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GUEST EDITORIAL

Transforming the classrooms: innovative digital game-based learning designs and applications

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Introduction

Digital game-based learning has been recognized as an effective approach in promoting students' learning motivation, which is an important factor of improving students' learning performance. In recent years, many educational computer games have been developed for enhancing learning in various subject domains, such as mathematics (Hung et al. 2012), natural science (Hwang et al. 2012), social science (Hung et al. 2012) and engineering (Cagiltay 2007). Several studies have reported the effectiveness of educational computer games in enhancing the learning interest of students, and even increase their motivation (Hwang et al. 2012). In comparison with traditional instructions or conventional technology-enhanced learning, digital game-based learning is able to provide a more interesting and challenging learning environment for acquiring knowledge (Bourgonjon et al. 2010; Gerber and Scott 2011; Hwang et al. 2012; Hwang et al. 2013).

In the meantime, researchers have indicated that the effectiveness of educational computer games might not be as significant as expected if they are developed without embedding appropriate learning strategies; therefore, it has become an important issue to develop educational computer games by taking effective learning strategies, knowledge construction tools, or educational theories into account (Chao et al. 2013; Hwang et al. 2013; Sung and Hwang 2013).

The aim of this special issue is to provide an opportunity for researchers to present their studies related to the development of educational computer games with effective learning strategies. The developed games need to be thoroughly evaluated via practical applications. The submitted papers all went through a double-blind review. It is expected that through

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the publication of this special issue researchers can inspire each other in developing more creative and effective educational computer games in the future.

After a rigorous review process, seven high-quality research papers have been accepted for publication in this special issue, which would collectively present new perspectives and challenges in bridging the strategies and applications in digital-game based learning. In the first paper, Hwang, Hung and Chen reported a peer assessment-based game development approach, which was applied to an elementary school science course. The experimental results showed that the approach helped the students in improving their deep learning status in terms of ''in-depth thinking,'' "creativity," and "motivation". In the second paper, Chu and Zhang presented an educational computer game for migratory bird identification based on a two-tier test approach. It was found that the proposed approach significantly promoted the students' learning motivation, learning achievements and technology acceptance degree in comparison with those who learned with the conventional e-learning approach. In the third paper, Chen, Wong and Wang investigated the effects of the type of exploratory strategy and level of prior knowledge on middle school students' performance and motivation in learning chemical formulas via a 3D role-playing game. Several interesting findings were reported in this study, such as "significant worked-example effect was revealed on knowledge comprehension and marginal worked-example effect occurred on knowledge application." In the paper titled "Embedding diagnostic mechanisms in a digital game for learning mathematics," Huang, Huang and Wu presented a mathematics game with diagnostic mechanisms and showed the effectiveness of the approach in enhancing students' interest and reducing their anxiety in learning mathematics by conducting a learning activity in an elementary school. In the paper titled "Using Digital Board Games for Genuine Communication in EFL Classrooms," Chen and Wu proposed a digital board game for language learning. An experiment on an English course for EFL students showed that the digital board game could improve the students' learning performance. In the paper of Borro-Escribano et al., the development of a game-like simulation system for representing transplant management procedural knowledge was reported. In the paper of Voulgari, Komis and Sampson, the perceptions of players on the learning impact of massively multiplayer online games, the potential transfer of skills to other domains, the learning practices they employ, and elements of the design of the environment that may present positive conditions for learning were investigated.

From these papers, a common finding is that merely applying digital games to educational settings might be insufficient. To provide an effective digital game-based learning environment, it is important to design good learning strategies or tools in a game-based learning environment (Hung et al. 2013); moreover, the learning objectives and contents need to be well-integrated into the gaming missions and scenarios. The papers included in this special issue have demonstrated good examples for better references. There are several research trends/directions for the digital game-based learning research identified by the researchers of this special issue. For example, it is expected that more and more educational computer games with good learning strategies and well-designed learning content will be presented by researchers, as predicted by Hwang and Wu (2012). In addition, emphasizing on personal factors, such as preferences or learning styles, should be taken into account by researchers for developing more adaptive and effective educational computer games in the future (Chen et al. 2011; Hwang et al. 2012).

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