

# An Online MMORPG Card Game Based on Multi-Dimensional Scaffolding to Develop Reading Comprehension and Contextual Problem-Solving Skills

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**Abstract:** This study designed an online massively multiple online role-playing card game that integrates a multi-dimensional scaffolding framework. The learning goal is to develop students' reading comprehension and contextual problem-solving skills. The game components include task cards (contextual problem-solving texts) and knowledge cards (corresponding to the learning content of the task cards). Students first need to read and analyze the text and learning information of the task cards and match the correct knowledge cards within a limited time. Multi-dimensional scaffolding provides students with three different dimensional clues in the game to help students complete the game tasks. Preliminary experimental results showed that students have a high degree of flow in this game activity. They think the game is easy to operate and will not cause excessive anxiety.

**Keywords:** multi-dimensional scaffolding, MMORPG, card games, reading comprehension, contextual problem-solving

## 1. Introduction

Developing students' reading comprehension and contextual problem-solving skills has been recognized as one of the important tasks for instructors nowadays (Karaca-Atik et al., 2023). Among the many instructional strategies, digital game-based learning (DGBL) has been considered an effective method to prompt students' reading comprehension (Yang & Kuo, 2022) and problem-solving skills (Chou et al., 2023). However, poorly designed digital games will have a negative impact on learning. (Barzilai & Blau, 2014). In recent years, educational online massively multiple online role-playing games (MMORPGs) have attracted the attention of researchers. The MMORPGs have stories and involve diverse contextual problem-solving tasks (Hou, 2012). Previous studies suggested that MMORPGs can support students' learning of key skills (Sourmelis et al., 2017).

This study designed an online MMORPG card game integrating multi-dimensional scaffolding (Hou & Keng, 2021) to cultivate students' reading comprehension and situational problem-solving skills. The design concept of this game platform is based on two elements of board games: card components and matching mechanisms (Li et al., 2022). Digital card components include task cards and knowledge cards. Each game task contains one task card, three to six correct and eight incorrect knowledge cards. Game tasks are texts of contextual problem-solving tasks within 300 words. The information on the knowledge card is related to the learning content of the task card. The goal of the game is to successfully match the task card with the corresponding correct knowledge card.

The design of the multi-dimensional scaffolding mechanism is to give students multiple clues in the game to help them think and successfully challenge the game tasks, including the following three clue mechanisms: (1) Key points clues: Mark the keywords of the text of the task card to help students quickly grasp the key points. (2) Knowledge card clues: Provide

clues to the knowledge cards to help students determine the correct knowledge cards. (3) Contextual clues: Provide additional contextual clues to task cards to facilitate students' cognitive analysis and link to the correct learning knowledge.

After students select a task card to challenge in the system, the system will automatically give them a combination of knowledge cards for this task card. Students first need to read and analyze the text and learning information of the task cards and match the correct knowledge cards within a limited time. During the game, students can use the three scaffolding mechanisms to obtain clues to challenge the game tasks successfully. The system has an instant checking mechanism that can provide students with timely feedback. This helps them to know which knowledge cards are correctly matched or incorrectly. For incorrectly matched knowledge cards, students can think and match them again. After students have successfully matched all the knowledge cards, the system will display all the correct answer instructions for the task card to deepen students' learning.

Key points clues: Mark the yellow keywords of the text to help students quickly grasp the key points.



Knowledge card clues: Provide clues to the types of knowledge cards to help students determine the correct knowledge card.



Figure 1. The multi-dimensional scaffolding mechanism provides students with multiple clues to help them think and complete game tasks.

## 2. Method

This study utilized a one-group pretest-posttest design to initially explore the effect of this game on students' flow, technology acceptance, and cognitive load. The participants were 30 seventh-grade students. The Flow Scale for Game (FSG) questionnaire developed by Kiili (2006) was adopted for this study to assess students' engaged state of mind in a game activity. It consisted of 22 items in two dimensions: flow antecedent and flow experience. The technology acceptance questionnaire was modified from the original design by Davis (1989) to assess students' technology acceptance for this game. It consisted of nine items in two dimensions: usefulness and ease of use. The activity anxiety questionnaire was modified from the originally developed by Krashen (1987) and adapted by Hung (2001) to assess students' anxiety levels during this game activity. The Cronbach's alpha values of the FSG, technology acceptance, and activity anxiety questionnaire were .94, .91, and .92 respectively. All questionnaires were five-point Likert. The game activity time was 50 minutes. Afterward, students completed the three questionnaires.

## 3. Results

The results are shown in Table 1. The overall flow mean was 3.99, and the technology acceptance mean was 4.24. The one sample *t*-test results of each dimension of flow and technology acceptance were significantly higher than the median (the median 3 in the 5-point scale was used as the test value). The results found that the game may facilitate students' engagement in this game activity, and they believed the game was simple to play and helped them learn. The activity anxiety mean was 2.40. The one-sample *t*-test was significantly lower than the median. The results found that students did not experience excessive anxiety during this game activity.

Table 1. *The descriptive statistics and one sample t-test of flow, technology acceptance and activity anxiety*

| Variables             | Mean | SD   | t       |
|-----------------------|------|------|---------|
| Flow                  | 3.99 | 0.68 | 7.91*** |
| Flow antecedent       | 3.88 | 0.70 | 6.88*** |
| Flow experience       | 4.14 | 0.75 | 8.34*** |
| Technology acceptance | 4.24 | 0.72 | 9.45*** |
| Usefulness            | 4.29 | 0.72 | 9.79*** |
| Ease of use           | 4.14 | 0.94 | 6.66*** |
| Activity anxiety      | 2.40 | 1.09 | -3.01** |

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

## 4. Discussion

This study designed an online MMORPG card game integrating multi-dimensional scaffolding to cultivate students' reading comprehension and contextual problem-solving skills. Preliminary results showed positive effects of the game on flow, technology acceptance, and activity anxiety. In the future, we will conduct a quasi-experimental design to explore the effectiveness of this game on students' reading comprehension and situational problem-solving skills. At the same time, the impact of three scaffolding mechanisms on students learning are discussed respectively.

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