Journal of Human Centered Technology

https://www.humentech.utm.my E-ISSN: 2821-3467

Digital Immersion in Melaka: Enhancing Historical Learning through Technology on the Malaccan Sultanate

Hamzah Asyrani Sulaiman[1]*, Chia Yen Toh Darren[1], Che Ku Nuraini Che Ku Mohd[1]

[1]Fakulti Teknologi Maklumat dan Komunikasi, Universiti Teknikal Malaysia Melaka, 76100 Durian Tunggal, Melaka, Malaysia

*Corresponding Author asyrani@utem.edu.my

Cite: https://doi.org/10.11113/humentech.v4n1.99 Research Article

Abstract:
This article presents an evaluation on the “Enjoy Melaka” game, which aims to create an engaging educational tool that informs and enlightens the public society on the historical riches of Malaccan Sultanate. The main objectives of this study were to develop an interactive three-dimensional (3D) game that provides an immersive learning experience and to assess its effectiveness as a medium for disseminating historical information. The game was set around the Melaka River attraction site, allowing human players to explore a virtual world filled with historical landmarks and facts. The game was designed for the players to collect items to activate in-game checkpoints that displayed educational content about the Malaccan Empire. There were four checkpoints, each elaborating on different historical aspects of the Sultanate. The accumulated scores allowed the players to progress through the game until they achieved the maximum score. The game development involved creating a detailed 3D environment and integrating educational content into the gameplay. Data were collected through testing activities conducted with a target group of public users. This group provided feedback on the game's effectiveness in making historical information more engaging compared to traditional textual forms such as books, brochures, newspapers and online articles. The important contribution of this study is highlighted through the interactive 3D games which can serve as a more engaging and effective medium for historical education. By transforming the approach in conveying information about the Malaccan Sultanate, the “Enjoy Melaka” game has the potential to enhance public interest and understanding on historical period.

Keywords: 3D games; Historical games; 3D environment; Games for human; Melaka

1. INTRODUCTION

The historically prominent Sultanate of Melaka holds great significance in the history of Malaysia. Therefore, this project aims to enhance the dissemination of valuable historical facts and raise public awareness of the historical greatness of the Malaccan Empire.

The primary objective of this paper is to present a thorough evaluation of the usability of a 3D game development project named ‘Enjoy Melaka!’. This three-dimensional (3D) game offers a novel and non-traditional method of conveying historical facts and cultural riches of the Malaccan Sultanate, making it easier for the public to understand the history of the Malaccan Empire. To evaluate user satisfaction and effectiveness, five evaluation components were employed. The research question addressed in this study is how to best deliver educational content about Malaccan history to the public through 3D games.

Research Question: The main research question addressed in this study is: *How effective is the "Enjoy Melaka!" 3D game in improving user satisfaction and learning outcomes, compared to traditional methods of historical education?* This game was developed to engage the public in exploring the rich history of the Malaccan Sultanate through an interactive platform.

The importance of this project lies in its potential to transform the way historical information is communicated. Digital games can promote historical subjects by providing interactive and immersive experiences that traditional media often lack. Previous studies have shown that digital games can enhance learning by increasing engagement and motivation among users (1–5). By integrating educational content into an engaging 3D environment, the “Enjoy Melaka!” game aims to make historical learning more appealing and accessible.

In this paper, we aim to present a thorough evaluation of the usability of "Enjoy Melaka!" through user satisfaction surveys and effectiveness testing to demonstrate its potential as an educational tool.

Received 09 September 2024; Accepted 22 November 2024
Available online 06 February 2025

2. LITERATURE REVIEW

Games are artificially constructed expressions of play which allow the persons who are involved in the activity to transcend immediate imagination and direct physical activity. Eventually, games would branch out and seamlessly evolve into their electronic forms, which are known as video games, computer games and electronic games. Video games are electronic games that can be interacted with using human-controlled input through devices like controllers, keyboards or joysticks. Normally, video games are mostly used by society during leisure activities to induce feelings of relaxation and entertainment. However, they can also be used for educational purposes, computer-based learning, development of motor skills and improvement of hand-eye coordination (6–8).

To devise an effective video game, there needs to be an engaging level of interactivity in the gameplay. Also, the game must have an interesting and highly immersing story that the game player will be involved in. Besides, the quality and level of the art style and video game graphics would also make the game more attractive and more enticing.

Currently, there are a few examples of related work and existing systems that are like the 3D game that is constructed and created in this project. These examples of related work are serious games that contribute to the improvement in the learning capacities and the enhancement of the capabilities of the game players to learn and grasp new knowledge and new information (9–13).

In our study, we checked for a model of educational games that has existed for capability of bringing the attention of the player to learn something while playing the games. Among them is sandbox games called Minecraft Education Version and Discovery Tour: Ancient Egypt.

Minecraft Education is the educational edition of the popular sandbox game that is known as Minecraft. A sandbox game is a video game that offers the players a high level of autonomy and a huge capacity for creative actions as part of its gameplay (4). Sandbox games function on the basis that they are an open world game, meaning that the player can create anything or build anything they want in the game world. While the original Minecraft game has a gameplay that focuses on providing entertainment to its players, the Minecraft Education game is an application created to streamline the learning process for learners such as school children and young kids. This game is primarily designed for use in classrooms and school-like scenarios as an effective technology-assisted learning tool (5). Due to the open world nature of the Minecraft Education game, a huge diversity and variety of simulations can be constructed to assist the learning process in schools and classrooms. This means that teachers and schools can create any form of simulations in the Minecraft Education application to reenact and reengineer monumental historical events and important happenings in the history of the world to enable the students to learn more effectively about those historical events in classrooms. For example, the teachers can teach about the happenings of the Great Fire of London that happened in the 17th century by creating a custom simulation of the historic disaster in the Minecraft Education application and let the students to play around in the scenario to access effective levels of experiential learning.

“Discovery Tour: Ancient Egypt” is an educational game that allows the player to tour the world of ancient Egypt to learn more about life in Egypt during that era. The players can discover more about the historical happenings and daily life in those bygone periods of human history (6). Actual historians are among the people who have helped made the creation and embodiments of this history-themed game experience possible. Therefore, with these high amounts of historic accuracy, the players can know how everyday life is like for people living in the eras of Ancient Egypt. This game is so successful that a course that specializes in the teaching of Egyptology at University of California, Los Angeles (UCLA) has already assimilated this Egypt-based video game in its curriculum as an official learning tool for the students. The level of detail and degree of historic accuracy embedded into the history-based video game makes the players who play the game understand and know more about everyday life in Egypt without major discrepancies.

3. ENJOY MELAKA! GAME

The central objective behind the development of the 3D game, 'Enjoy Melaka!', is to serve as a dynamic and immersive platform for disseminating knowledge and insights pertaining to the illustrious history of the Malaccan Sultanate. This innovative educational endeavor seeks to illuminate the historical richness and cultural significance of the now-defunct Empire of Melaka during its golden age in the 15th century.

At its core, 'Enjoy Melaka!' endeavors to transcend traditional methods of historical education by harnessing the engaging and interactive nature of 3D gaming technology. By seamlessly integrating factual information and historical narratives within the gameplay experience, the game offers players a unique opportunity to delve into the annals of history in a captivating and enlightening manner.

Through meticulously crafted gameplay mechanics and narrative-driven storytelling, 'Enjoy Melaka!' not only imparts essential knowledge about the greatness and successful reign of the Melakan Sultanate but also fosters a deeper understanding and appreciation for its cultural heritage. Players are invited to embark on a virtual journey through the vibrant streets and grandiose landmarks of ancient Melaka, where they can unravel the complexities of its political, economic, and social landscape firsthand.

By leveraging the immersive capabilities of 3D gaming, 'Enjoy Melaka!' transcends the limitations of traditional educational mediums, offering a more streamlined, fruitful, and efficient means of learning. Through interactive exploration, players are empowered to actively engage with historical content, facilitating a higher level of comprehension and retention.

Moreover, 'Enjoy Melaka!' serves as a testament to the innovative potential of digital media in education, demonstrating how technology can be harnessed to bridge the gap between past and present, while fostering a sense of cultural pride and identity among players.

In essence, the creation of 'Enjoy Melaka!' represents a pioneering effort to harness the power of 3D gaming as a transformative tool for historical education. By combining entertainment with enlightenment, the game endeavors to

ignite curiosity, inspire learning, and preserve the legacy of the Malaccan Sultanate for generations to come. Figure 1 and 2 are the screenshots of the developed 'Enjoy Melaka!' 3D game.

Figure 1. Screenshot of the Main Menu of the Game.

Figure 2. Screenshot of the Enjoy Melaka! Gameplay.

3.1 Models of the Primary Landmarks of Melaka

All photographs and figures should have a good resolution and contrast quality. At least 300 dpi was applied for the resolution. The primary landmarks of the tourist attraction sites of Melaka were reconstructed and reengineered in the 3D modelling application of Blender to be used in the backdrop of the game of 'Enjoy Melaka!'. To do this, reference images of the actual structures in real-life scenarios were gathered from the Internet. Then, based on the architectural features and structural details depicted in the reference images, the 3D models of the Menara Taming Sari structures, the Stadthuys buildings and the Jambatan Old Bus Station structures were created and constructed in the 3D modelling application of Blender.

After that, the 3D models of the landmarks of Melaka were placed in the backdrop of the game so that the players who play the game can easily notice the prominent structures of the landmarks. Figure 3 shows all models that have been created using Blender software.

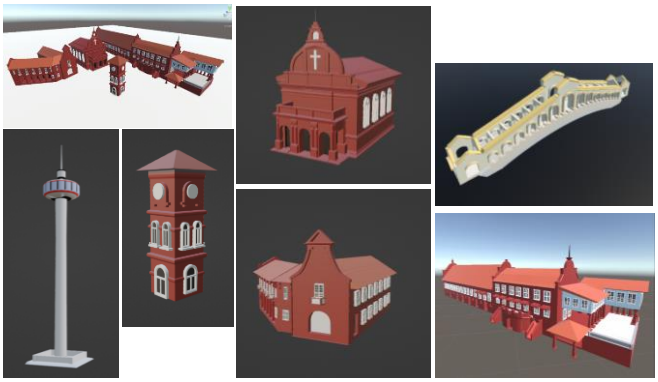


Figure 3. Screenshots of the 3D models of the landmarks of Melaka.

3.2 Models of the Buildings Found in the Surrounding Areas of the Actual Melaka River

Ten buildings that are visible on the riverbanks of the actual Melaka river site were reengineered and reconstructed into their virtual, digital, 3D forms using the 3D modelling application of Blender.

To do this, reference images were first collected to get the exact details of how the buildings look like in real-life. A portion of the reference images was derived from the web browser while a portion of the reference images was collected during a field trip to the actual Melaka river site in December 2023.

After successfully creating the 10 buildings, the 10 buildings were scattered around the game world and arranged in random, non-linear sequences. The buildings were oriented in appropriate ways to make the game world look physically attractive. Figure 4 shows all the related buildings.

Figure 4. Screenshots of the 3D models of the buildings found at the Melaka river attraction site.

3.3 The Model of the Primary Game Character

Based on reference images of the actual Melaka river cruise ferry, the 3D replica of the actual Melaka river cruise ferry was constructed and engineered in the 3D modelling application of Blender. The structural features of the 3D replica were carefully structured to resemble the actual ferry vehicle that operates on the Melaka river waters in real life. This 3D model of the Melaka river cruise ferry became the main character that can be controlled and moved around on the river waters to collect collectible items in the game world of the 'Enjoy Melaka!' game. Figure 5 shows the 3D model of the actual Melaka River cruise ferry.

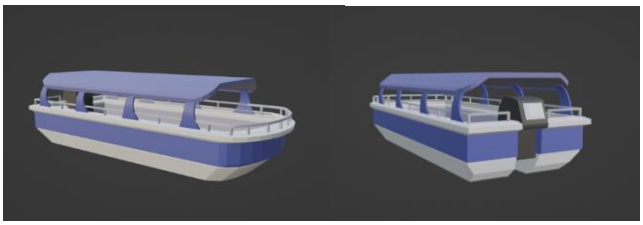


Figure 5. Screenshots of the 3D model of the actual Melaka River cruise ferry.

3.4 The River-Esque Game World

The gameplay was based on the player controlling a 3D replica of the actual Melaka river cruise ferry along the river waters that resembled the real Melaka river site. The angle of the camera view was manipulated by moving the cursor in different directions. The player can look around and explore the surroundings of the game world as they traverse along the river waters as the blue-colored ferry-like vehicle. Figure 8 shows all the river-esque entities.

The borders of the game world were adorned with mountainous terrains, ocean waters, city walls and huge castle gates to give the game world a city-esque environment of the olden eras. Besides, the river banks were decorated with landscaping items that were made up of low-poly 3D models of pots of plants, benches, trees and lampposts as shown in Figure 6.

Figure 6. Screenshots of the 3D models of the landscape items.

3.5 Exploration of the Game World and Learning-Based Quests

To play the game, the main character, the 3D replica of the actual Melaka river cruise ferry was maneuvered along the river waters that were structured to resemble the actual Melaka river. As it moved along the river waters and traveled into newer terrain, the game character collected collectibles such as the 3D models of a Malay-Javanese dagger called a 'keris'. These collectibles were generally brown in color. Every 7 'keris' collectibles collected, a checkpoint 'keris' appeared. The checkpoint 'keris' was golden-white in color. When the checkpoint 'keris' was retrieved, a floating UI item was visible. On this UI item, educational content and texts about the history of Melaka were shown and displayed to the player. Hence, through playing this game, the player learned more about the history of the Malaccan Sultanate.

When all 36 'keris' collectible items were collected by the game character, which was a blue ferry vehicle, the game ended. When the game ended, a Level Completion screen appeared, showing the score accumulated through playing the game. The player can choose to restart the game or quit the game. Figure 7 shows the 'keris' collectible items.

Figure 7. Screenshots of the 3D models of the 'keris' collectible items.

3.6 Narrations of the History of Melaka through Educational Pop-Ups

For educational purposes, pop-ups were integrated into the game world to enable the players to learn more about the history of Melaka. Figures 8 and 9 show the educational pop-ups that appeared during the game.

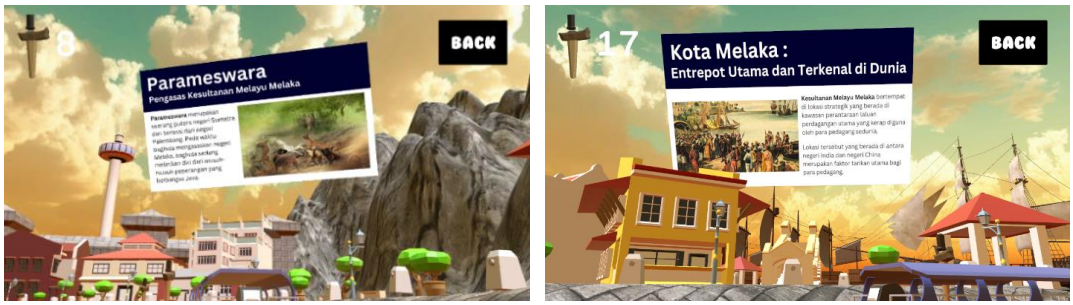


Figure 8. Pop-up pictures in the game world.

Figure 9. Pictures of educational content used as pop-ups in the 3D game.

The Malay language, the national language of Malaysia, was used to elaborate about the historical facts of Melaka. A picture was added to be fitted into the content along with some texts. The educational pop-ups appeared when the checkpoints were activated through collecting the relevant keris (a Malay-Javanese dagger) collectible items. A sound notification indicated that the educational pop-ups have appeared and that the relevant checkpoint has been activated.

3.7 Methodology for Game Development

The development of "Enjoy Melaka!" involved several key stages, from conceptualization to final production. We used Unity 3D as the game engine due to its flexibility and suitability for creating educational games with interactive 3D environments. The process began with historical research to gather accurate information about the Malaccan Sultanate, which was used to inform the game's narrative and design:

Game Design: The gameplay mechanics were designed to be simple yet engaging, with the player controlling a ferry that navigated along the Melaka River. The core mechanic of the game was exploration and collection, with players gathering historical artifacts (represented as collectible items, the "keris") which unlock educational content about the Malaccan Sultanate.
3D Modelling: Blender was used to create the 3D models of Melaka's landmarks and surrounding buildings. Reference images were taken from real-life scenarios and field research. Models of landmarks like Menara Taming Sari and Stadthuys were built to reflect historical accuracy, providing a recognizable backdrop for players.
Game Mechanics: The game incorporated basic mechanics of navigation, object collection, and score accumulation. The player accumulated points by collecting 'keris,' with periodic checkpoints that activate educational pop-ups about the historical significance of the collected items. Upon collecting all items, a final score was displayed, signaling the end of the game.
Sound and Interaction: Audio feedback played a crucial role in enhancing immersion. The sound cues notified players when key actions occurred, such as the appearance of educational content.
Testing and Refinements: Prototype versions of the game were tested with different groups, focusing on refining gameplay to make it intuitive and educational.

4. USABILITY EVALUATION

This segment of the study depicts diagrams and charts derived from the research-based outcomes and findings of the testing activities to summarize the conclusive results of the evaluation process.

4.1 Members of the Public

This study involved a sample of 10 respondents from the public. The data collection method used in this study was the use of questionnaires. An online questionnaire, through the Google Forms platform, was administered to the respondents along with a website link to a game publishing website. At the game publishing website, the test users can download the 'Enjoy Melaka!' game and play the game on their own computers and laptop. In the testing activities for the members of the public, the respondents evaluated the 3D game by giving their ratings and scores on a few aspects of the 3D game. The 4 aspects were efficiency, user interface, accessibility and effectiveness. The data collected from the testing activities were then analyzed and compiled into graphical representations and statistical visuals.

4.2 Charts of Efficiency for Members of the Public

This segment of the paper elaborates on the testing outcomes regarding the efficiency of the 3D game as a viable tool to help the members of the public learn more about the history of Melaka. The respondents were required to state their rating scores based on some statements to indicate the level of efficiency possessed by the 3D game. Figure 10 shows the results after the testing activities that were conducted with the members of the public.

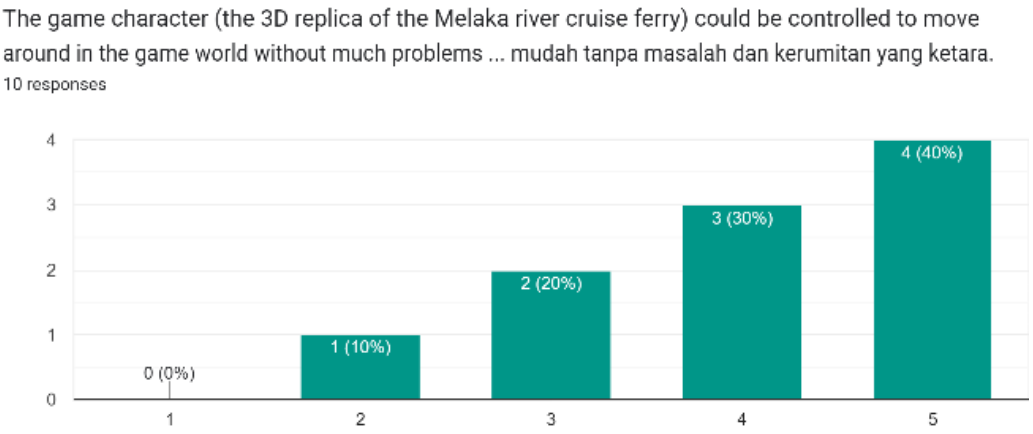
Out of the 10 respondents involved in this phase of the testing activities, 7 of them expressed a positive opinion about how well the game character in the 3D game moved in the game world. This means that there was none of any huge problems and major deficiencies when the game player controlled the game character to manoeuvre the game world. Based on the results, the players were not hindered from controlling the game character seamlessly.

Next, out of the 10 respondents, 9 of them stated that the experience of playing the 3D game makes them feel happy, contented and excited. The results indicated clearly that positive emotions arose when the game was played. This means that game has the capability to capture the attention of the players and make them look forward to play the game. It also means that the 3D game is an effective learning tool due to the vibrant, colourful and explosive nature of the way. The educational experience was accessed through playing the 3D game. Besides, 8 respondents from the total pool of 10 respondents, or 80% of all respondents expressed a positive stance regarding the correctness of the functions of the buttons found in the 3D game. This means that most of the buttons in the game did not have malfunctions and errors when the players played the game.

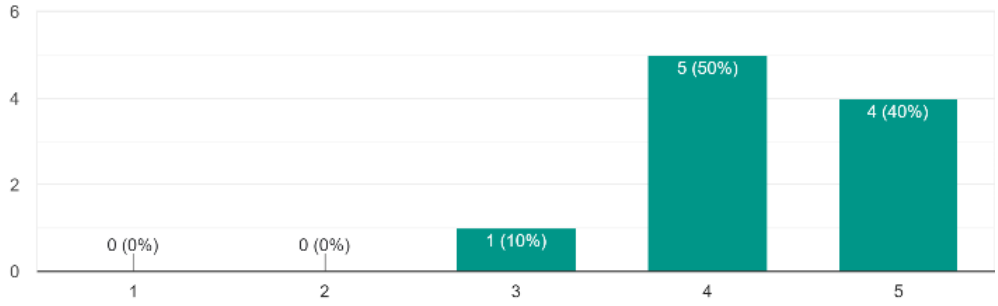
Out of the 10 respondents involved, 7 of them expressed positive stances that the 3D game has a good tempo in its gameplay. This means that the experience of playing the game was not erratic, chaotic or disorderly. With a good tempo and pace, the players derived positive feelings from playing the game and enjoyed the game more. Then, only 4 persons out of the 10 respondents, or, approximately 40% of all respondents stated that the process of playing the 3D game was not boring or dull. There are 5 respondents, or, 50% of the respondents that expressed a neutral stance while one of 10 the respondents stated that the game induced feeling of boredom. Based on the results, it is likely that the game can be further improved to possess more attributes and features that can automatically captivate the people who play the game and not make them feel bored and emotionally stale.

Six persons from the 10 respondents who were involved in the testing activities stated that the process of playing the 3D game was made even more enjoyable due to the addition and integration of sound effects and background music. The other 4 respondents expressed a neutral stance. This is probably because the audio components and sound effects increased the feelings of reward and gratification every time the player collected a collectible item or triggers a checkpoint to pop-up. Also, the audio that emanated from the buttons in the game makes the game seem interesting and makes it easier for the mind of the player to be alert and have heightened the level of attention.

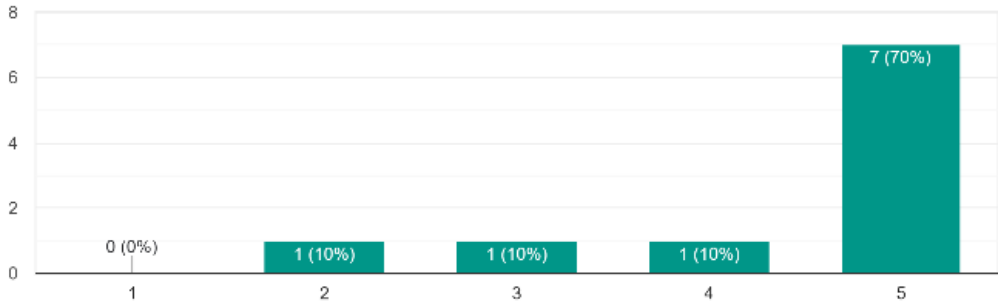
Also, 9 of the 10 respondents stated a positive stance that the keris (a Malay-Javanese dagger) collectible items function well in the gameplay as the respondents can collect the keris collectibles items that hover above the river waters. This indicates that there are minimal occurrences of errors and malfunctions that were presented in the collectibles system of the game. Eight of the 10 respondents expressed a positive opinion on the functions of the audio sliders that were embedded in the ‘Options’ menu. This indicates that there was no malfunctioning feature in the aspects of the game that enabled the adjustment of the audio volume and that the audio volume in the game can be effectively controlled using the audio sliders.



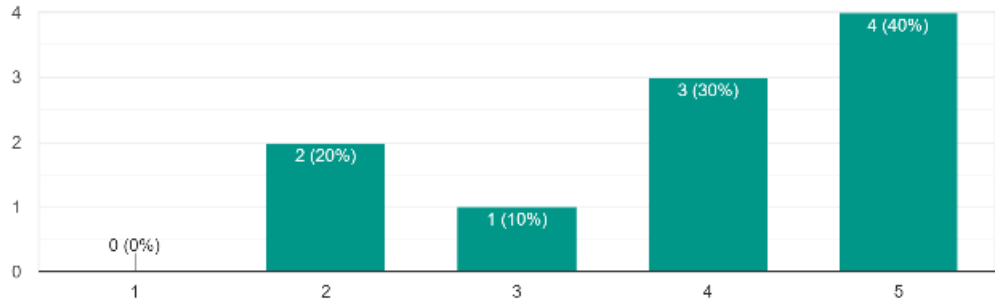
The experience of playing the game makes me feel happy, contented and excited. Proses bermain permainan 3-Dimensi ini membuatkan saya merasai...perasaan kegembiraan, kepuasan dan keterujaan.
10 responses



There are no significant errors in the way the buttons function. Masalah kebolehfungsian yang serius dan rumit tidak wujud dalam butang-butang yang muncul dalam permainan 3-Dimensi ini.
10 responses



The tempo of the gameplay is appropriate, well-paced and not too erratic. Tempo dan kelajuan proses permainan 3-Dimensi ini amat berpatutan, berirama tenang dan tidak terlalu tergesa-gesa.
10 responses



The gameplay experience does not make me feel bored. Proses permainan bagi permainan 3-Dimensi ini tidak membuat saya berasa emosi berunsur kebosanan.
10 responses

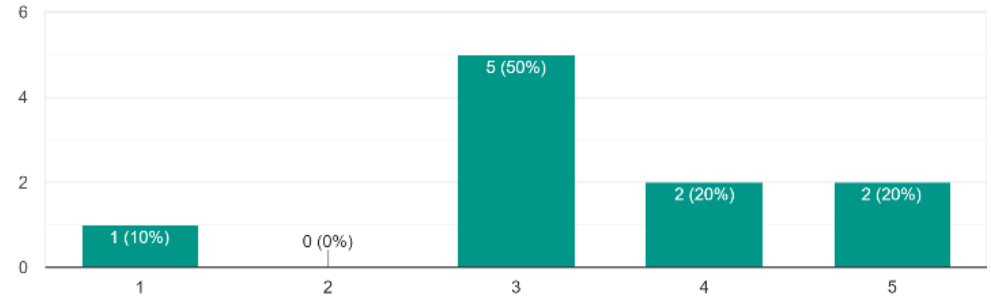


Figure 10. Results of efficiency by public members.

5. CONCLUSION

The findings suggest that "Enjoy Melaka!" enhances user engagement and retention of historical knowledge. The game's combination of narrative-driven gameplay and educational checkpoints significantly contributed to both user satisfaction and the effective learning of historical content.

Overall, the rationale behind the implementation and development of this 3D game is an attempt to devise a system that could convey and deliver information about the cultural heritages and historical facts in a much more fruitful, relevant and streamlined way. The players could learn and gain insights and useful knowledge more effectively and easily through the assistance of this 3D game as a learning tool.

AUTHORSHIP CONTRIBUTION STATEMENT

Hamzah Asyrani Sulaiman: supervision, writing - review & editing; Chia Yen Toh Darren: writing - original draft, formal analysis, writing - review; Che Ku Nuraini Che Ku Mohd: supervision, conceptualization

DATA AVAILABILITY

Data are available within the article and/or its supplementary materials.

DECLARATION OF COMPETING INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGMENT

The authors sincerely thank Universiti Teknikal Malaysia Melaka (UTeM), the Department of Interactive Media, the Faculty of Information and Communication Technology (FTMK), the Advanced Interaction Technology (AdViT) research group, and all those who supported and participated in this research.

REFERENCES

(1) Gouveia D, Lopes D, Carvalho CV De, Batista R. Time mesh: An educational historical game. 2012 IEEE Fourth International Conference on Digital Game and Intelligent Toy Enhanced Learning. 2012; 171–173. https://doi.org/10.1109/DIGITEL.2012.49
(2) Rahimi FB, Kim B, Levy RM, Boyd JE. A game design plot: Exploring the educational potential of history-based video games. IEEE Trans Games. 2020; 12(3):312–322. https://doi.org/10.1109/TG.2019.2954880
(3) Fischer LE. “RevQuest: The Black Chambers”: Bringing together technology and gaming at a historical site. 2013 Digital Heritage International Congress (DigitalHeritage). 2013; 551–558.
(4) Giang NKH, Ferschin P, di Angelo M. Medieval craftsmen at castle Waldenfels historical construction work as serious game. 2015 Digital Heritage. 2015; 243–250. http://hdl.handle.net/20.500.12708/56135
(5) Ali MF Bin, Jeu NP, Teeng CH. Enriching Malaysian cultural and folklore through mobile game learning development: Wau & Toyol. 2020 IEEE Graphics and Multimedia (GAME). 2020; 1–6. https://doi.org/10.1109/GAME50158.2020.9315081
(6) Udeozor C, Russo-Abegão F, Glassey J. Perceptions and factors affecting the adoption of digital games for engineering education: A mixed-method research. Int J Educ Technol High Educ. 2023; 20(2). https://doi.org/10.1186/s41239-022-00369-z
(7) Wang LH, Chen B, Hwang GJ, Guan JQ, Wang YQ. Effects of digital game-based STEM education on students’ learning achievement: a meta-analysis. Int J STEM Educ. 2022; 9. https://doi.org/10.1186/s40594-022-00344-0
(8) Valentová M, Brečka P. Assessment of digital games in technology education. Int J Eng Pedagogy. 2023; 13(2). https://doi.org/10.3991/ijep.v13i2.35971
(9) Demir Ü. An examination of the impact of game-based geometric shapes education software usage on the education of students with intellectual disabilities. ECNU Rev Educ. 2022; 5(4).
(10) Udeozor C, Toyoda R, Russo Abegão F, Glassey J. Digital games in engineering education: Systematic review and future trends. European J Eng Educ. 2023; 48. https://doi.org/10.1080/03043797.2022.2093168
(11) Ekin CC, Polat E, Hopcan S. Drawing the big picture of games in education: A topic modeling-based review of past 55 years. Comput Educ. 2023; 194. https://doi.org/10.1016/j.compedu.2022.104700
(12) Chung S, Kim SI, Hwang H, Han DH. The effectiveness of game coding education on problematic internet gaming. Psychiatry Investig. 2023; 20(6). https://doi.org/10.30773/pi.2022.0218
(13) Ullah M, Amin SU, Munsif M, Safaev U, Khan H, Khan SS, Ullah H. Serious games in science education. A systematic literature review. Virtual Real Intell Hardware. 2022; 4(3). https://doi.org/10.1016/j.vrih.2022.02.001