

Preserving Local Fishing Heritage With a VR Educational Game: Integrating Sustainability and Cultural Identity Mechanisms

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The Asian Conference on Education 2025
Official Conference Proceedings

Abstract

Once a cornerstone of Taiwan's economic development, the fishing industry is now facing challenges such as marine resource depletion and labor shortages. As the SDGs and ESG principles gain prominence, preserving local fishing culture and fostering regional identity have become critical issues. This study designed a VR game centered on Huanggang's century-old Benghuozi (Sulfur fire fishing) practice to promote cultural identity and belonging. Twenty-one university students in northern Taiwan participated in the VR experience and completed a questionnaire and qualitative survey. Results showed enhanced immersion in Benghuozi culture and stronger place identity and dependence on Huanggang fishing port. The VR experience also fostered deeper understanding of traditional fishing methods and active learning motivation. Overall, the culturally embedded VR game serves as a digital tool for cultural preservation with educational and sustainability value.

Keywords: friendly fishing technique, virtual reality, game-based learning, cultural identity, SDGs

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The International Academic Forum
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Introduction

The Benghuozi (Sulfur fire fishing) practice in Jinshan's Huanggang is a century-old, environmentally friendly fishing technique. Nevertheless, the practice now faces a transmission crisis due to a shortage of skilled labor. In light of sustainable development goals (SDGs) and environmental, social, and governance (ESG) principles, innovative approaches are needed to preserve intangible cultural heritage and strengthen regional identity. By utilizing virtual environments to assist college students in game design, 3D virtual tools can be employed to visualize discussion content, enabling participants to gain a more concrete understanding of the topics explored. This approach also enhances critical thinking, creativity, communication, and collaboration skills (Damaševičius & Sidekerskienė, 2024), while positively influencing engagement (Pellas et al., 2021) and academic emotions (Lin et al., 2025).

Virtual Reality (VR) allows individuals to transcend the limitations of time and space. Even places that cannot be physically visited can be previewed comprehensively in advance. For example, VR experiences have documented the traditional Benghuozi culture, raising public awareness of cultural heritage and immersing audiences in the lives of fishermen and maritime traditions. This not only enhances tourists' experiences but also contributes to the preservation and innovation of fishing port culture.

Research further indicates that virtual tourism experiences can serve as an information preview and reference for travelers before their trips. Activities that are time-sensitive or location-restricted can still be experienced anytime through VR. This form of virtual tourism has already been proven effective in stimulating users' willingness and motivation to travel (An et al., 2021). The VR educational game designed in this study incorporates features such as operational simulation, character simulation, and scene simulation to cultivate students' sense of local identity.

To investigate the impact of integrating local fishing knowledge into VR educational games on learners, the research questions are as follows:

1. What is the effect of this VR educational game on learners' sense of presence?
2. What is the effect of this VR educational game on learners' place identity and attachment?
3. What are the qualitative opinions of learners after using this VR educational game?

Method

This study recruited 21 Taiwanese participants aged 18 and above, with an average age of 22.30 years, who engaged in learning activities using VR headsets. The research procedure included: a 10-minute activity briefing, followed by a 40-minute VR game-based learning session, and concluded with a 20-minute administration of scales measuring sense of presence, place identity, and place dependence, along with an open-ended questionnaire. The scales were structured as follows: The Sense of Presence scale comprised 5 items based on Hwang et al. (2022). Place Identity and Place Dependence scales were derived from the Place Attachment Inventory used by Williams and Vaske (2003), with 6 items each. All scales employed a 5-point Likert scale design.

This study utilizes portable VR glasses and an integrated application characterized by their stability and efficiency to address the temporal limitations inherent in traditional Sulfur Fire

Fishing. The primary goal is to foster cultural identity among tourists through immersive digital storytelling, thereby facilitating the preservation of cultural heritage. The interface architecture is anchored in on-site field investigations, featuring digital reconstructions of fishing scenes and regional maps complemented by brief annotations. To enhance interactivity, the system employs an interactive quiz-based mechanism, which not only increases participation but also maximizes the educational impact of combining emerging technologies with intangible cultural heritage (Figure 1, Figure 2, and Figure 3).

Figure 1

VR Operation Simulation – Fishing Boat Interactive Facility



Figure 2

VR Character Simulation – Role-Play As Crew Members to Experience Fishing Missions



Figure 3

VR Scenario Simulation – On-Site Filming Scene Production



Results

This study employed Wilcoxon signed-rank tests to analyze sense of presence, place identity, and place dependence. Results indicate that the mean scores for all three variables significantly exceeded the median of 3 on the five-point scale ($p < .001$) (Table 1). This indicates that using this VR game for historical and cultural knowledge learning not only provides students with a heightened sense of presence but also fosters greater identity and place dependence toward the local culture.

Qualitative questionnaires further explored learners' perceptions of differences between VR-based local cultural learning and traditional lecture-based learning. Findings are summarized as follows: 48% (10 persons) believed VR's presence enhanced understanding of local industry techniques and cultural context; 29% (6 persons) felt VR fostered emotional resonance and motivated learning; 19% (4 persons) found VR more engaging than conventional lectures. 4% (1 person) had no opinion (Figure 4.)

Table 1

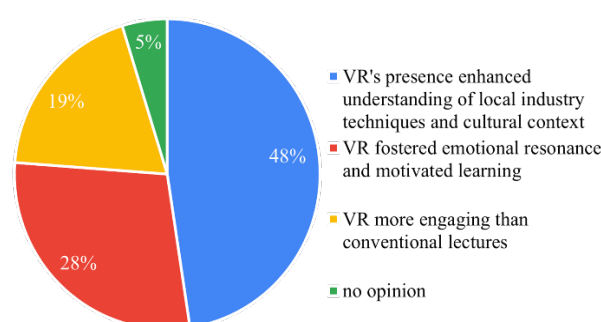
The Result of the One-Sample T-test for Each Aspect

	Mean	SD	p	Effect Size
Sense of Presence	3.98	.66	< .001***	.97
Place Identity	4.17	.53	< .001***	1.00
Place Dependence	3.91	.43	< .001***	1.00

*** $p < .001$, test value = 3

Figure 4

The Result of the Qualitative Opinion Analysis



Conclusion

This study designed a VR game themed around Jinshan's Huanggang culture, enabling students to simulate traditional fishing processes and explore local industrial characteristics. The aim was to enhance students' understanding of local fishing techniques and cultural significance, thereby fostering a stronger sense of cultural identity and attachment to their community. Results indicate that the VR experience significantly enhanced participants' sense of presence within Jinshan's Huanggang culture, accompanied by heightened local identity and attachment. Qualitative feedback further revealed that VR exploration

deepened understanding of century-old fishing techniques and cultural significance while boosting learning motivation.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Grammarly, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further declares that, apart from Grammarly, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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