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3D ADVENTURE GAME DEVELOPMENT: CHINESE TRADITIONAL TRAIL

Fazlina Mohd Ali[1], Hou Jingbo[2], Marizuana Mat Daud[3*], Siti Solehah Mohd Hamid[4], Liyana Safra Zaabar[5]

[1,2,4] Faculty of Information Science & Technology, Universiti Kebangsaan Malaysia, Malaysia
Email: fazlina.mohdali@ukm.edu.my, a185579@siswa.ukm.edu.my, solehah.mhamid@ukm.edu.my
[3] Institute of Visual Informatics, Universiti Kebangsaan Malaysia, Malaysia
Email: marizuana.daud@ukm.edu.my
[5] Fakulti Sains dan Teknologi Pertahanan, Universiti Pertahanan Nasional Malaysia (UPNM)
Email: liyanasafra.edu@gmail.com
[*] Corresponding Author

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Abstract:

As younger generations become more detached from their cultural heritage, there is a growing need for innovative solutions to make learning about traditions more engaging and accessible. This study addresses the challenge of preserving and promoting traditional Chinese customs and culture in an increasingly digital and globalized world. The primary objective of this research is to design and implement a digital tool that promotes the popularization of Chinese culture, making it accessible to users in different cultural contexts. By blending entertainment with education, the game aims to overcome the challenges of cultural detachment and create a meaningful connection between users and Chinese heritage. To tackle this issue, this study proposed and developed a 3D adventure game to introduce users to traditional Chinese customs through interactive and immersive gameplay. The game is built using Unity3D for its versatile game development capabilities, while Blender is utilized for scene design. Users can explore these environments, interact with cultural objects, and receive detailed information on customs, activities, and artifacts, fostering a deeper understanding of Chinese traditions. Grounded on feedback from users, the developed 3D Chinese Traditional Trail game enhances realism and engagement, providing an interactive platform that encourages learning through exploration.

Keywords:

3D Games, Educational Games, Unity3D, Chinese Traditional, Cultural Heritage

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Introduction

China's development is becoming increasingly modern, and the new generation of young people is becoming increasingly distant from traditional Chinese culture and customs. Many excellent traditional Chinese cultural customs have been gradually forgotten under the influence of modernization, resulting in fewer and fewer people understanding traditional Chinese culture and customs (Xingming, 2020). At the same time, there are problems in spreading the knowledge of traditional Chinese culture and customs. In many literature, it is pointed out that there are severe deficiencies in new media in disseminating traditional Chinese culture (Lyu, 2024). The main body of diffusion is dominated by the lack of official and professional attractiveness, and at the same time, the form of dissemination is single. This results in a smaller scale and intensity of traditional Chinese cultural knowledge dissemination.

Traditional teaching methods are monotonous and inefficient in disseminating knowledge. Monotonous lectures in conventional education make students disinterested and easily distracted, making it difficult for them to absorb knowledge efficiently. A study conducted by a researcher found that in traditional stand-up lectures, undergraduate students were 1.5 times more likely to fail a course than students who used more motivational techniques (Kloepper, 2017). Conventional teaching methods are also less applicable and require more time and effort. In traditional education, students must set aside time to attend lectures, which does not allow them to study anytime, anywhere. When attending lectures, it is necessary to be energetic and control their concentration on unattractive content.

Researchers claim that many traditional educational games are gaining feedback about boredom because of using outdated approaches. Some game designers create educational games that are neither motivating nor fun (Sharipova nodira, 2023). Numerous educational games lack good form and style design, which makes it difficult to attract users for immersive and efficient learning. An example of a game is Team Xtreme, a game listed by the 1 More Castle website as one of the worst educational games ever (1MoreCastle. (n.d.)). The game aims to improve users' understanding of weather patterns and natural disasters but has been criticized for being too simple and engaging for students. Monotonous traditional educational games are inefficient in disseminating knowledge and cannot serve a good educational purpose.

This scenario motivated this study to develop an educational traditional game using interactive technology 3D called "Chinese Traditional Trail." The game provides free exploration and implanted challenges with moderate difficulty to attract players better and increase their motivation while improving their knowledge-learning efficiency. It enables players to learn about the relevant cultural knowledge efficiently, thus promoting the efficient spread of traditional Chinese culture.

Related Works

Today, modernization has led to the neglect of China's rich cultural heritage and traditions among the younger generation. Therefore, it is essential to effectively promote and educate the younger generation on traditional Chinese customs and culture. The field of education and cultural communication has seen a rise in the application of games, a product of the rapid advancement and development of science and technology. The Horizon report forecasts the widespread use of augmented reality technology and game-based learning within the next two to three years (Cheng et al., 2024). Efficient dissemination of knowledge is increasingly

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promoted by utilizing properties like the engaging nature of games, which boost users' interest in learning and help them acquire knowledge effectively.

Educational literature suggests that games provide students instant feedback and motivate them to continue learning. The immersive learning experience facilitated by games helps students better understand knowledge and concepts, leading to longer knowledge retention. As a result, games make a valuable contribution to education (Wichadee & Pattanapichet, 2014). Efficient knowledge absorption by users is facilitated by the unique appeal of games and the positive emotions they engender.

Some studies have concluded that technologically based games that allow student-centered learning opportunities are more effective than traditional teaching methods (Azhara & Sutapa, 2019). In medical education, a randomized controlled trial of third-year medical students concluded that game-based e-learning was more effective than script-based training methods in cognitive learning outcomes and had a more significant positive motivational impact on learning. This indicates that game-based e-learning can be utilized as a practical teaching approach for self-directed learning (De' et al., 2020). Similarly, for cultural topics to be practical, educators must be familiar with cultural elements, including games, and understand the related skills and background knowledge. These competencies enhance their ability to impact students' comprehension and engagement positively (Mingchen & Xinjun, 2022).

3D Adventure Game

3D adventure games are a form of video gaming. They generate a three-dimensional virtual environment for players to tackle challenges and tasks. The genre commonly integrates puzzle-solving, exploration, combat, and features in-game narratives. These games enable users to examine objects intimately and provide an immersive gaming experience. 3D gaming environments provide significant stimulation to users' which improves cognitive abilities. However, different game formats offer various experiences to users. A suitable format enables educational games to achieve efficient teaching and learning objectives. Adventure game formats enable players to explore or solve puzzles from a first-person perspective (Wan et al., 2021). A researcher employs computer games as an educational tool, identifying suitable game genres and elements through an experiment involving a group of students who played commercial games (Manero et al., 2016). The study explored the potential of game-based learning in enhancing educational outcomes. The study findings reveal that the students favored 3D adventure games and evidence that player attitudes and behavior influence gaming outcomes.

Educational content can be communicated through narrative or embedded in the game world, as well as puzzles in adventure-based educational games. The absence of time constraints and the high degree of freedom of exploration enable players to absorb the knowledge presented in the game thoroughly (Wichadee & Pattanapichet, 2014). Insight and perception are crucial to designing adventure games. These games aim to challenge and inspire players to explore and manipulate the game space. This can stimulate their curiosity and encourage meaningful play. The puzzles within the game offer insights that can maintain player engagement and motivation. These attributes give adventure games educational potential.

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Dissemination Of Traditional Cultural Heritage Through Games

In cultural dissemination, augmented reality implemented in virtual environments can offer individuals a valuable cultural experience. This technology has the added benefit of overcoming physical barriers in museums, exhibitions, books, and audiobooks (Vocaturo et al., 2019). Highly realistic virtual environments allow users to explore inaccessible environments and learn about traditional culture in a fully immersive and efficient manner. In a study, the authors evaluated the learning outcomes of several students by comparing the use of a jigsaw puzzle game for cultural heritage learning with a preference for video-based learning. The experiment results demonstrated that the digital puzzle-oriented gaming approach improved learners' ability to recognize and retain pattern structures and increased their motivation to learn compared to traditional video learning methods. This research offers insights into developing serious games for cultural heritage education (Ye et al., 2021). Furthermore, it highlights the efficacy of games in communicating traditional cultural heritage.

Another study focuses on the virtual reality game, which serves as a guided tour of the Forbidden City (Li et al., 2022). It incorporates a real-life map of the Forbidden City, allowing users to explore its many historical sites. Throughout the tour, users encounter a kitten non-playable character, which offers valuable information on the history and cultural significance of the sites visited. As in Figure 1, the images in virtual reality technology enable users to experience the Forbidden City up close without traveling. Users can engage with objects and non-playable characters within the scene to gain insight into relevant cultural information. Simultaneously, they may participate in small games to pique their interest in learning and understanding related cultural knowledge. Players can acquire manageable cultural knowledge through gameplay while fostering their curiosity for the Forbidden City and Chinese culture.

Chinese traditional furniture origin focusing on the mortise and tenon technique is another development to inspire and expose the younger generation to Chinese culture. As in Figure 2, the game employs 3D technology to display intricate details of wooden creations built using the mortise and tenon methods. It also showcases the utilization of mortise and tenon expertise in historic Chinese traditional furniture and architecture through 3D dissection and demonstration (Yu, 2020). The game features a range of levels focused on the mortise and tenon technique, enabling the player to understand this age-old craft comprehensively. The various modes offer distinct challenges and opportunities for learning, while clear and concise instructions ensure accessibility for all. Technical terminology is introduced gradually and defined in a manner that is easy to understand, ensuring even novice users can enjoy the experience.

A further similar successful traditional game is known as Roma VR - Domus is an immersive VR educational game (Clerici et al., 2022). The game is designed to allow users to experience life in the ancient Roman era in virtual reality, as in Figure 3. The game's primary setting is the ancient city of Pompeii, which is now in ruins. The game takes users on a journey to 79 Ad, before the eruption of Mount Vesuvius, to visit the famous home of an ancient Roman banker before the volcano destroyed it. The players learned about the unique way of life in ancient Rome. Users can follow an audio guide or explore on their own to immerse themselves and learn about the lives of the inhabitants of Ancient Pompeii.

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Figure 1: Forbidden City

Source: (Li et al., 2022)

Figure 2. Chinese Traditional Furniture

Source:(Yu, 2020)

Figure 3. Roma VR

Source:(Clerici et al., 2022)

The literature evidenced that game developments promote broader and more effective dissemination of traditional Chinese culture for various audiences. Therefore, this study

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focused on increasing the motivation of users of all ages to play interactive 3D adventure games. Thus, it provides an immersive experience while increasing the users' efficiency in learning about knowledge related to traditional Chinese culture. The objectives of this study are to research and collect information about traditional Chinese culture and customs, to design and develop a computer game application about traditional Chinese culture and customs, and to test the developed game application through user acceptance testing.

To better understand the existing Chinese traditional games, as discussed in this section, a comparison with the three other most similar existing games and the proposed Chinese Traditional Trail are presented in Table 1. This comparison highlights the existing 3D educational games to disseminate culture and promote the discovery of the differences between the games.

Table 1: Comparison of Existing 3D Educational Games to Disseminate Culture.

Functions/ Features	**System/Application**			
	Chinese Traditional Furniture (Yu, 2020)	**Forbidden City Journey (Qing Dynasty)** (Li et al., 2022)	**Roma VR - Domus** (Clerici et al., 2022)	**Chinese Traditional Trail**
Languages	Chinese	English	English	English
Device	Mobile	Computer	Computer	Computer
Game Themes (Environment)	Piecing Mortise and Tenon	Visit the Forbidden City	Visit Ancient Pompeii	Discover ancient Chinese gardens
Types of Culture	Mortise & Tenon	Palace Culture	Roman Culture	Culture &Customs
With quests	Yes	No	No	Yes
Penalty Mechanism	Yes	No	No	Yes
Reward Mechanism	Yes	No	No	Yes
Free space for exploration	No	Yes	Yes	Yes

Methodology

The project is being developed using the Agile Process Model. The Agile Process Model was adapted as a software development methodology. This approach divides the project into several phases and emphasizes continuous collaboration and improvement. In the development process using this methodology, each iteration is designed as a complete software development

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lifecycle, including planning, requirements analysis, design, coding, and testing before a working product is delivered to the customer. The methodology allows for continuous improvement based on customer satisfaction and needs. Further, the Chinese Traditional Trail is developed in Unity, mainly in C#, and scripted in Visual Studio. The game uses SQLite as a database so that the relevant data can be saved locally promptly. At the same time, the game is modeled by Blender.

Figure 4. shows the scope and boundaries of the system using the context diagram, which describes the system's associations and interactions with external entities.

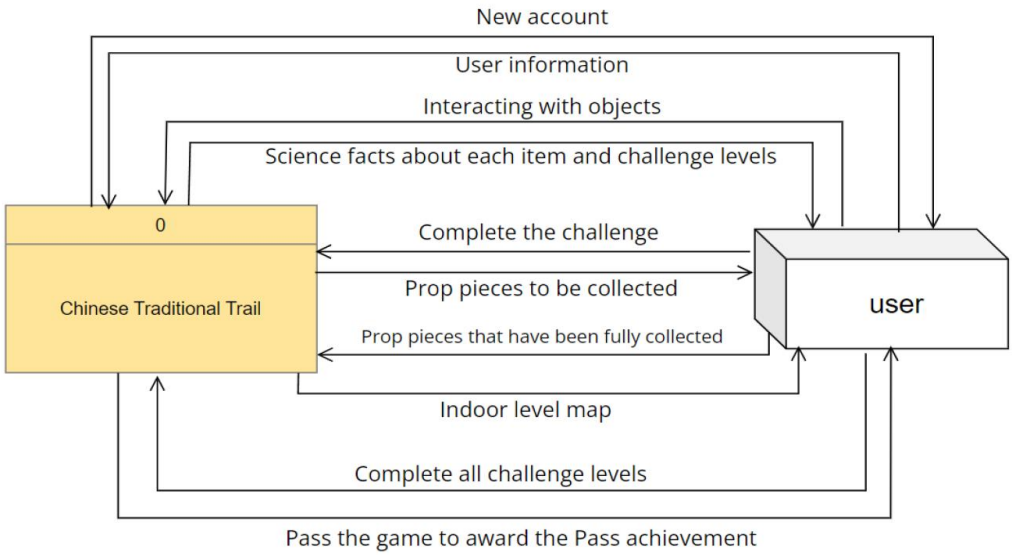

Figure 4: Context Diagram

The Model-View-Controller (MVC) design architecture, as in Figure 5, was chosen for the Chinese Traditional Trail application because it is easy to maintain and manage the application. Each part is independent, has a clear responsibility, and has a low level of dependency at runtime.

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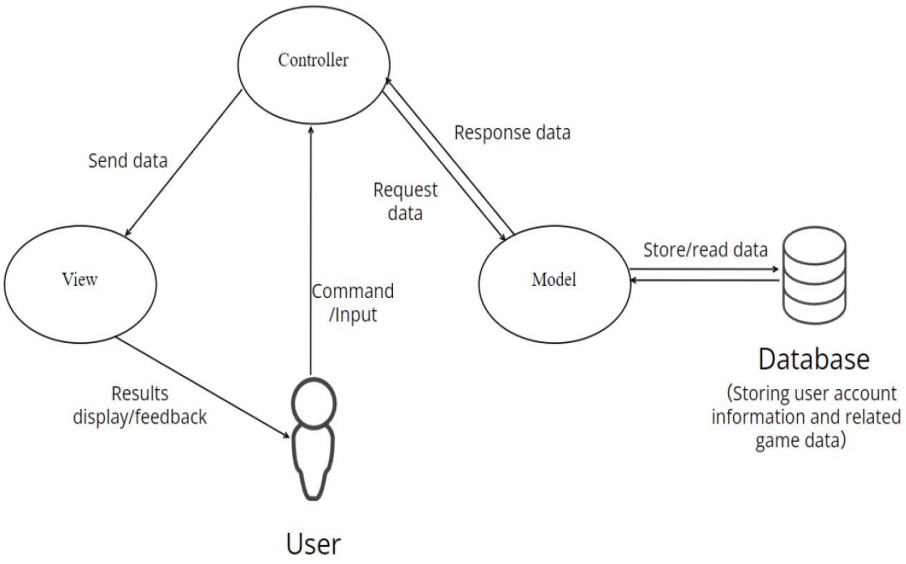

Figure 5: Model-View-Controller (MVC) Design Architecture

Results and Discussion

Chinese Traditional Trail Module

The Chinese Traditional Trail system comprises six main components: account registration, login, game guide, yard map exploration, indoor map exploration, and game progress management. Figure 6. presents the module hierarchy chart design of the Chinese traditional trail game. The Chinese Traditional Trail program first requires users to register for an account to store their personal information and game progress. When the user logs into the game for the first time, the Game Guide module introduces the user to the game's background, the main quests, and the essential operation. The game map is divided into two modules, Yard and Interior, which can be freely explored. The game management module will update and display the user's quest, prop collection status, and game completion progress in real-time. Users must complete quests on the yard map before unlocking the indoor map. In both modules, users can freely interact with objects, learn about them, and complete challenges to advance their game completion progress. When the user has completed all the challenges in both maps, they will be prompted to pass the level and receive a passing achievement.

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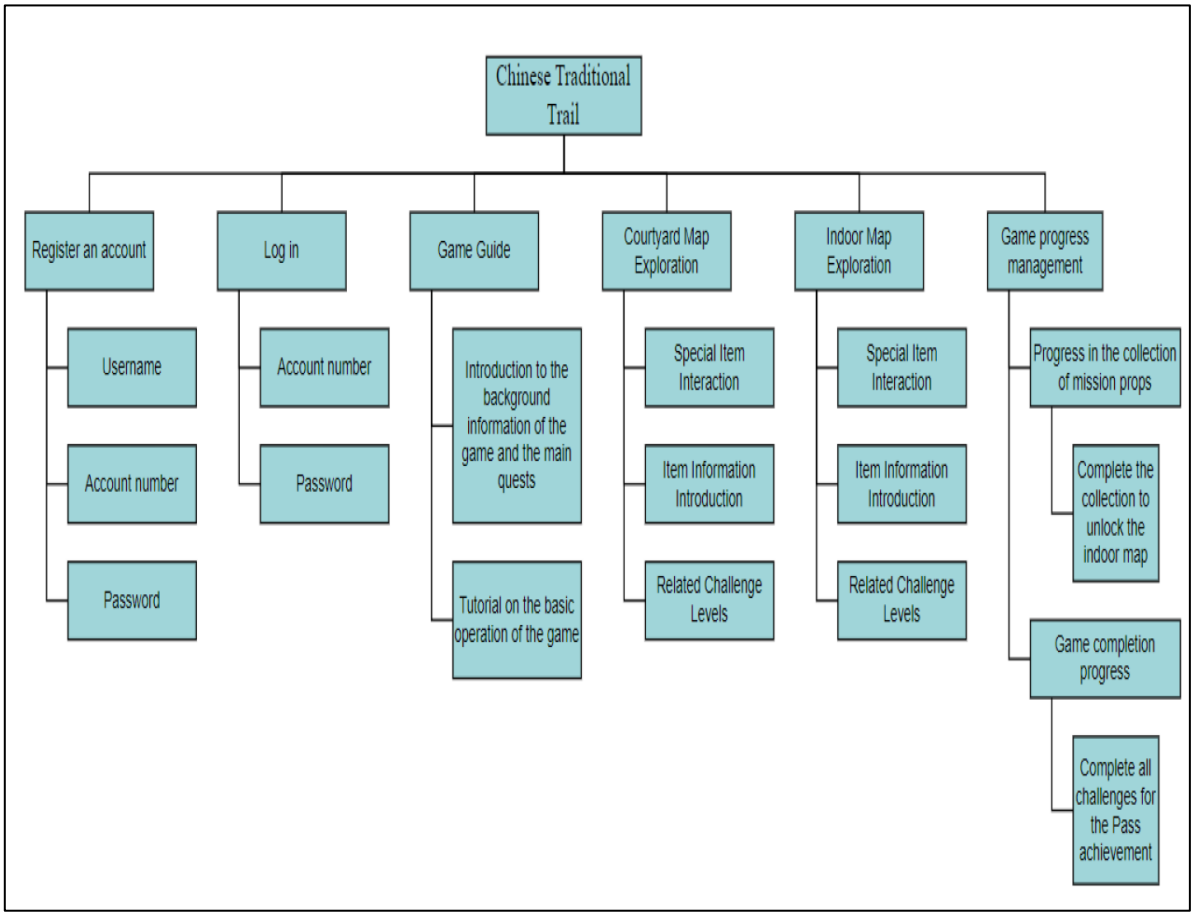

Figure 6: Module Hierarchy Chart Design

Chinese Traditional Trail Interfaces

This interesting 3D Chinese traditional trail was developed successfully, and some of the crafted primary interfaces are shown in Figure 7 to Figure 11.

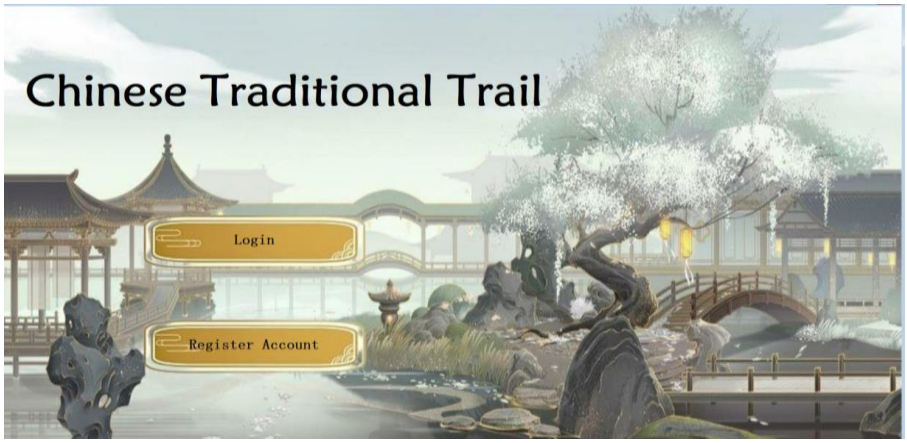

Figure 7: Login Screen

Journal of Information System and Technology Management
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Figure 8: Outdoor Map & Game Journey

Figure 9: Indoor Map & Game Journey

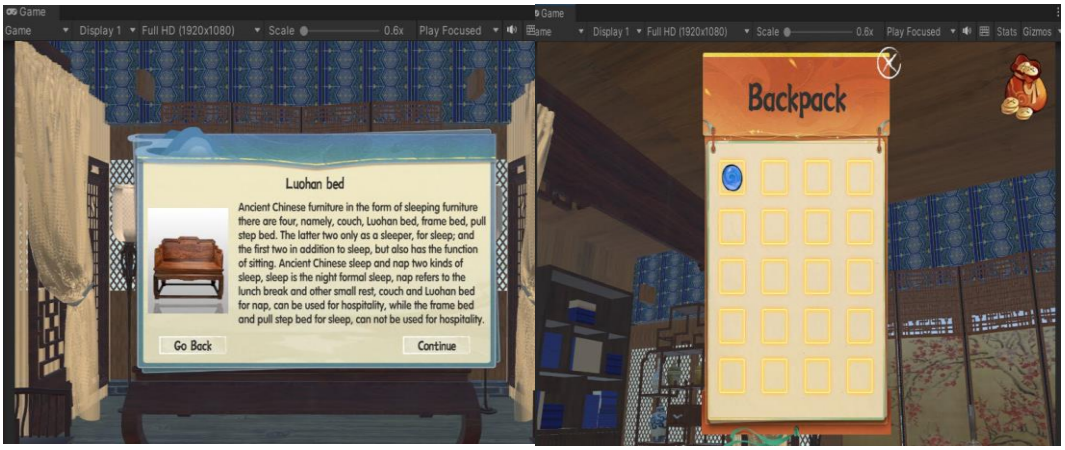

Figure 10: Game information & Rewards

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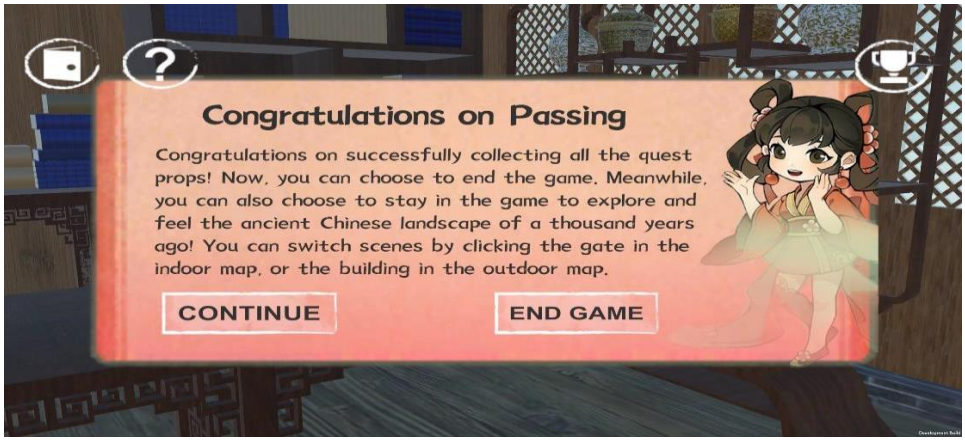

Figure 11: Closure of Game Journey

The Chinese traditional trail game was successfully developed, and a few interfaces are shared, as shown in Figure 7 to Figure 11. Users are required to log in to the game and can freely move in the game to complete tasks. There are indoor and outdoor maps; initially, some information and instructions will be provided as users' directions to move around the maps. After the player clicks on a particular item- a Chinese instrument, the knowledge and information about that item will appear. Players need to finish reading and learning the information. Further, the player can proceed to the related challenge by clicking the 'continue' button till the completion of missions. When the user completes the challenges, they will be rewarded with the appropriate item, and a congratulatory message will pop up to indicate that the game mission has been accomplished.

User Testing: Software Functional

The software functionality test was conducted among 17 users. They all completed the test, and the functionality results are compiled and summarized, as well as the functional testing feedback from 17 users after using the Chinese Traditional Trail game, as shown in Table 2. The feedback results indicate that each primary function of the Chinese Traditional Trail has been smoothly implemented.

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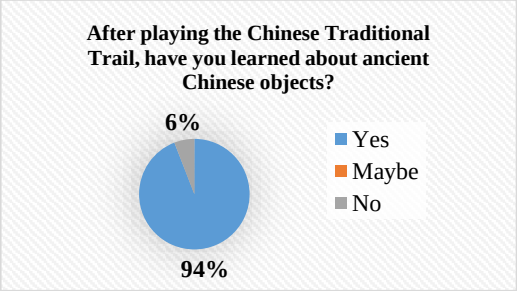
Table 2. Software Functionality Test Results

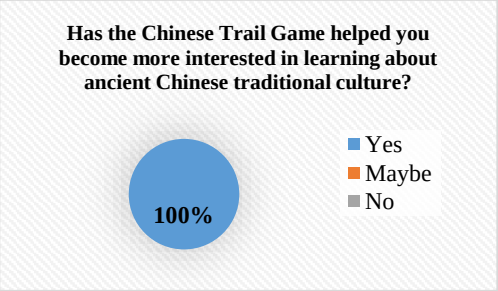
Test Case ID	Content of the test	Pass/Fail
Case_001_1	Invalid account cannot be registered	Pass
Case_001_2	Valid accounts can be registered	Pass
Case_001_3	Accounts cannot be re-registered	Pass
Case_002_1	Cannot log in with a non-existent account	Pass
Case_002_2	Registered accounts can successfully log in	Pass
Case_002_3	The same account cannot be online at the same time	Pass
Case_003_1	Buttons for interacting with items work	Pass
Case_004_1	Expected increase of items in the backpack after a successful challenge	Pass

User Testing: User Acceptance

A user acceptance test was conducted to ensure the users were satisfied and the objectives of this game development were achieved successfully. Hence, the same 17 users completed playing the Chinese Traditional Trail game, and they filled out a total of 15 questions. The summary results that focus on the objectives of this study are shared in Figures 12 to 15.

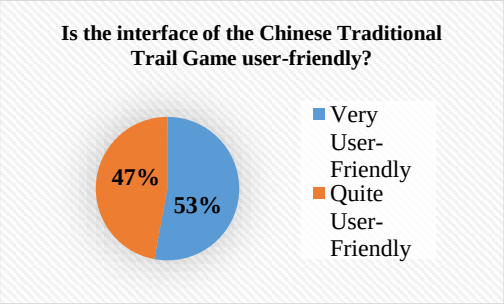


Figures 12. Learning Efficiency



Figures 13. Promoting Learning Interest

Figures 14. Cultural Experience



Figures 15. Feedback on User UI/UX

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Based on the analysis of the results collected from the 17 users in Figure 12—Figure 15, the overall effect of the Chinese Traditional Trail game is relatively sound. The essential functions were successfully implemented, and there is a certain degree of educational significance, which can achieve the main objectives of the development. The visual effect of the game still needs to be improved. Meanwhile, the game's user interface and level design must be further optimized to make the game more attractive.

Conclusion And Future Recommendations

The rapid progress of science and technology has provided a good platform and various ideas for realizing more efficient education methods. Nowadays, more and more people engaged in the education industry tend to improve people's learning efficiency from the perspective of interest. The technique of combining video games with education is gradually being widely used. This study provides users with a lot of knowledge and information about traditional Chinese culture and customs in the form of a game. The 3D visual effect can give users more accurate information and a more immersive gaming experience. The free-exploration game format in this development can better enhance players' interest. At the same time, the challenge and reward mechanism can promote the learning efficiency and motivation of the users. Chinese Traditional Trail's unique game format and sound visual effects can increase users' interest and spread knowledge and information more efficiently than traditional educational games.

As for future recommendations, the Chinese Traditional Trail game can be extended in the range and variety of maps. The variety of maps can provide a more comprehensive experience for users. It will also be possible to present a more comprehensive array of items related to Chinese traditional instruments. As the size of the maps increases, the quests in the game can be more diversified so that the user can efficiently gain knowledge through the quests. Future researchers can make this gaming more enjoyable by providing varied journeys to accomplish the game's mission.

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