

Digital Transformation of Ethnic Dance Heritage: A Multimodal Game to Balancing Instructional and Cultural Essence

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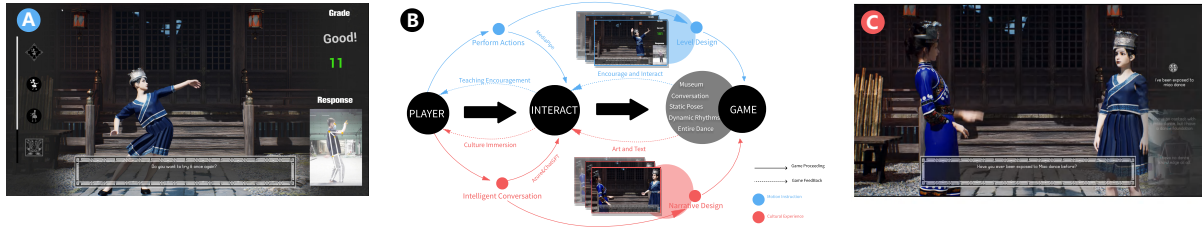


Figure 1: Dance Educational Game system overview:(a) Motion instruction by motion interaction;(b)Multi-modal interactive game. Players receive both motion guidance and cultural experiences;(c) Culture experience by intelligent conversation.

ABSTRACT

In the inheritance of ethnic dances, striking a balance between dance motion instruction and cultural experience is crucial. In this study, we have employed a multimodal interactive approach to create a digitized educational game for the inheritance of ethnic dances, thereby enhancing players' engagement and experience in the process of dance. Through experimental validation, we have substantiated the efficacy of our game.

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1 INTRODUCTION

Within the current research on the preservation of traditional ethnic dances, we face a common challenge: finding a balance between the dance motion instruction and the ethnic cultural experience. With the growing prominence of virtual space reconstruction in the field of cultural heritage, research on the digitization of traditional ethnic

dances, such as i-Treasures[Dimitropoulos and Manitsaris 2014] and Terpsichore[Hou et al. 2022], primarily focuses on digitally recording dance motions. And digital dance ethnography[Aristidou et al. 2019] enhances the cultural context of dance in a semantic way. However, these efforts often lack attention to instructional aspects of dance motions.

Taking the Hmong dance as an example, we build a dance game that balances motion teaching and cultural experience with the help of multimodal interaction technology, which contains the main functions of teaching demonstration, learning assessment, and cultural immersion. We also verified the effectiveness of the game in motion teaching and cultural experience through a pilot study.

2 CONCEPT

We design the following digital dance educational game as illustrated in Figure1, sharply balancing instruction and culture through multimodal interaction to provide a profound dance learning experience. This research uses Unreal Engine 5.1 for game development and employs a regular color camera to capture players' dance motions:

2.1 Interaction

We captured players' dance motions from videos using posture estimation technology. Differing from wearable devices like VR, our interactive approach is more convenient and flexible. Voice-enabled intelligent dialogue is also incorporated, enabling users to engage deeply in the dance experience. Posture estimation and capture technology were implemented via MediaPipe, while intelligent dialogue was realized through Azure and ChatGPT.

*Both authors contributed equally to this research.

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2.2 Instruction

Drawing inspiration from real dance instruction and based on input from professional dancers, we extract the minimal dance units, kinetic patterns, from ethnic dances. The digitized dance instruction is progressively divided into static motions, dynamic rhythms, and complete dances. Motion recognition technology captures players' joint information in 3D space, calculating the angles between players' skeletal vectors and those of the virtual character in each animation frame to accurately assess players' motion. Positive feedback is then provided to encourage continuous learning, ensuring players receive high-quality motion guidance and formative training.

2.3 Culture

We create virtual environments and virtual characters based on the birthplaces of ethnic dances, allowing players to personally experience the presentation of visual elements such as Hmong clothing, backgrounds, and regions. Players engage in intelligent dialogue with virtual characters and participate in in-depth discussions about ethnic culture. Narrative elements are interwoven throughout the teaching phases, stimulating players' interest in motion learning and cultural immersion. In each teaching stage, we designed game narratives based on Hmong culture, and virtual characters narrated the storyline to help players better understand and learn Hmong dance motions.

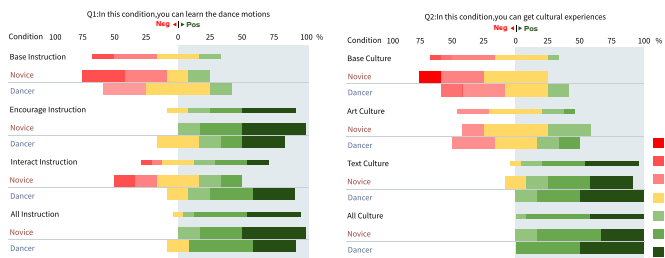


Figure 2: Results in motion instruction and cultural experience under different conditions. We use a 7-point Likert scale with different colours representing different scores.

3 EXPERIMENT AND RESULTS

We recruited 12 participants (six males, six females, mean age=20.92) for our dance game experiment to validate the effectiveness of game-based multimodal interactive design in dance instruction and cultural experience. After the experiment, each participant filled out a questionnaire and conducted an interview. 6 participants had no previous exposure to dance.

To investigate the effectiveness of the game in motion instruction, we designed the following four conditions: Base is basic dance instruction only. Encourage is feedback-based encouragement in instruction. Interact is interactive instruction. All is All of the above.

To investigate the effectiveness of the game in cultural experience, the following conditions were designed: Base is basic dance content. Art is dance-related artistic elements. Text is dance-related textual elements. All is all of the above.

The results in Figure 2 reveal that for both novices and dancers, Encourage, Interact, and All conditions consistently exhibit significant improvements in dance motion instruction compared to the Base condition. In Encourage and All scenarios, novices generally find it easier to learn dances compared to the Base, while dancers consider Interact more effective in assisting them to quickly acquire new dance forms.

Regarding cultural experience, participants perceive Text, and All conditions as significantly enhanced compared to the Base. Notably, Text yields the most pronounced cultural experience enhancement for novices and dancers, markedly surpassing the effect of Art. Conversely, Art does not exhibit significant improvement compared to Base.

Based on the above findings, we posit that in the context of digital ethnic dance instruction and cultural experience, learner identity differentials influence instructional preferences. Encouragement-based instruction is better received by novices, while interactive instruction is more suitable for skilled dancers in swiftly mastering novel dances. Concerning cultural experience, all players can rapidly gain effective cultural experience from narrative text aligned with cultural connotations.

Furthermore, we delved into novices' and dancers' perceptions of each condition. Novices acknowledge that Encourage significantly enhances their motivation to sustain learning. Dancers find Interact in line with the actual dance learning process, particularly suitable for players with dance backgrounds. While Art acquaints players with ethnically relevant cultural elements tied to dance, its depth requires further exploration. In contrast, Text, infused into dance instructional discourse, dynamically showcases the cultural essence of dance, aiding players' comprehension of form and rhythm.

4 CONCLUSION

This study introduces a multimodal interactive game for digitizing ethnic dances that simultaneously addresses motion instruction and cultural experience. Experimental outcomes reveal that the multimodal interactive dance education surpasses traditional digital records in terms of dance instruction and cultural experience, yet also suggests further areas for exploration and refinement.

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