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DESIGN AND EVALUATION OF A 2D EDUCATIONAL GAME ON MALAYSIAN CULTURAL HERITAGE: TRAVEL GAME – HERITAGE QUEST JOURNEY TO THE PAST

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ABSTRACT

This study presents the design, development, and evaluation of *Travel Game: Heritage Quest – Journey to the Past*, a 2D educational game created to enhance awareness of Malaysia's tangible cultural heritage, particularly the Lenggong Valley and the *Perak Man*. Developed using the open-source Godot Engine (v4.0) and guided by the Agile methodology, the project integrates interactive storytelling, puzzles, and non-playable character (NPC) dialogues to promote heritage learning through exploration and problem-solving. A total of 21 participants, including students and general users, took part in usability testing via online playthroughs and post-game surveys. Quantitative results indicated high usability and engagement scores (mean ≥ 4.6/5), while qualitative feedback revealed strong appreciation for the game's visual design, narrative structure, and cultural content. Participants also demonstrated improved understanding of Malaysian prehistoric heritage after gameplay. These findings suggest that serious games can effectively complement heritage education by transforming passive learning into interactive, meaningful experiences. The study contributes to the growing body of digital heritage learning by offering a localized, culturally contextualized model for integrating educational games into both academic and tourism settings.

Keywords: Cultural Heritage, Educational Game, Game-based Learning, Lenggong Valley, Usability Evaluation

INTRODUCTION

Cultural heritage is a cornerstone of national identity, memory, and continuity. It encompasses tangible assets such as artifacts, monuments, and archaeological sites that narrate the evolution of civilizations (Usero & del Brío, 2011). In Malaysia, the Lenggong Valley represents one of the most significant heritage landscapes, recognized by UNESCO in 2012 for its archaeological importance, particularly the discovery of the Perak Man—the oldest complete human skeleton in Southeast Asia. Despite its global recognition, public awareness and appreciation remain limited, especially among younger generations who often perceive heritage education as distant, abstract, or irrelevant (Ministry of Tourism, Arts and Culture Malaysia, 2020; Rashid et al., 2013).

Traditional heritage education methods—such as textbooks, lectures, and museum visits—have been criticized for their passive and didactic nature, which struggle to engage digital-native learners meaningfully. Today's generation often gravitates toward interactive, technology-driven experiences that emphasize participation, exploration, and creativity. In this regard, game-based learning has emerged as a transformative pedagogical approach, offering the ability to combine entertainment with structured educational goals. Research shows that serious games enhance engagement, motivation, and cognitive retention, particularly in cultural and historical education (DaCosta & Kinsell, 2022).

Globally, a range of initiatives demonstrate the potential of digital games in cultural heritage. Projects such as *Assassin's Creed: Discovery Tour* (Ubisoft, 2019), *Heritage Quest AR* (ImpactGames.eu, 2024), and the *UNESCO World Heritage Sites Quiz* (McLean, 2022) illustrate how interactive experiences can translate complex historical narratives into accessible knowledge. However, these tools often present limitations: some require expensive hardware, while others lack contextual alignment with local cultures, thereby reducing their educational impact for specific communities. This highlights the need for locally grounded, accessible, and culturally relevant digital heritage games.

In Malaysia, the development of such educational games is still in its early stages. Existing projects, like *Hey Anak Malaysia! Jom Bermain* (Abd Ghani & Anuar, 2025), indicate the promise of localized efforts but also reveal gaps in narrative depth, gameplay complexity, and contextual richness. Addressing this gap, this study introduces *Travel Game: Heritage Quest – Journey to the Past*, a 2D educational game designed with the Godot Engine and developed using Agile methodology. The game focuses on the Lenggong Valley's tangible heritage and integrates quests, puzzles, and interactions with non-playable characters (NPCs) to foster active learning.

The primary objective of this study is to design, develop, and evaluate a serious educational game that enhances awareness of Malaysia's tangible heritage, with emphasis on the Lenggong Valley and the Perak Man. Beyond assessing usability and player engagement, the study also examines the game's potential as a culturally relevant tool for heritage education and digital tourism. In doing so, it contributes to bridging the gap between conventional heritage education and the interactive learning preferences of contemporary learners.

LITERATURE REVIEW

Digital Game-Based Learning and Cultural Heritage

Digital game-based learning (DGBL) has been widely recognized as a promising educational approach that merges entertainment with structured learning objectives. Within the domain of cultural heritage, serious games provide immersive, interactive environments that encourage exploration, problem-solving, and narrative-driven learning (DaCosta & Kinsell, 2022; Lampropoulos et al., 2022). These games enhance engagement and motivation while also promoting long-term retention of knowledge, aligning well with constructivist, learner-centered pedagogies. By integrating historical content with gameplay mechanics, DGBL can make complex cultural narratives accessible to younger audiences who may not otherwise engage with heritage education.

International Developments in Heritage Games

Globally, several projects highlight the potential of digital games to preserve and disseminate heritage knowledge:

- **The Dawn of Art** (Atlas V, Novelab & Google Arts & Culture, 2020) uses virtual reality to recreate the Chauvet Cave, immersing players in prehistoric art. While emotionally powerful, its reliance on advanced VR equipment limits accessibility, especially in schools and low-resource contexts.
- **Heritage Quest AR** (ImpactGames.eu, 2024) applies augmented reality to connect users with physical heritage sites. It encourages exploration and strengthens personal connections with history but is constrained by AR-compatible devices and internet connectivity.
- **UNESCO World Heritage Sites Quiz** (McLean, 2022) offers a lightweight, web-based learning format that is highly accessible. However, its trivia-style interaction lacks narrative depth and sustained engagement, reducing its effectiveness for deeper cultural education.

These examples demonstrate innovation but also reveal recurring challenges: technological requirements, lack of cultural contextualization, and limited narrative depth. This underlines the importance of designing accessible and locally relevant heritage games.

Local and Regional Heritage Games

In Southeast Asia, localized projects are emerging to address cultural awareness among youth. Malaysia's *Hey Anak Malaysia! Jom Bermain* (Abd Ghani & Anuar, 2025) is a pioneering example, offering school-based game experiences that resonate with Malaysian learners. Similarly, *Upin & Ipin Universe* (Streamline Studios, 2025) integrates cultural mini-games and folklore into an open-world exploration, showcasing the potential of games to reflect indigenous traditions and practices. Despite these advances, many local games remain limited in scope, lacking the depth and contextual richness needed for sustained educational impact (Cesaria et al., 2020).

Comparative Analysis

A critical review of heritage games reveals strengths and limitations across international and local projects. Table 1 summarizes the main findings.

Table 1

Comparative Analysis of Heritage Education Games and Platforms

Project / Game	Type of Experience	Key Strengths	Key Limitations	Relevance to Malaysian Heritage
The Dawn of Art (Atlas V, 2020)	Virtual Reality (VR)	Highly immersive, realistic recreation of prehistoric cave art; strong emotional engagement	Requires advanced VR hardware; limited to well-funded institutions; primarily Western focus	**Low** – global narrative with minimal local contextual value
Heritage Quest AR (ImpactGames.eu, 2024)	Augmented Reality (AR)	Encourages real-world exploration; enhances personal connection with history	Dependent on AR-compatible devices and internet; limited local heritage representation	**Medium** – adaptable but lacks Malaysian-specific integration
UNESCO World Heritage Sites Quiz (McLean, 2022)	Web-based Quiz	Simple, device-friendly; promotes repetition and recall; accessible for all ages	Lacks narrative depth and interactivity; engagement is short-lived	**Low** – generic, global content; overlooks regional heritage
Upin & Ipin Universe (Streamline Studios, 2025)	Open-world Exploration	Strong cultural identity; includes traditional games, folklore, and narratives; appealing to local audiences	Technology-heavy; does not fully emphasize historical heritage	**High** – reflects Malaysian culture but more entertainment-focused
Hey Anak Malaysia! Jom Bermain (Abd Ghani & Anuar, 2025)	2D Educational Game	Designed for Malaysian schools; resonates with youth; introduces heritage themes	Limited depth and complexity; mostly introductory exposure	**High** – strong cultural relevance, but lacks scalability
Travel Game: Heritage Quest –	2D Educational Game	Culturally contextualized; historically accurate; puzzle and quest-	Minor usability refinements	**Very High** – directly addresses Malaysian tangible heritage

Journey to the Past (This Study)		driven interactive storytelling; accessible via PC	needed; scope for future expansion	(Lenggong Valley, Perak Man)

Research Gap and Contribution

The literature demonstrates that while heritage games are expanding worldwide, most face three recurring limitations: (i) high technological barriers that hinder accessibility, (ii) insufficient alignment with local cultural contexts, and (iii) limited integration of interactive storytelling to support critical learning. In Malaysia, current initiatives provide valuable foundations but remain limited in narrative depth and focus more on entertainment than heritage preservation.

This study addresses these gaps through *Travel Game: Heritage Quest – Journey to the Past*, a 2D educational game that balances accessibility with cultural authenticity. Designed with the Godot Engine (v4.0) and Agile methodology, the game integrates quests, puzzles, and NPC interactions grounded in the Lenggong Valley's archaeological heritage. By blending historical accuracy with interactive design, the project contributes both to heritage education and to the growing body of locally contextualized digital learning tools.

METHODOLOGY

The development of *Travel Game: Heritage Quest – Journey to the Past* adhered to the Agile methodology, which emphasizes frequent iterations, stakeholder feedback and progressive refinement of both educational value and usability. Agile development was chosen due to its proven efficacy in educational game contexts where iterative cycles facilitate adaptation to user feedback and evolving requirements (Abrahamsson et al., 2017). Research indicates that applying Agile processes such as time-boxed sprints, iterative prototyping, and continuous review significantly enhances the usability and educational quality of serious games (DaCosta & Kinsell, 2022).

The Agile lifecycle adopted in this project consists of six core stages: Planning, Design, Development, Testing, Deployment and Review. Each stage contributed to the development of a prototype that was gradually enhanced to meet educational goals, gameplay expectations and usability standards.

Figure 1

The phases of Agile Methodology

Game Development Approach

During the Planning phase, project scope, learning objectives, and cultural content were defined based on literature review and consultation of Lenggong Valley heritage resources. The Design phase involved creating storyboards, flowcharts, and mock-ups of game levels (Cave, Forest, Village, Tent, Secret Forest), integrating quests, puzzles, and non-playable character (NPC) interactions. The Development phase utilized the Godot Engine (v4.0) with GDScript for logic implementation, Aseprite for pixel art, and Adobe Illustrator for visual enhancements. Each sprint produced functional prototypes tested internally before refinement.

Data Collection

To evaluate usability and educational impact, user testing was conducted with 21 participants. Recruitment targeted secondary school students, university students, and casual players to represent diverse age groups and gaming backgrounds. Participants were selected through convenience sampling but ensured representation of digital natives (youth learners) and general users.

The evaluation was carried out via an online playtest hosted on *Itch.io*. Participants accessed the game on personal computers and completed a structured questionnaire delivered through Google Forms after gameplay. The questionnaire contained:

- **Demographic items** (age, gender, gaming frequency, educational background).
- **Usability items** (interface design, navigation, control intuitiveness, visual appeal).
- **Educational items** (clarity of historical content, understanding of Lenggong Valley heritage, perceived learning).

- **Engagement items** (enjoyment, motivation, willingness to recommend).

Most questions used a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), supplemented by open-ended questions for qualitative feedback. This dual design enabled both quantitative analysis of trends and qualitative insights into strengths and limitations.

System Implementation and Testing

The game was implemented as a 2D top-down exploration-based design featuring quests, puzzles, and interactive dialogues with NPCs. Educational content was embedded into these interactions to ensure that learning was achieved through gameplay rather than passive reading. The prototype was deployed on *Itch.io* to maximize accessibility and allow cross-device compatibility testing.

Testing followed two stages:

1. **Internal Testing** – Iterative debugging and refinement within the research team during each sprint cycle.
2. **Field Testing** – External user playtesting with the 21 participants, focusing on functionality, navigation, and educational clarity.

The game followed a linear loop:

Main Menu → Intro Video → Exploration Scenes (Cave, Forest, Village, Tent, Secret Forest) → Outro → Main Menu.

Each scene included quests, NPCs, objects and branching dialogues.

GDScript was used to implement logic, events and interactions. Pixel art ensured a consistent visual style, while audio and ambient music enhanced immersion. All interactions were designed to deliver historical content in an engaging, non-disruptive way.

Evaluation and Analysis

Evaluation focused on two main dimensions:

4. **Usability Evaluation** – Based on ISO 9241-11 principles, examining effectiveness (task completion), efficiency (ease of navigation), and satisfaction (overall experience). Mean scores and standard deviations were computed for Likert-scale responses, while open-ended responses were thematically analyzed for recurring issues.

4. **Educational Effectiveness** – Measured through self-reported knowledge gain, recognition of the Perak Man, and understanding of Lenggong Valley's heritage. The questionnaire items were aligned with the study's learning objectives to assess whether the game improved cultural awareness.

Findings from both quantitative and qualitative data were triangulated to provide a holistic understanding of the game's performance.

Ethical Considerations

All participants were informed about the purpose of the study and consent was obtained before participation. Data was collected anonymously and used solely for research purposes.

Deployment

Following initial testing and refinement, the improved version of the prototype was deployed on Itch.io for wider access. The deployment served both functional and evaluative purposes. Functionally, it provided a complete experience from start to finish. Evaluatively, it served as a real-world testbed for longer play sessions, feedback on pacing and player learning outcomes. The deployment version included fully implemented quests, fixed navigation paths, optimized animations and balanced audio-visual elements. Players could complete the entire game loop, interact with all educational content and revisit scenes to reinforce learning. This stage also allowed for system compatibility testing across different devices (different spec of computers) and browsers. Player metrics such as time spent in each scene and completion rates were informally tracked during playthroughs.

Review

The review phase involved a comprehensive evaluation of the game's overall effectiveness and readiness for academic submission. Collected data from testing and deployment were assessed against the original project goals and success metrics, with all work executed independently.

Improvements were made based on reviewer suggestions and gameplay recordings. Specific adjustments included refining quest instructions, reducing animation lag and simplifying dialogue where players had reported confusion. Educational content was cross-verified for historical accuracy and simplified for better comprehension without losing depth. This phase ended with a refined prototype that is stable, rich in content, educationally sound, and ready for both presentation and academic dissemination.

DESIGN AND DEVELOPMENT

This section outlines the design rationale, narrative and gameplay design. Then it follows through with educational design considerations summarises the core features of the Travel Game: Heritage Quest – Journey to the Past.

Design Rationale

The design of Travel Game: Heritage Quest – Journey to the Past was guided by two central objectives:

1. To promote awareness and understanding of Malaysia's tangible cultural heritage, particularly the Lenggong Valley and the *Perak Man*.
2. To provide an engaging, interactive learning experience that supports constructivism and exploratory learning approaches.

The game was developed using the Godot Engine (v4.0), chosen for its open-source flexibility, efficient 2D rendering, and compatibility with educational deployment on standard PCs. The Agile methodology enabled continuous refinement through iterative sprints, integrating user feedback into each development cycle. Each sprint focused on improving both usability and educational alignment, ensuring that design iterations were responsive to user testing outcomes.

Narrative and Gameplay Design

The storyline centers on *Nafu*, a university student who is transported back in time to the prehistoric Lenggong Valley. Through quests and interactions with non-playable characters (NPCs), Nafu learns about ancient tools, foraging practices, and the cultural significance of the *Perak Man*. The game's linear progression—spanning locations such as the Cave, Forest, Village, Tent, and Secret Forest—follows a structured knowledge path where each stage introduces and reinforces specific heritage concepts.

Pedagogical integration was embedded through interactive storytelling, problem-solving quests, and in-game quizzes. Each interaction required players to apply learned knowledge, transforming historical facts into experiential understanding. For instance, answering NPC questions correctly allowed progression to new areas, reinforcing recall and comprehension through gameplay mechanics rather than traditional instruction.

Educational Design Considerations

The game incorporated key learning design principles:

- **Contextual Authenticity** – Visuals and dialogue were adapted from verified historical and archaeological references to maintain authenticity and educational value.
- **Scaffolded Learning** – The quests were sequenced to gradually increase complexity, allowing players to build understanding through exploration.
- **Feedback Mechanisms** – In-game feedback (via quizzes and NPC dialogue) reinforced correct knowledge and provided gentle correction for mistakes, fostering self-paced learning.
- **Cultural Representation** – Art direction used pixel-art aesthetics to visually interpret prehistoric settings while ensuring accessibility across devices with minimal performance demand.

Prototype Development *(Travel Game: Heritage Quest – Journey to the Past)*

A functional prototype of *Travel Game: Heritage Quest – Journey to the Past* was developed to fulfil the game requirements outlined during the initial design phase. Prototyping played a vital role in validating design choices. It also helped refine educational and interactive features while allowing user feedback to be collected through iterative testing. The Godot Engine (v4.0) was selected for its strong 2D development capabilities, while Aseprite supported the creation of pixel-based visual assets. Adobe Illustrator and Photoshop were used to enhance environment and UI designs. CapCut handled editing for cinematic and educational video sequences embedded in cutscenes. These tools allowed seamless integration of visuals, narrative and gameplay, resulting in a responsive prototype suitable for desktop deployment. Figures 11 and 23 display selected interface and gameplay screens from the final build.

Figure 2

The Main Menu of Travel Game: Heritage Quest – Journey to the Past

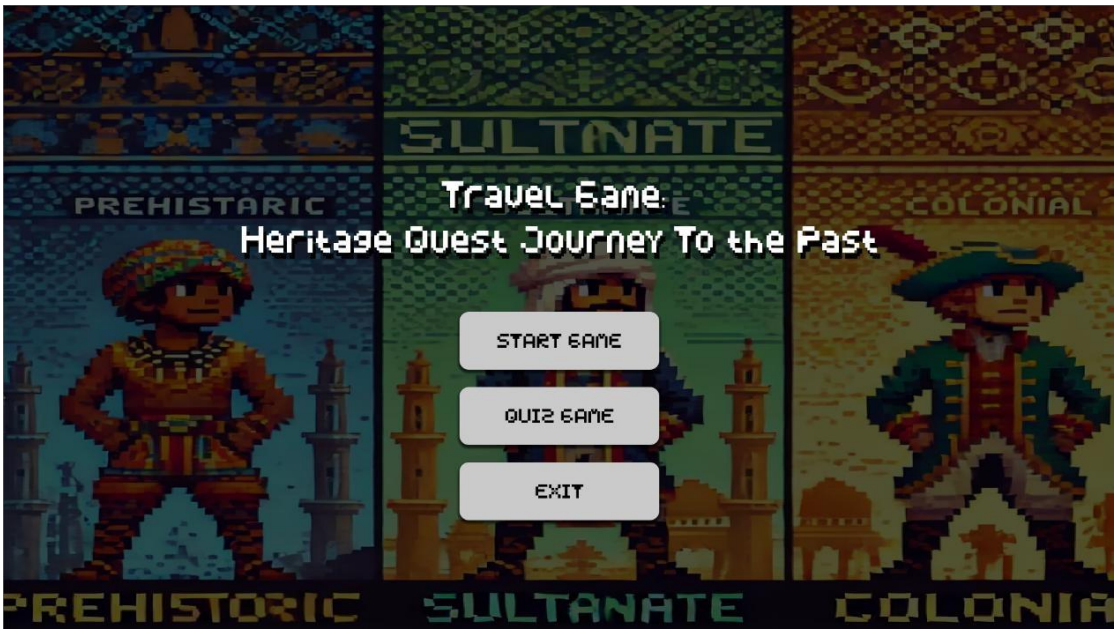


Figure 3

The Quiz Game of Travel Game: Heritage Quest – Journey to the Past (View learning)

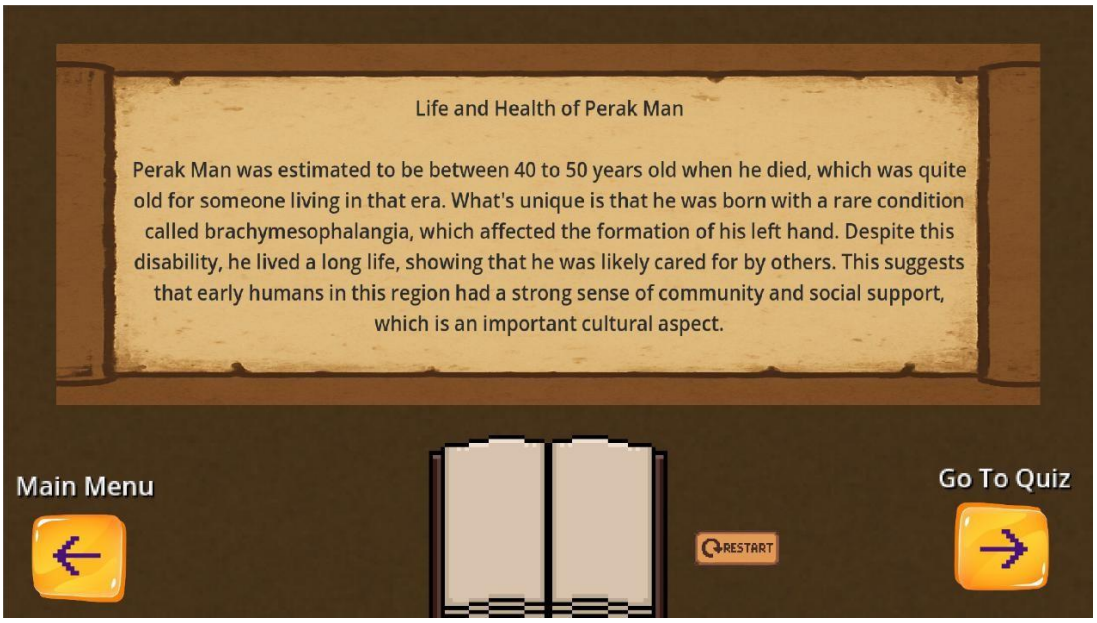


Figure 4

The Quiz Game of Travel Game: Heritage Quest – Journey to the Past (Answer Quiz)

Figure 5

The Quiz Game of Travel Game: Heritage Quest – Journey to the Past (Score Quiz)

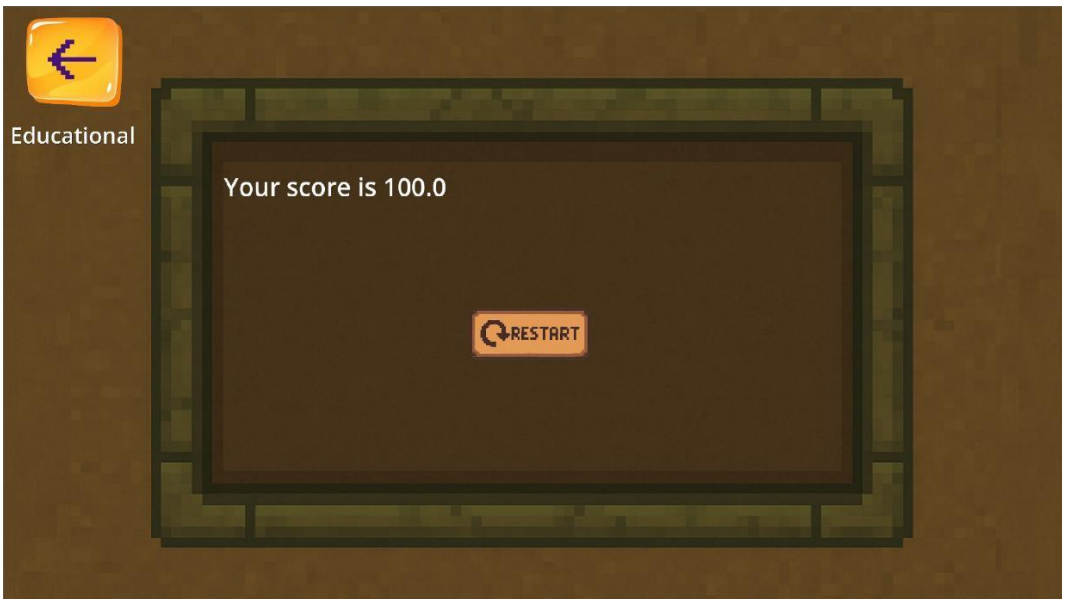


Figure 6

The Video Introduction of Travel Game: Heritage Quest – Journey to the Past (Enter Game)

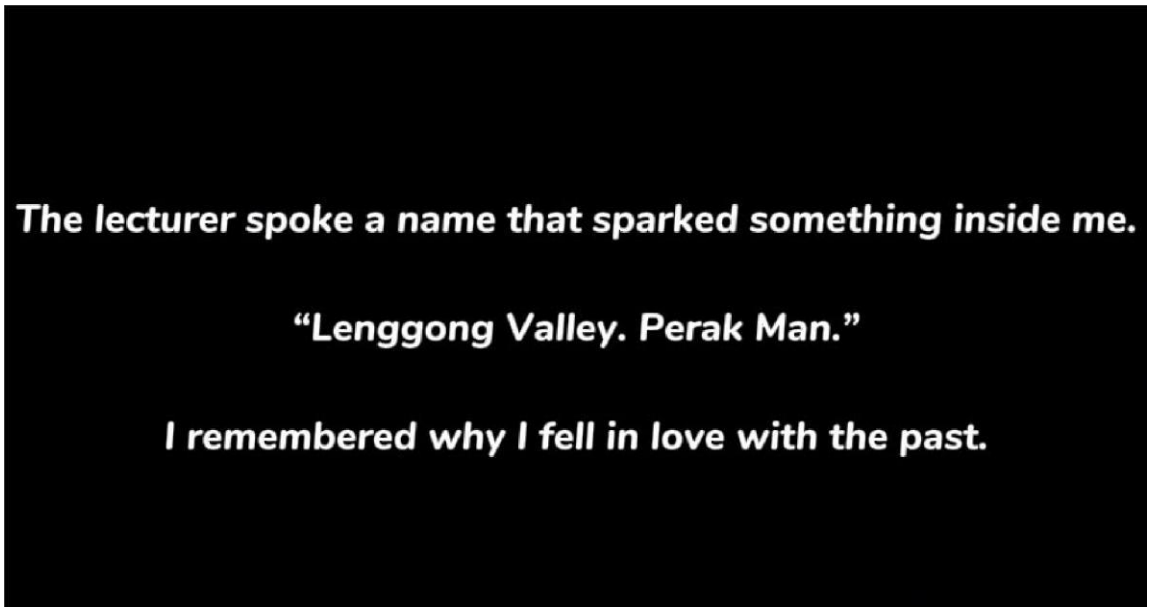


Figure 7

The Video Introduction of Travel Game: Heritage Quest – Journey to the Past (Enter Game)

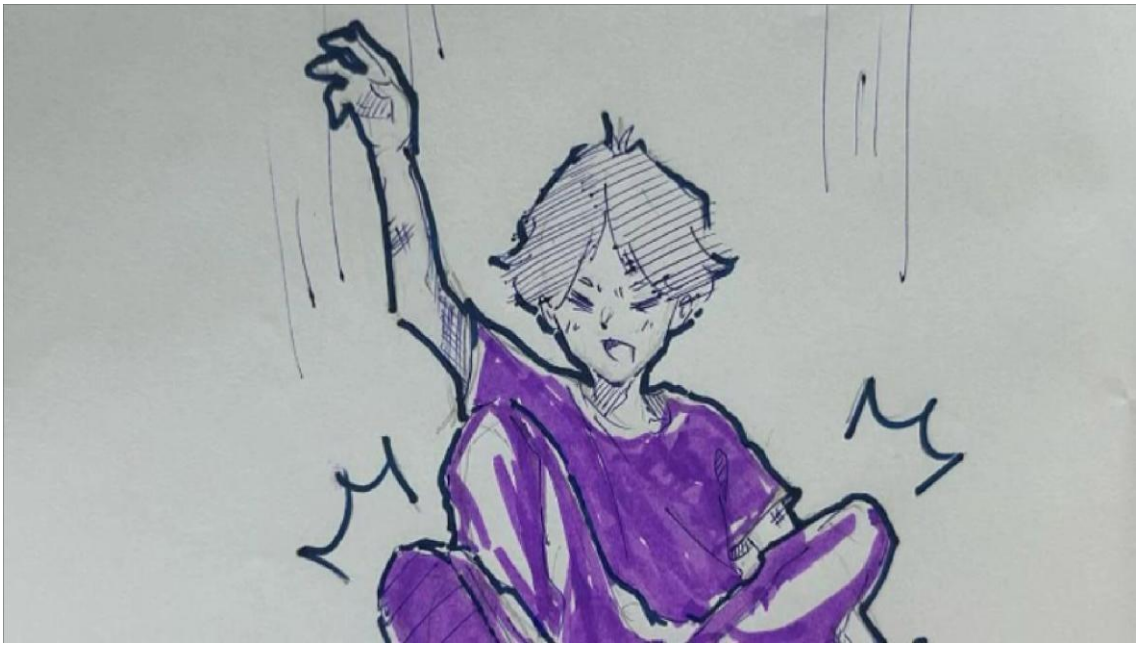


Figure 8

The Gameplay tutorial of Travel Game: Heritage Quest – Journey to the Past

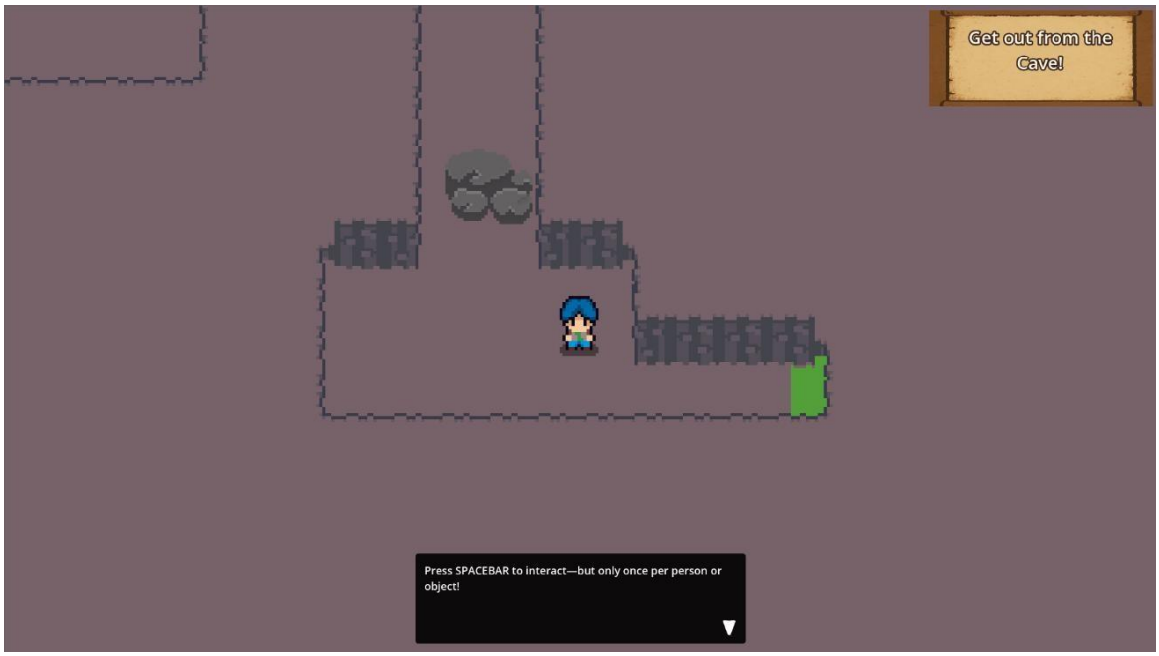


Figure 9

The Quest (Collect Firewood) of Travel Game: Heritage Quest – Journey to the Past

Figure 10

The In game (Quiz) of Travel Game: Heritage Quest – Journey to the Past

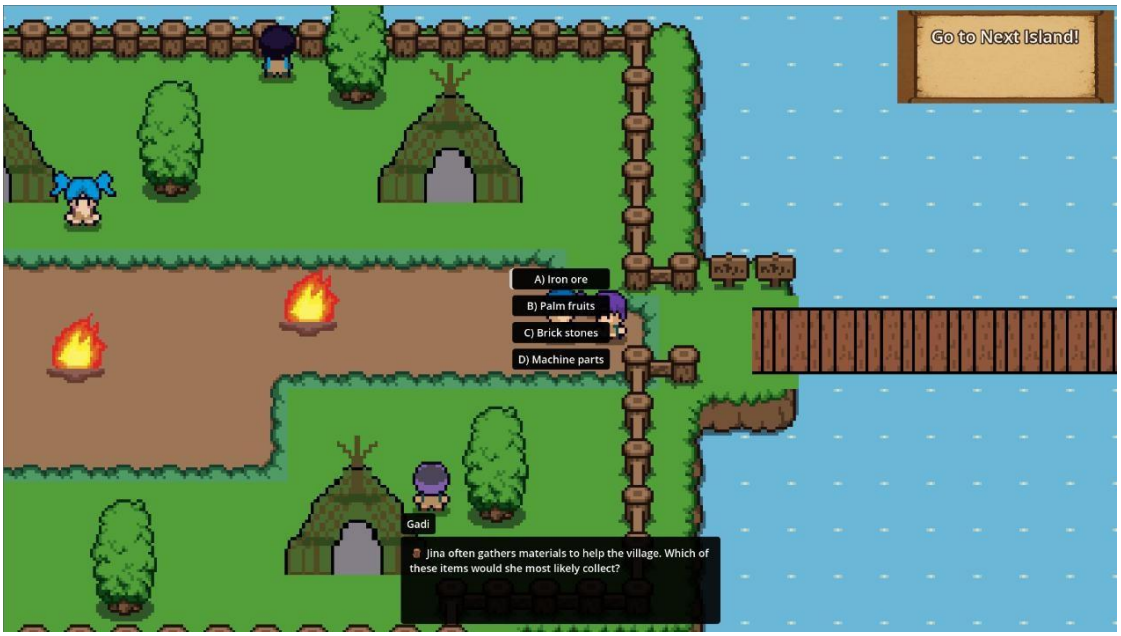


Figure 11

The Knowledge Summary of Travel Game: Heritage Quest – Journey to the Past

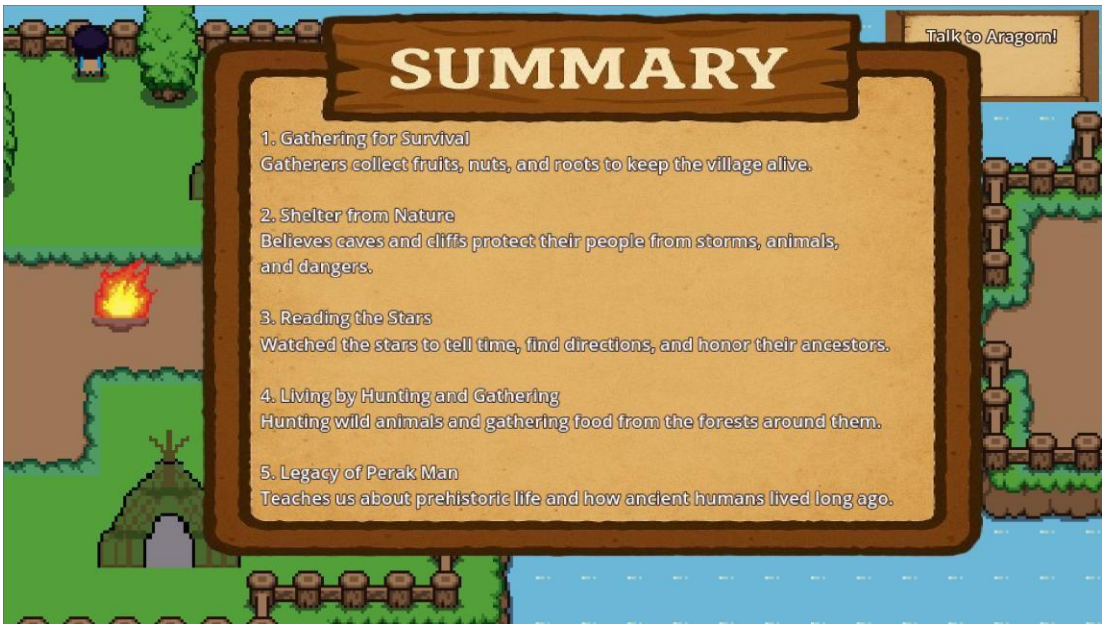


Figure 12

The Puzzle of Travel Game: Heritage Quest – Journey to the Past

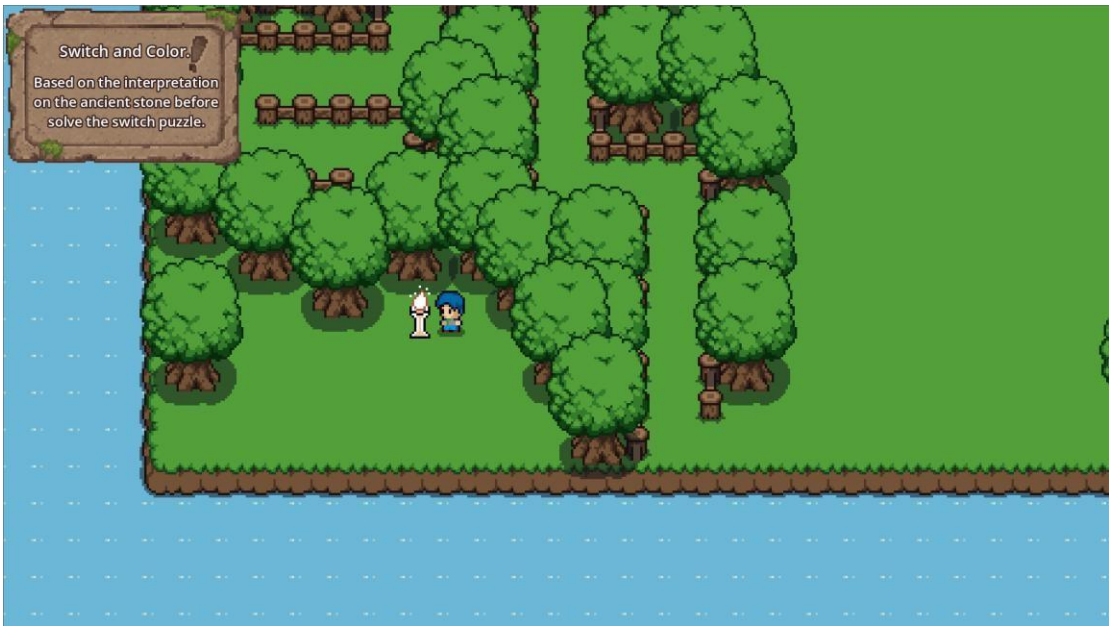


Figure 13

The Learning of Travel Game: Heritage Quest – Journey to the Past

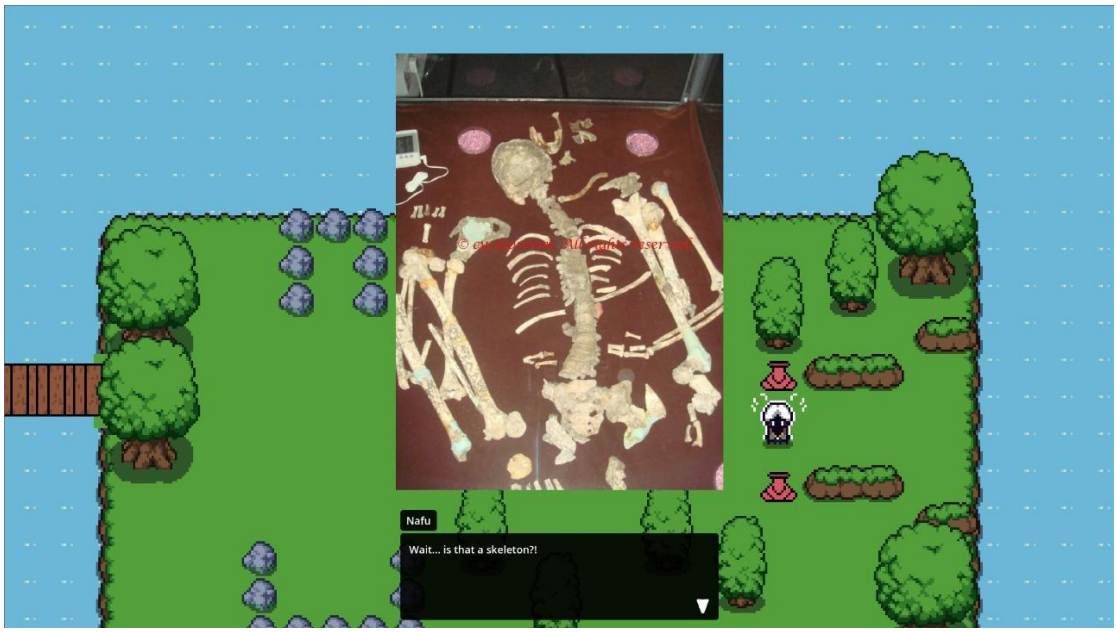
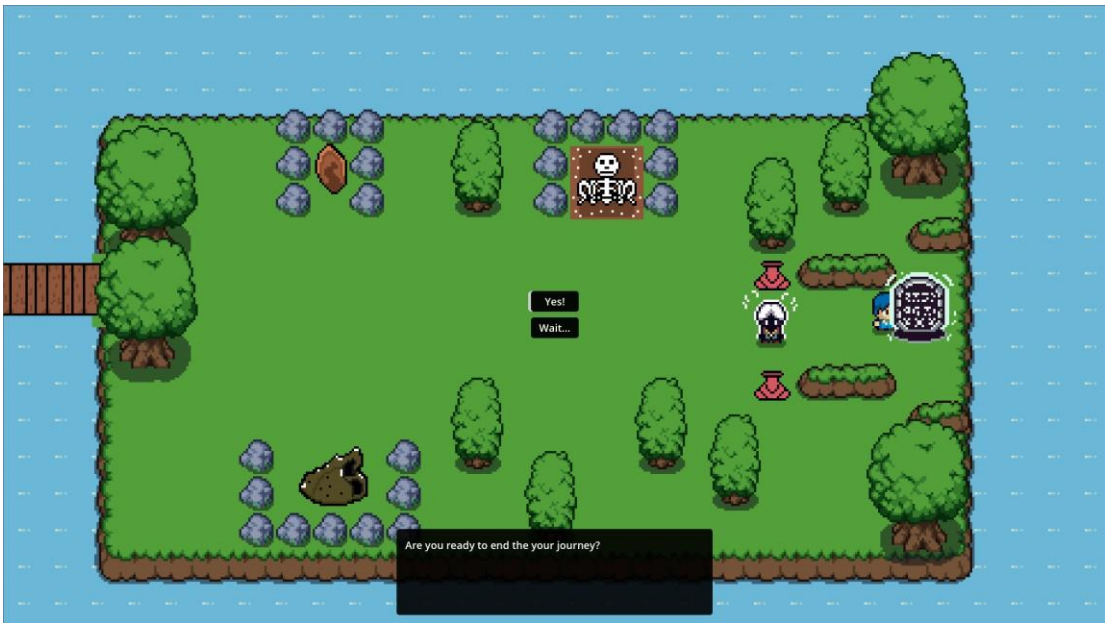


Figure 14

The End of Travel Game: Heritage Quest – Journey to the Past



Summary of Core Features

To support clarity, the final version of Travel Game: Heritage Quest – Journey to the Past incorporated the following core features:

- **Exploration and Interaction:** Top-down 2D world with heritage-themed locations.
- **Quests and Puzzles:** Tasks linked to archaeological and cultural knowledge.
- **In-game Quiz System:** Reinforcement of key facts through interactive assessment.
- **NPC Dialogue:** Contextual storytelling and guided learning.
- **Audio-visual Elements:** Atmospheric music and pixel-based graphics to support immersion.

Through this iterative process, the final prototype achieved a balance between usability, cultural authenticity, and educational engagement—aligning technical design decisions with pedagogical intent.

ANALYSIS AND RESULTS

Evaluation Setting and Participants

A total of 21 participants completed the usability evaluation, representing a diverse group of users. Most participants were male (76%) and aged between 13 and 25 years. The group included secondary school students, university students, working adults, and one game developer, ensuring a balance of learners and general users. Over 70% reported playing digital games frequently, while 76% had never played an educational game before. Notably, more than half had no prior knowledge of the *Perak Man*, underscoring the relevance of the game as a cultural awareness tool.

Usability Evaluation

The usability of Travel Game: Heritage Quest – Journey to the Past was assessed using ISO 9241-11 criteria of effectiveness, efficiency, and satisfaction.

- Effectiveness – Participants reported that the game's objectives were clear, tasks could be completed smoothly, and the quest-based structure effectively guided progression. NPC interactions were rated as highly useful for understanding cultural content.
- Efficiency – The interface design and 2D navigation were described as simple and intuitive. The majority found the controls responsive and easy to master, even for non-gamers. Minor usability issues, such as collision glitches and navigation bugs, were noted but did not significantly hinder gameplay.
- Satisfaction – Quantitative results showed strong positive responses. Players highlighted the visual appeal, storyline, and puzzle integration as engaging features. Table 2 summarizes the top-rated elements.

Table 2

Selected Usability and Engagement Scores (5-point Likert scale)

Evaluation Item	**Mean Score**
"I would recommend this game to others for both learning and fun."	4.71
"The game interface (UI) was easy to understand and use."	4.67
"After playing, I understand who Perak Man is and why he is important."	4.67
"The game controls were intuitive and easy to use."	4.62
"The visual design of the game enhanced my experience."	4.62

Open-ended responses reinforced these results, with participants praising the visual design, immersive quests, and interactive dialogues. Suggestions for improvement included expanding content, adding more levels, and refining storyline depth.

Educational Effectiveness

The evaluation also examined whether the game achieved its cultural learning objectives.

- Knowledge Gain – A majority of players reported learning something new about Malaysia's prehistoric heritage, particularly the *Perak Man* and Lenggong Valley. For more than half, this was their first exposure to the topic.
- Engagement with Heritage Content – Quests, puzzles, and NPC dialogues were consistently identified as mechanisms that made heritage knowledge more memorable compared to traditional learning methods.

- Cultural Relevance – Players expressed that the localized context increased their sense of connection to history, making the experience more relatable than international heritage games.

Overall, results demonstrated that the game effectively blended educational content with interactive engagement. Both usability and educational outcomes were rated positively, confirming the potential of the game as a tool for heritage education and digital tourism.

CONCLUSION

This study presented the design, development, and evaluation of *Travel Game: Heritage Quest – Journey to the Past*, a 2D educational game aimed at promoting awareness of Malaysia's tangible cultural heritage, particularly the Lenggong Valley and the *Perak Man*. Developed using the Godot Engine and guided by the Agile methodology, the project integrated iterative refinement with user feedback to ensure that both technical functionality and educational value were optimized.

The findings demonstrate that serious games can serve as effective tools for heritage education and cultural tourism when grounded in local narratives and accessible technologies. Usability evaluation revealed that players found the game intuitive, engaging, and educationally enriching, while qualitative feedback confirmed that interactive storytelling, NPC dialogues, and heritage-themed puzzles successfully increased understanding and appreciation of Malaysia's prehistoric culture.

This research contributes to the growing field of digital heritage learning by providing an accessible, contextually grounded game model that bridges the gap between traditional heritage education and the learning preferences of contemporary digital natives. It extends the existing literature by showing how localized serious games can both educate and emotionally connect users with their cultural roots.

Beyond academic contexts, the project has practical implications for cultural institutions and tourism authorities. The game can be adapted for museums, schools, and visitor centers as an interactive supplement to heritage exhibitions. By integrating digital gameplay into cultural tourism experiences, stakeholders can enhance visitor engagement and foster sustained heritage appreciation.

Future work will focus on expanding content coverage to include other Malaysian heritage sites, refining gameplay based on further usability testing, and exploring cross-platform deployment, including mobile and augmented reality (AR) versions. Continued collaboration with heritage experts and educators will also strengthen the game's authenticity and educational depth.

In summary, *Travel Game: Heritage Quest – Journey to the Past* demonstrates the potential of serious games to connect technology, culture, and learning in meaningful ways—revitalizing the appreciation of Malaysia's heritage through interactive, learner-centered digital experiences.

ACKNOWLEDGMENTS

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AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by all authors.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Informed consent was obtained from all individual participants included in the study.

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