant for interactive environments, such as heritage galleries. Gamification, which involves applying game design elements in non-game contexts, has been shown to increase motivation, engagement, and knowledge retention. The Experiential Learning Theory (ELT) cycle, developed by David Kolb, outlines a four-stage process that fosters deep and meaningful learning through active engagement. Experiential learning offers several educational advantages, including enhanced problem-solving skills, increased engagement and retention, and a deeper understanding of topics [22]. In the context of an interactive game at the World Fuzhou Heritage Gallery, each stage plays a vital role in enhancing user experience and education. The cycle begins with direct knowledge, where users interact with the game by solving puzzles, exploring virtual spaces, or engaging with cultural artifacts, thereby immersing themselves in a hands-on learning experience. This is followed by reflection, during which users pause to think critically about what they've encountered, such as the cultural significance of an artifact or the historical narrative behind it. Next, in the conceptualization stage, users form abstract ideas or connections, linking their experiences to broader themes, such as Fuzhou's rich trade history or its traditional craftsmanship. Finally, in the application stage, users apply their newfound knowledge and skills in real-time by completing tasks, solving challenges, or simulating real-world scenarios, such as curating a virtual exhibition. Together, these stages form an iterative learning loop, ensuring that users not only absorb information but also internalize and apply it effectively, making the interactive game both engaging and educational.

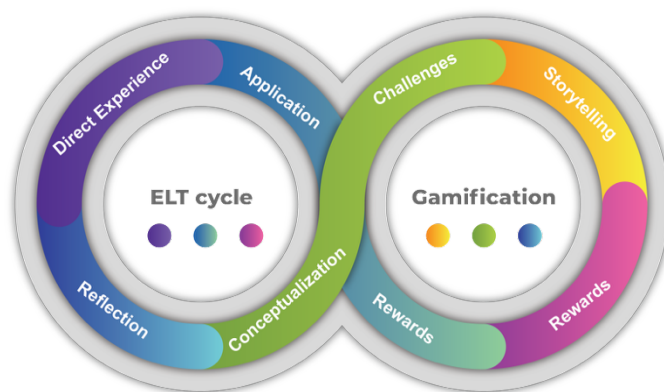


Figure 2. Integration of Experiential Learning Theory (ELT) and Gamification

Gamification is a powerful tool that applies game-design elements to non-game environments, such as heritage galleries, to enhance user engagement and motivation. At its core, gamification incorporates four key components: challenges, rewards, storytelling, and progression, each playing a vital role in creating an immersive and educational experience. Challenges, such as solving puzzles or completing tasks related to cultural artifacts, encourage critical thinking and active engagement, prompting users to delve deeply into the gallery's content. Rewards, such as earning points, badges, or unlocking new levels, provide a sense of achievement and motivate continued interaction. Storytelling immerses users in a narrative context, connecting them emotionally to the cultural heritage being presented, such as through historical scenarios or character-driven quests. Ultimately, progression provides users with a clear sense of advancement, enabling them to track their progress and maintain interest over time. Together, these elements transform a static gallery visit into an interactive, enjoyable, and meaningful learning experience, aligning perfectly with the World Fuzhou Heritage Gallery's goals of engaging younger audiences and promoting cultural education.

METHODOLOGY

The study will employ a mixed-methods approach, combining qualitative and quantitative techniques to examine the research problem thoroughly. This design facilitates a comprehensive understanding by utilising quantitative data collection to assess engagement and learning outcomes through instruments such as pre- and post-tests and surveys, while also incorporating qualitative insights to examine participants' experiences, perceptions, and feedback regarding the interactive game. First, the target group for this study consists of youth aged 12–20 who visit the World Fuzhou Heritage Gallery, as they represent the primary audience the interactive game aims to engage. The target group for this study consists of youth aged 12–20 who visit the World Fuzhou Heritage Gallery, as they represent the primary audience the interactive game aims to engage. A sample size of 50–100 participants is suggested to achieve a balance between statistical reliability for quantitative analysis and the feasibility of qualitative data collection. Simple regression analysis requires a minimum of 50 samples, with 100 samples often being preferred for most research situations [23].

Second, the purpose of the pre- and post-game evaluations is to assess variations in learning outcomes and engagement levels among participants. To evaluate methods of evaluation for pre-game, in-game, and post-game assessments of simulation games [24]. The pre-game survey will assess participants' initial interest levels before they interact with the game and evaluate their baseline understanding of the gallery's cultural heritage. After the gaming experience, the post-game survey will assess information retention, perceived involvement, and overall satisfaction with the interactive game. Both surveys will

incorporate Likert scale questions, such as "How engaging did you find the game?" to measure participants' experiences, alongside open-ended questions like "What did you enjoy most about the game?" to obtain qualitative insights into their opinions and preferences. Third, focus group discussions will be conducted to gather comprehensive qualitative insights into participants' experiences and perspectives on the interactive game. The purpose of these discussions is to examine subjects such as usability, enjoyment, and the perceived educational value of the game from the perspective of youth visitors. To do this, 2–3 focus groups will be formed, each comprising 6–8 individuals who have finished the game. The discussions will utilize semi-structured interview questions, to foster open debate while addressing key topics.

Fourth, the game creation and implementation process will require collaboration with game developers and educators to create an interactive game that corresponds with the gallery's content and appeals to the target audience of adolescents aged 12–20. The game will feature engaging elements, including a narrative, gamification features such as points and badges, and multimedia components like videos and audio tracks, to create an immersive and educational experience. Conducting gamified experiments indicates the necessity for pilot tests and pre-testing the foundational games [25]. A pilot test will be performed with a small group of 10–15 youth participants to gather preliminary feedback, enabling the refinement and enhancement of the game before its comprehensive implementation. This iterative method will help resolve potential problems and enhance the overall quality of the interactive experience.

The data analysis will employ both quantitative and qualitative methodologies to ensure a comprehensive understanding of the study's results. Statistical tools, such as SPSS, will be employed for the quantitative analysis of survey data. Essential analyses will involve using paired t-tests to compare pre- and post-game scores on knowledge exams, thereby assessing the educational impact of the interactive game. Descriptive statistics, including the mean and standard deviation, will be calculated to summarize the participants' engagement levels, providing insight into the game's effectiveness in capturing their interest. Furthermore, correlation analysis will be conducted to investigate potential correlations between involvement levels and learning outcomes, clarifying whether increased engagement is associated with enhanced knowledge retention. The qualitative analysis will involve transcribing focus group discussions and employing thematic analysis to identify recurring themes and patterns in participants' input. This methodology will provide deep knowledge into participants' experiences, perceptions, and recommendations concerning the interactive game, enhancing the quantitative data and facilitating a more comprehensive understanding of its effectiveness in improving visitor engagement and learning at the World Fuzhou Heritage Gallery.

DISCUSSION

By integrating interactive games into its exhibits, the museum can create immersive experiences that meet the current expectations of visitors, particularly those accustomed to dynamic, technology-oriented environments. These games can substantially improve educational outcomes by utilizing experiential learning methods, allowing visitors to actively engage with and absorb cultural knowledge in a meaningful way. Moreover, these activities can enhance the gallery's position as a cultural center for the surrounding community, fostering a deeper connection between younger generations and their past. By adopting interactive technology, the World Fuzhou Heritage Gallery may enhance visitor involvement while maintaining its significance and sustainability as an essential institution for education and cultural preservation in the digital era.

CONCLUSION

This study highlights the transformative potential of interactive games as a tool for revitalizing heritage galleries, such as the World Fuzhou Heritage Gallery in Sibiu. Traditional galleries often struggle to engage younger audiences who are accustomed to dynamic, technology-driven experiences. By incorporating

interactive games, these spaces can address this challenge by creating immersive and participatory environments that resonate with modern expectations. Such interventions not only capture the attention of younger visitors but also foster deeper connections with cultural content, ensuring that heritage spaces remain vibrant and meaningful in today's digital age. Interactive games leverage principles of experiential learning and gamification to bridge the gap between tradition and innovation. Experiential learning theory emphasizes the importance of direct engagement and reflection, making it particularly relevant in educational settings such as heritage galleries. Gamification, on the other hand, uses elements such as storytelling, rewards, and problem-solving to motivate users and enhance their learning outcomes. By combining these approaches, interactive games can transform static displays into dynamic experiences that educate and entertain, appealing to both the intellectual and emotional sensibilities of younger audiences. Ultimately, the integration of interactive games into heritage spaces has far-reaching implications. Beyond increasing visitor engagement, these interventions promote meaningful learning by enhancing content retention and cultivating cognitive skills, such as spatial reasoning and problem-solving. Moreover, they ensure the continued relevance of heritage galleries in an era where digital experiences are increasingly dominant. By aligning with the needs and preferences of younger generations, heritage spaces can fulfil their mission of preserving cultural history while inspiring future stewards of cultural preservation. This approach underscores the crucial role of innovation in protecting the cultural and educational significance of heritage institutions.

ACKNOWLEDGEMENT

The authors would like to thank UTS for funding this work under an internal grant 1/2021/09.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] Cultural Heritage in Action: Thematic Analysis of Policy and Practice Across Europe. (2023). Cultural Heritage in Action. European Commission. <https://culturalheritageinaction.eu/>.
- [2] Griggs, N., & Lacey, G. T. (2022). Barriers and limitations to national park visitation by millennials: Perceptions from second-generation Australians. *Annals of Tourism Research Empirical Insights*, 3(2), 100074. <https://doi.org/10.1016/j.annale.2022.100074>
- [3] Yolthasart, S., Intawong, K., Thongthip, P., & Puritat, K. (2024). The Game of Heritage: enhancing virtual museum visits through gamification for tourists. *TEM Journal*, 3359–3372. <https://doi.org/10.18421/tem134-7>
- [4] Wang, H., Gao, Z., Zhang, X., Du, J., Xu, Y., & Wang, Z. (2024). Gamifying cultural heritage: Exploring the potential of immersive virtual exhibitions. *Telematics and Informatics Reports*, 15, 100150. <https://doi.org/10.1016/j.teler.2024.100150>.
- [5] How heritage sites can attract and engage younger audiences. (2024, October 24). Mather & Co. <https://www.matherandco.com/>
- [6] Zakariya, K., Nizarudin, N. D., Jani, H. H. M., Ibrahim, P. H., Sani, J. A., & Harun, N. Z. (2024). TRANSITIONING FROM TRADITIONAL TO DIGITAL METHODS: INSIGHTS ON DOCUMENTING AND EXHIBITING LANDSCAPE HERITAGE. *Deleted Journal*, 14(1). <https://doi.org/10.31436/japcm.v14i1.877>
- [7] Agbisit, J. (2024, November 8). Are traditional museums and galleries on the brink of extinction? - The ASEAN Magazine. *The ASEAN Magazine*. <https://theaseanmagazine.asean.org/article/>
- [8] Wang, C., & Zhu, Y. (2022). A survey of museum applied research based on mobile augmented reality. *Computational Intelligence and Neuroscience*, 2022, 1–22. <https://doi.org/10.1155/2022/2926241>

- [9] Voorde, Britt M. ten (2023) Exploring Engagement in Science Museums : A Comparative Study of Static and Interactive Exhibitions.
- [10] Gong, X., Zhang, X., & Tsang, M. C. (2020). Creativity development in preschoolers: The effects of children's museum visits and other education environment factors. *Studies in Educational Evaluation*, 67, 100932. <https://doi.org/10.1016/j.stueduc.2020.100932>
- [11] Fard, A. (2023, April 18). UX Gamification Concept: Principles and Tactics. UI UX Design Agency for SaaS, Fintech & AI | Adam Fard UX Studio. <https://adamfard.com/blog/gamification/>
- [12] Khan, I., Melro, A., Carla, A., & Oliveira, L. (2020). Systematic Review on Gamification and Cultural Heritage Dissemination. *DOAJ* (DOAJ: Directory of Open Access Journals). <https://doi.org/10.34624/jdmi.v3i8.21934>
- [13] Ribeiro, M., Santos, J., Lobo, J., Araújo, S., Magalhães, L., & Adão, T. (2024). VR, AR, gamification and AI towards the next generation of systems supporting cultural heritage: addressing challenges of a museum context. *Web3D '24: Proceedings of the 29th International ACM Conference on 3D Web Technology*, 1–10. <https://doi.org/10.1145/3665318.3677172>
- [14] Dave, S. (2023, July 29). What is the experiential learning theory of David Kolb? *Practera*. <https://practera.com/what-is-the-experiential-learning-theory-of-david-kolb/>.
- [15] Ismail, H., & Saiful, S. (2022). Implementing experiential learning on students reading comprehension. *IDEAS Journal on English Language Teaching and Learning Linguistics and Literature*, 10(1), 926–949. <https://doi.org/10.24256/ideas.v10i1.288>
- [16] Nair, S., & Mathew, J. (2019). A theoretical framework for gamified learning. *International Journal of Innovative Technology and Exploring Engineering*, 8(12), 2846–2851. <https://doi.org/10.35940/ijitee.l3032.1081219>
- [17] DaCosta, B., & Kinsell, C. (2022). Serious Games in Cultural Heritage: A review of Practices and Considerations in the Design of Location-Based Games. *Education Sciences*, 13(1), 47. <https://doi.org/10.3390/educsci13010047>
- [18] Pyae, A. (2018). Understanding the role of culture and cultural attributes in digital game localization. *Entertainment Computing*, 26, 105–116. <https://doi.org/10.1016/j.entcom.2018.02.004>
- [19] Wang, Y., Hsu, Y., & Fang, K. (2021). The key elements of gamification in corporate training – The Delphi method. *Entertainment Computing*, 40, 100463. <https://doi.org/10.1016/j.entcom.2021.100463>
- [20] Garaialde, D., Cox, A. L., & Cowan, B. R. (2021). Designing gamified rewards to encourage repeated app selection: Effect of reward placement. *International Journal of Human-Computer Studies*, 153, 102661. <https://doi.org/10.1016/j.ijhcs.2021.102661>
- [21] Jylhä, H., & Hamari, J. (2020). Development of measurement instrument for visual qualities of graphical user interface elements (VISQUAL): a test in the context of mobile game icons. *User Modeling and User-Adapted Interaction*, 30(5), 949–982. <https://doi.org/10.1007/s11257-020-09263-7>
- [22] Tan, R. F., Kamaruzzaman, Z. A., Kamaruzzaman, Z. A., & Murti, G. T. (2023). An exploration of experiential learning using business simulation and gamification: A case study. *Journal of ICT in Education*, 10(2), 98–112. <https://doi.org/10.37134/jictie.vol10.2.6.2023>
- [23] Memon, M. A., Ting, H., Cheah, J., Thurasamy, R., Chuah, F., & Cham, T. H. (2020). Sample size for survey research: Review and recommendations. *Journal of Applied Structural Equation Modeling*, 4(2), i–xx. [https://doi.org/10.47263/jasem.4\(2\)01](https://doi.org/10.47263/jasem.4(2)01)
- [24] Bas, N., Löffler, A., Heininger, R., Utesch, M., & Krcmar, H. (2019). Evaluation methods for the effective assessment of simulation games. In *Advances in intelligent systems and computing* (pp. 626–637). https://doi.org/10.1007/978-3-030-11932-4_59
- [25] Mohaddesi, O., & Harteveld, C. (2020). The Importance of Pilot Studies for Gamified Research. *Extended Abstracts of the 2020 Annual Symposium on Computer-Human Interaction in Play*, 316–320. <https://doi.org/10.1145/3383668.3419889>