




# A study on the application of game-based learning integrated augmented reality to the experience in Ailan Pazeh culture

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## Abstract.

Pazeh is one of plains indigenous peoples in Taiwan and presents historical and rich characteristic culture. Nevertheless, a lot of Pazeh related cultural traditions are declining along with the crisis of losing Pazeh language. Applying game-based learning integrated augmented reality to the delivery of Ailan Pazeh culture, this study expects to have people enter Ailan Pazeh community and experience Pazeh people's life through game interaction in order to learn Pazeh culture through game experience. This study aims to design Ailan Pazeh AR games. Pazeh culture characteristics are extracted through field study and literature collection, and game-based learning is regarded as the game design mechanics to enhance people's interaction with Pazeh culture with AR games. The study contains 5 steps. First, Pazeh culture in Pazeh indigenous villages is collected through fieldwork, and literatures related augmented reality and game-based learning are summarized. Second, Pazeh culture characteristics are extracted and integrated into augmented reality and game-based learning to enhance the flow experience in games. Third, the prototype interface of the augmented reality APP is designed. Fourth, Pazeh augmented reality APP games are actually developed. Fifth, game testing is preceded to evaluate users' experience feelings. The first three steps are currently completed, and the successive development, testing, and evaluation will be continued. Interest and interactivity in the game experience will be estimated in the future for more people realizing the beauty of Pazeh traditional culture.

**Keywords:** Pazeh, augmented reality, game-based learning.

## 1 Introduction

### 1.1 Background and Motivation

Ailan Pazeh presents historical and rich characteristic culture. However, the crisis of losing Pazeh language results in the declination of Pazeh culture and history. Local

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elderly would lead tourists to visit Pazeh indigenous villages through interpretation for visitors understanding the life and environment of Pazeh people. Nonetheless, traditional customs and clothing could not be exhibited through films or real objects during the interpretation that the complete Pazeh culture cannot be smoothly promoted to the public. For this reason, augmented reality is applied to Ailan Pazeh in this study to reinforce visitors' experience in Ailan Pazeh culture through the interactivity, entertainment, and education of augmented reality. Delivering local culture through the game-based learning leads people to enter Pazeh indigenous villages and realize the beauty of Ailan Pazeh culture with learning by playing.

## 1.2 Research Objectives

1. To extract Ailan Pazeh culture characteristics through fieldwork and data summary.
2. To design the AR games with Ailan Pazeh culture.
3. To discuss player experience in using Ailan Pazeh AR games.

## 2 Literature Review

### 2.1 Ailan Pazeh

Pazeh is one of plains indigenous peoples in Taiwan. Pazeh settlement currently covers Liyu Lake settlement in Sanyi Township, Miaoli County (Neisha Ta ba), Anli community in Dashe Village, Shenggan District, Taichung City (Anli Dashe Pahoropuru), and Ailan Li in Puli Township, Nantou County (Wunioulanshe Auran) (Ministry of Culture, 1999). Pazeh peoples in Ailan Li are selected as the research objects in this study. Pazeh culture is summarized as following through fieldwork, local elderly's introduction, and literature summary.

- Food: Early Pazeh people would pickle food in salt to extend the expiration date. Traditional food of Ailan Pazeh contain pickled meat, sauce bamboo shoots, moss, stir-fried bird's-nest fern, Annona (a kind of fruit), and umu rice cake (the essential food for Pazeh New Year).
- Plants: Ailan Pazeh life keeps passing down the ancestors' wisdom and applies the nature to food, clothing, accommodation, and transportation to form the life experience and culture. The native plants in Ailan Pazeh include Giant elephant's ear, Chinese soap berry, hawas, *Zanthoxylum ailanthoides*, bird's-nest fern, moss, and Annona.
- Language: Pazeh language is one of Taiwan Austronesian languages. After the 921 earthquake in 1999, Pazeh people started to revive the language culture, such as collecting vocabulary, editing dictionary, publishing ethnic language materials, and opening ethnic language courses. Under the assistance of Jin-Yu Pan, the Ailan elderly, Pazeh Dictionary was collaboratively edited by Jen-Kuei Li, an academician of Academia Sinica, and Singeru Tsuchida, a Japanese scholar, in 2001. Jin-Yu Pan, who could speak fluently Pazeh language, passed away in 2010 resulting in the crisis of losing Pazeh language. It therefore was listed as one of the most endangered

languages in the world in Atlas of the World's Languages in Danger by United Nations Educational, Scientific and Cultural Organization (Ministry of Culture, 2021).

- **Clothing:** Pazeh traditional clothing is formally sleeveless, with Ramie as the major material, which is based on red color weaved diamond, star, and various geometric patterns with yarn. In addition to yarn, Pazeh is also good at weaving patterns with special materials like animal hair and *Reseda odorata* that it is accepted as one of the ethnic groups, among indigenous groups in Taiwan, good at weaving clothing. Unfortunately, Pazeh weaving skills, along with the time change, are lost along with the introduction of modern clothing (Ministry of Culture, 2020).
- **Legend:** “Maxa-daxedaxe” is the most representative legend of Pazeh. According to the legend, Maxa-daxedaxe was a witch and a formidable person, as she would change into cat eyes to enhance the night vision, freely fly, and eat the hearts of naughty children.
- **Traditional custom:** November 15th in lunar calendar is the new year of Pazeh, when “maazazuah”, “mahalit”, and “dance of copper gong” are the most representative activities and customs.
  - a. **Maazazuah:** A long-distance marathon, mainly for training strong body to symbolize hero and glory.
  - b. **Mahalit:** A festival to seek the root and remember ancestors. In addition to celebrating the maazazuah winner, Pazeh history and culture are delivered through “Aiyen” singing and dancing to teach the reason to conduct oneself in the world.
  - c. **Dance of copper gong:** The people used to strike gongs, when having major hunting harvest during the new year and winning in maazazuah, to celebrate with the people.
- **Pazeh community:** Many ethnic people were displaced from terraces originally reclaimed by Pazeh people due to Typhoon Ellen in 1958. Yin-Jei Pan, a Pazeh elderly, and the brothers later returned Pazeh indigenous villages to rebuild the home and add Pazeh and Chinese introduction signs. Pazeh community still remains the natural lake and stone wall, and a lot of Pazeh books and traditional appliance are kept in Pazeh culture studio to extend Pazeh history and culture (see Fig. 1 & 2).



**Fig. 1.** Stone wall (shot by the researcher)



**Fig. 2.** Pazeh culture studio (shot by the researcher)

## 2.2 Augmented Reality Game

Augmented reality (AR) is a technology overlaying virtual images to real world space. The combination of virtual objects and real environment could be seen through handheld or head-mounted displays. Augmented reality is mature and applied to various fields, particularly in education (Billinghamurst, 2002).

Ssu-Fan Chang (2016) indicated that when applying augmented reality to video games, players' interactive behaviors are changed from virtual space into real environment. The real-time interaction between virtual objects in games and real environment could respond to the game story settings, reinforce players' immersive experience, and allow players simultaneously observing the correlations between virtual information and real environment for the next game.

AR games, being an educational learning tool, could effectively provide on/off-campus learning. In the game content design, visual design, teaching design theory, and model application cannot be ignored, and situated learning through guidance could result in good teaching effectiveness and promote motivation, attitude, learning performance, and interests in the learning process (Lin et al., 2021; Alper et al., 2021).

## 2.3 Game-based Learning

Game-based learning, compared to traditional learning model, presents better interactivity, entertainment, and education. Information learning of education, culture, and society could be effectively promoted by inducing inner learning motivation and motive, giving learners high-level thinking, learning interests, and problem solving, as well as reinforcing learning attention and knowledge memory (Li-Wei Shih, 2013; Chia-Yeh Lin, 2014; Ching-Hui Hsu, 2015).

Smith & Mann (2002) and Shi & Shih (2015) proposed that game-based learning design should take interface, interactivity, storytelling, and game mechanics into account to enhance learners' interaction intention by promoting the richness and interest.

- **Interface:** The consistency and ease of use of the interface should be emphasized in the design so that players could smoothly and rapidly grasp the key points for operation.
- **Interactivity:** Multiple dimensions and forms are used for interaction. The interaction process cannot be restricted to a single element, but should consider natural interaction, player-game interaction, and elements between technology and groups in order to achieve learning interaction.
- **Storytelling:** Transitions are used as the story structure and narrative sequence for building the immersive experience environment, reinforcing players' emotions and feelings in the game story, and promoting learning motivation.
- **Game mechanics:** Game mechanics is the major key to maintain the game balance. Players' fairness in the games could be ensured by building definite rules, rewards, and objectives.

## 2.4 Literature Summary

From the literature, it is realized that current information learning of education, culture, and society has broken traditional teaching model along with the advance of science and technology. The application of AR technology and game-based learning could enhance users' overall interactive experience and create more interesting and richer learning environment to more efficiently enhance users' learning intention and knowledge absorption.

In this case, this study expects to integrate the design points of game-based learning and the real-time interactivity of augmented reality into the experience design of Ailan Pazeh culture. Suggestions for the interaction design of game-based learning integrated augmented reality are proposed as the reference of AR games for future game-based learning.

## 3 Research Methodology

Through fieldwork on the tribes and literature collection, suitable AR game elements are summarized in this study. Game-based learning and augmented reality are applied to Ailan Pazeh culture to enhance the interest and interactivity of cultural experience and understand users' interaction conditions and feelings in the game-based learning integrated augmented reality. The study is executed in 5 stages.

(1)Literature analysis and fieldwork: The characteristics and design methods of augmented reality and game-based learning are summarized through literature data. Literature collection is preceded in Ailan Pazeh indigenous villages through fieldwork to understand traditional culture by visiting Pazeh living fields and elderly's introduction.

(2)Game-based learning APP planning according to literature analysis and fieldwork: Ailan Pazeh culture characteristics are extracted as the design ideas. Game-based learning integrated augmented reality applied to Pazeh living fields and cultural knowledge are applied to the gaming process to reinforce gaming and learning experience and increase visitors' interactivity and immersion in the games.

(3)Game-based learning APP prototyping: After planning the game content and mechanics, game contents of challenges, image illustration, and interactive interface are designed.

(4)Iterative adjustment and development of game-based learning APP: After the design of AR game content, students in Department of Digital Media Design are invited to the programming, which is developed with Unity game engine and converted to QR Code for players' download playing.

(5)Testing and evaluation: After the development of AR games, subjects are invited to experience the Ailan Pazeh game. The game design mechanics is adjusted according to players' feedback, and the subjects are preceded questionnaire survey after the end of the game to evaluate players' experience in the application of augmented reality and game-based learning to Ailan Pazeh culture. Learning interaction, interest, and satisfaction are the evaluation dimensions for the SPSS to organize the subjects' questionnaire feedback.

### 4 Completed step of current research

The first three steps of this study are completed to integrate the fieldwork on Pazeh tribes and literature data analysis, extract characteristic elements in Pazeh culture, and integrate into the game-based learning APP for building Pazeh AR games. The game design mechanics covers game fields, game content planning, game interface, and game interaction, using game-based learning and AR for promoting Pazeh culture. The completed steps of this study are organized in Table 1.

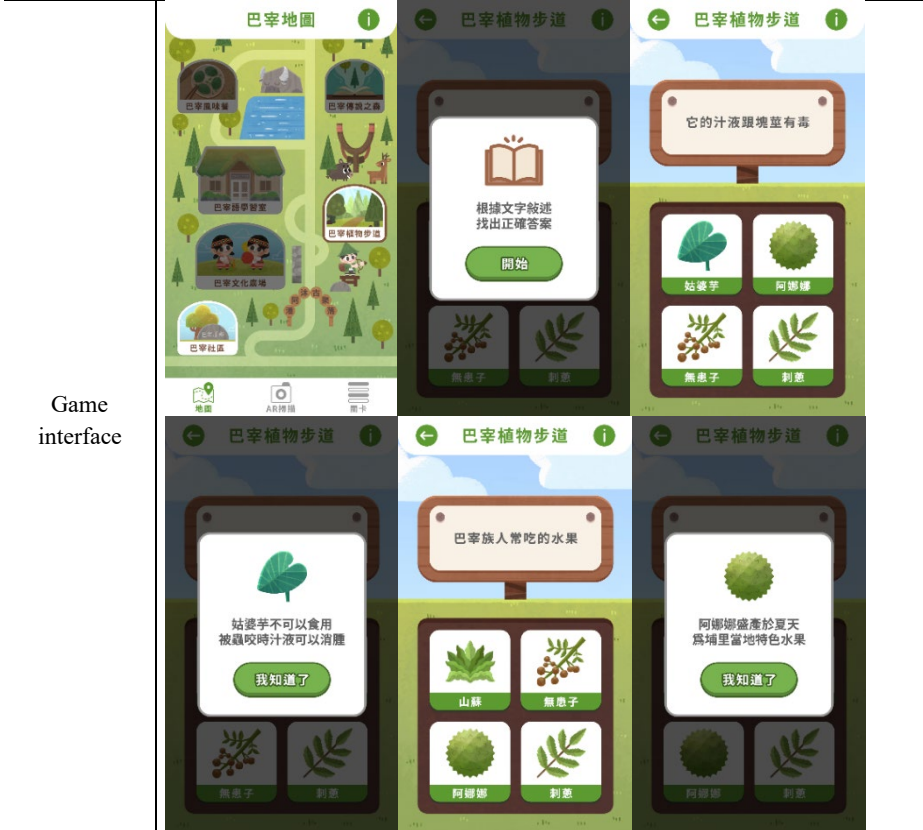
**Table 1.** Drawing in this study

<b>Game start-up screen</b>	
Game interface	
Playing way	Introduction of game
Interactive explanation	Reading the introduction and interactive explanation about FUN PAZEH.
<b>Challenge 1. Introduction of Pazeh</b>	
Game interface	



Playing way	AR scan—stone in Pazez indigenous village
Interactive explanation	Achieve the entrance of Pazez indigenous villaged according to APP prompts, and scan “stone in Pazez indigenous village” to display the introduction of Pazez.

Challenge 2. Pazez plants







Playing way Game—plant Q&A

Interactive explanation During the game, a Pazeh elderly would introduce Pazeh plants and test players' understanding of plants through games.

### Challenge 3. Pazeh food

Game interface





	 <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p><b>醬筍</b></p> <p>將高竹與鹽巴做醃漬 感受筍筍鹹鮮的韻味</p> <p>了解</p> </div> <div style="text-align: center;"> <p><b>筍白筍</b></p> <p>埔里盛產的農作物 是愛蘭巴宰族的美食</p> <p>了解</p> </div> </div>	
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<p>Playing way</p>	<p>Introduction of food—food illustration</p>
<p>Interactive explanation</p>	<p>The cuisine appearance is displayed through real pictures and illustrations, and Pazeh special cuisine is introduced.</p>

**Challenge 4. Pazeh legend**

<p>Game interface</p>	
<p>Playing way</p>	<p>Game—look for Maxa-daxedaxe</p>

Interactive explanation

According to the text description, look for the girl matching the features of Maxa-daxedaxe.

Challenge 5. Pazeh custom

Game interface




Playing way

Game—festival puzzle

Interactive explanation	Click to rotate puzzles. Introduction of festival is displayed after completing the puzzle.
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**Challenge 6. Pazeh language**

Game interface



Playing way	Word introduction—Pazeh words
Interactive explanation	Display vocabulary in Pazeh picture books. Players could mark stars on favorite words.

<b>End of game</b>	
Game interface	
Playing way	<p>Congratulation to complete the game and challenge review are displayed after completing all games.</p>
Interactive explanation	<p>Players could re-experience the played challenge content.</p>

## 5 Phased result of the research and successive research

This study integrates Pazeh culture in games, promotes Pazeh culture with interactive and interesting playing way, as well as leads players to realize Pazeh culture and characteristics and start to understand and emphasize Pazeh people. Steps 4 & 5 would be successively implemented, including the development of game-based learning APP, the recruitment of subjects, and the game testing in Ailan Pazeh community, to evaluate players' experience and effectiveness in the APP, using learning interaction, interest, and satisfaction as the evaluation dimensions. The game design mechanics is then adjusted according the game experience feedback.

## References

1. Ministry of Culture (2021). Endangered language-Pazeh.
2. [https://memory.culture.tw/Home/Detail?Id=554518&IndexCode=Culture\\_Place](https://memory.culture.tw/Home/Detail?Id=554518&IndexCode=Culture_Place)
3. Ministry of Culture (1999). Pazeh literature and field study.
4. [:https://memory.culture.tw/Home/Detail?Id=993&IndexCode=member\\_material](https://memory.culture.tw/Home/Detail?Id=993&IndexCode=member_material)
5. Ministry of Culture (2020). Pazeh traditional clothing.
6. [https://memory.culture.tw/Home/Detail?Id=326631&IndexCode=Culture\\_Object](https://memory.culture.tw/Home/Detail?Id=326631&IndexCode=Culture_Object)
7. Billinghurst, M. (2002). Augmented reality in education. *New horizons for learning*, 12(5), 1-5.
8. Chang, Ssu-Fan (2016). The impact of the augmented reality game on user behavior and self-efficacy. Institute of Communication Studies, NYCU, Master's thesis.

9. Alper, A., Öztas, E. S., Atun, H., Çinar, D., & Moyenga, M. (2021). A Systematic Literature Review towards the Research of Game-Based Learning with Augmented Reality. *International Journal of Technology in Education and Science*, 5(2), 224-244.
10. Lin, H. C. K., Lin, Y. H., Wang, T. H., Su, L. K., & Huang, Y. M. (2021). Effects of incorporating augmented reality into a board game for high school students' learning motivation and acceptance in health education. *Sustainability*, 13(6), 3333.
11. Hsu, Ching-Hui (2015) ° Designing interactive interface of Apps - based on the games of mobile Apps. OSET 2015 Open Source and Educational Technology Conference.
12. Shih, Li-Wei (2013) ° A study of the situation, achievements, and issues in game-based learning. Department of Technology Application and Human Resource Development, NTNU, Master' s thesis.
13. Lin, Chia-Yeh (2014) ° Game-based learning materials design. Depart of Information Management, NCNU, Master' s thesis.
14. Smith, L., & Mann, S. (2002, July). Playing the game: A model for gameness in interactive game based learning. In *Proceedings of the 15th Annual NACCQ* (Vol. 397, p. 402).

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