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Effect of immersive digital gaming experience on elementary students' L2 learning

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1. Introduction

Availability of portable computing devices and advancement in immersive computer technologies have given rise to a recent spurt of research interests in leveraging benefits of digital games in educational contexts. In contrast to conventional approaches of technology enhanced learning, key advantages of incorporating digital games into second language (L2) learning are its affordances to provide immersive and motivational experience for situated language learning.

2. Theoretical foundation

Interactive and immersive learning environment is considered to be beneficial to L2 learners because of their efficacy in providing sensory input, interaction, task-based learning and output production (Cheng, She, & Annetta, 2015; Lin, Chen, Huang, Huang, & Chen, 2014). Researchers emphasize that some aspects of videogames, such as intrapersonal and intrapersonal factors, could promote intrinsic motivation. Highlighting games' role in transforming language learning as an experience to derive "situated meaning," Gee (2013) argues that games associate words with images, actions, goals and dialogue, allowing learners to understand new words in context, rather than as abstract symbols.

2.1 Player involvement, flow, and game immersion

Motivational theories ascribe engaging learning experience to high degrees of player involvement. The primary goal of digital games is to create visually satisfying and intrinsically motivating experiences for students to interact with the virtual world with high player involvement. Player involvement may be referred to by various terms such as presence, immersion, engagement, and flow (Calleja, 2011; Norris, Weger, Bullinger, & Bowers, 2014; Herrewijn, Poels, & Calleja, 2013). In Csikszentmihalyi's (1990) conceptualization, flow signifies a peak experience accompanied by optimal performance and a state of concentration and satisfaction when players are engaged in activities that are of intrinsic interests to them.

It is of practical significance to differentiate various levels of player involvement distributed along a continuum. Studies suggest that immersion, rather than flow, might be a more appropriate term to describe user's degree of involvement playing video games, because flow as a culminated experience is typically preceded by engagement with challenging tasks that require extended hours of practice, and that flow occurs only when some basic criteria are satisfied, such as clear goals, direct feedback, good balance between skill and challenge. Some games simply cannot have these criteria met, because they may not have clearly defined goals, or provide direct feedback to the player. By contrast, it does not require extended hours of practice to achieve immersion. Furthering the progressive nature of immersion, Jennett et al. (2008) argue that while flow and immersion overlap in the sense of distorting time and providing challenges, immersion is a precursor of flow, with the latter being the extreme end of the former, as a player can be immersed in a game while still being aware of other things they need to

attend to, without reaching a state of flow. In other words, immersion does not necessarily warrant flow, and a player can be immersed in a game but still not reaching the state of flow.

2.2 Immersive game-enhanced L2 learning

Studies note that visual effects of a video game help create immersive sensory experiences when interacting with visually appealing objects in the virtual world. Ivory and Kalyanaraman (2007) argue that innovations in sound and graphics can drastically change key variables of player experience, such as presence, involvement, and immersion. Järvinen (2002) identifies three graphical styles that have dominated video game design since its inception: Photorealism, Caricaturism, and Abstractionism. As all three styles have their distinctive roles in gameplay, how visual appearance of games could affect a game's aesthetic value and player's experiences is a question remains to be examined.

In the game that we use for this study, scenes are presented in photorealistic 3D renderings, which allows the players to interact with game objects that look more realistic. When navigating through the game scenes, players could build up a sense of place, which enhances the sense of presence, thus would be conducive to the experience of immersion, which in turn may benefit learner's performance.

3. Methodology

This study investigates how perceptions of immersive gaming experience derived from realistic-looking visual elements correlate to L2 learners' learning performance in a digital educational game.

3.1 Design and participants

This study employs a quasi-experimental design that involves an experiment and a control group to be compared regarding the participants' learning performance before and after the intervention. The participants are two classes of elementary students randomly selected from a pool of eight classes at the third grade. The two classes are similar to each other with respect to age, social economic status, and their academic performance as a whole. The experiment group consisted of 38 students, and the control group consisted of 25 students. The learning content of the two groups is the same, the only difference is that the experiment group learnt with the digital game, while the control group learnt with conventional DVD-based interactive learning system.

3.2 Instruments

To examine the player's involvement in relation to immersion, this study employs the Immersion Questionnaire (Jennett et al., 2008) to analyze the participant's perception about their learning experience. The questionnaire consists of 30 questions in five dimensions, including cognitive involvement, real world dissociation, emotional involvement, challenge, and control. To assess the participants' learning performance, we developed a set of quizzes based on the textbook used by the elementary school at which the experiment was conducted.

3.3 Procedure

The two classes of students are assigned to either the experiment or control group condition according to the recommendation of the teacher in charge of their English class.

4. Results and conclusions

To examine whether the learning performance of the two groups of students differ from each other before and after the intervention, a paired sample *t*-test was performed. Although both groups achieved some progress in terms of quiz scores, the students in the experiment achieved their progress on a statistically significant level ($p<.001$), while those in the control group did not. These results indicate that the students learning with the immersive digital game demonstrated greater potential in their language performance than their counterparts learning under non-game setting.

To understand how the students' learning performance is correlated to different dimensions of immersion, a regression test was performed. The results indicate that among the five dimensions of immersion, three of them (real world dissociation, challenge of tasks, and control) were found to be significantly correlated to the students' performance, with a marginal correlation between emotional involvement and learning performance.

This study presents empirical evidences that confirm the positive role of immersive game experience to language learning. Furthermore, it provides some nuanced insights on how specific aspects of immersion are correlated with learning performance in digital game-enhanced language learning.

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