Jiang, B. et al. (Eds.) (2025). Proceedings of the 33rd International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

A Collaborative MMORPG Card Game with Dual-Dimensional Peer Scaffolding for Reading Comprehension: A Pilot Study

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Abstract: This pilot study presents a collaborative massively multiplayer online role-playing game (MMORPG) card game designed to support reading comprehension through dual-dimensional peer scaffolding. The game integrates two peer scaffolding mechanisms: (1) a collaborative turn-based mechanics where three to four players collaboratively complete the same contextual problem-solving game task by matching task cards (contextual problem-solving texts) with corresponding knowledge cards (the learning content of the task cards). (2) A synchronous text-based discussion forum enables players to engage in real-time text-based discussions of game strategies both before and during gameplay. These peer-based supports aim to foster collaborative reading processes. In addition, three different types of clue-based support are embedded in the system to help students complete the tasks more effectively. Results indicate high levels of flow, a generally positive level of collaborative communication, and low cognitive load among participants.

Keywords: Collaborative learning, MMORPG, peer scaffolding, collaborative communication, cognitive load

1. Introduction

Reading comprehension is a fundamental skill that underpins learners' academic achievement across subjects and educational levels (Guthrie et al., 2006). It involves readers actively making sense of texts by integrating textual cues with prior knowledge (Paris & Hamilton, 2014). Many students struggle with complex texts due to insufficient instructional support and a lack of foundational skills (Faggella-Luby et al., 2015), leading to demotivation and frustration (Oliver & Young, 2016). Recent research suggests that integrating games into collaborative reading contexts can enhance learners' reading comprehension (Li et al., 2022). By engaging in peer discussions grounded in textual content, learners can develop a deeper understanding of what they read (Tseng & Yeh, 2018). As a result, designing effective game-based collaborative reading environments that facilitate meaningful peer interaction and shared interpretation of texts has become a critical issue in educational research.

Extending the pilot evaluation of single-player mode of the MMORPG card game "Time Warrior Academy" (https://adl.edu.tw/twa/) (Li et al., 2024), this study evaluated the collaborative mode for this game that integrates dual-dimensional peer scaffolding, namely collaborative turn-based mechanics and synchronous text-based discussion forum, to enhance learners' reading comprehension. The digital card game framework includes two primary components: task cards containing situational problem-solving texts (limited to 300 words) and knowledge cards featuring text-related learning materials. Each gaming task incorporates one task card, three to six accurate knowledge cards, and eight distractors. Groups of 3-4 learners collaborate through turn-based gameplay and synchronous discussions to read, analyze, and accurately match task cards with the appropriate knowledge cards. Dual-dimensional peer scaffolding is described as follows:

- Collaborative turn-based mechanics: Group members work together to complete the same task card. In each round, every player performs two actions, such as placing or

replacing knowledge cards in the answer area. This peer scaffolding mechanism supports joint problem-solving and encourages players to attend to their teammates' moves, thereby promoting reflection on group reasoning and decision-making.

- Synchronous text-based discussion forum: Players had one minute before gameplay to discuss strategies and exchanged messages during gameplay to coordinate actions and decisions. Real-time communication supported task completion within time limits and served as peer scaffolding by encouraging shared understanding and decision-making.

The system provides three types of clues to assist players in completing the game tasks: key point clues (highlighting important words in the task text), knowledge card clues (hinting at the correct knowledge cards), and contextual clues (adding background information to support comprehension and decision-making). It also features an instant diagnosis mechanism that checks the accuracy of the matched knowledge cards after all players have completed their actions in each round. When players successfully complete a task, an answer explanation is displayed to deepen their learning and reinforce understanding.

Figure 1. MMORPG card game with dual-dimensional peer scaffolding: collaborative turn-based mechanics and synchronous text discussion.

2. Method

The study preliminarily investigated learners' flow, collaborative communication, and cognitive load in the collaborative mode of the game. A one-group pretest–posttest design was adopted, involving 18 eighth-grade students. Participants were divided into groups of 3–4, with each member using a tablet. The Flow Scale for Game (FSG), developed by Kiili (2006), contains 22 items rated on a 5-point Likert scale. The Collaborative Communication Scale, developed by Huang et al. (2010), comprises 22 items rated on a 4-point Likert scale. The Cognitive Load Scale, developed by Hwang et al. (2013), consists of 8 items, each rated on a 4-point Likert scale. The Cronbach's α values for the three instruments were 0.978, 0.887, and 0.967, respectively. Participants played the game for 40 minutes and then completed the three questionnaires. This study was approved by the Research Ethics Committee of National Taiwan University (approval number: 202407ES013).

3. Results

As shown in Table 1, the mean score for overall flow was 4.15 (*S.D.* = 1.03), while the mean score for cognitive load was 2.97 (*S.D.* = 1.33). Using the median value of 3 as the test value, Wilcoxon signed-rank tests revealed that the flow score was significantly higher than 3 ($p < .05$). Although the cognitive load score was not significantly different from 3 ($z = -0.142$, $p > .05$), the mean score remained below the median of 3. These results suggest that learners were meaningfully engaged in the game-based activity and did not experience a high level of cognitive load during the learning process. The mean score for collaborative communication was 3.40 (*S.D.* = 0.43) on a 4-point scale, which was significantly higher than the theoretical median of 2.5 ($p < .05$), suggesting generally favorable peer interaction.

Table 1. *Descriptive statistics and Wilcoxon signed-rank tests for flow, collaborative communication, and cognitive Load*

	Mean	*S.D.*	*z*
Flow	4.15	1.03	2.920**
Cognitive load	2.97	1.33	-0.142
Collaborative communication	3.40	0.43	3.683***

** $p < .01$ *** $p < .001$

4. Discussion

This study designed a collaborative MMORPG card game featuring dual-dimensional peer scaffolding (collaborative turn-based gameplay and synchronous text-based discussion) to support reading comprehension. Preliminary results suggest that participants showed substantial engagement in learning activities, displayed effective collaborative communication patterns, and experienced manageable cognitive load levels. Future studies will utilize quasi-experimental designs to explore the impacts of various peer scaffolding dimensions (such as authentic human peers versus AI-generated virtual peers) within collaborative MMORPG environments on reading comprehension performance and associated psychological constructs.

Acknowledgements

This research was successfully completed with heartfelt gratitude to "The Digital Learning Enhancement Plan for Grades 1-12 Students" and "Taiwan Adaptive Learning Platform" supported by the Ministry of Education, Taiwan, for their invaluable support.

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