Chapter 23
Effects of the Digital Game–Development Approach on Elementary School Students' Learning Motivation, Problem Solving, and Learning Achievement

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ABSTRACT

In this study, the game-based development approach is proposed for improving the learning motivation, problem solving skills, and learning achievement of students. An experiment was conducted on a learning activity of an elementary school science course to evaluate the performance of the proposed approach. A total of 59 sixth graders from two classes of the elementary school participated in the experiment. One class of 30 students was selected as the experimental group, and the other class of 29 students was the control group. From the experimental results, it was found that the proposed game development-based learning approach could effectively promote the students' problem-solving skills. However, the students' learning achievement and motivations were quite different from our expectations. A discussion of the experimental group interview data is provided and suggestions made.

1. INTRODUCTION

With the emergence of cloud learning and digital technology, digital game-based learning has become an important research topic in education (Becker, 2007; Guillén-Nieto & Aleson-Carbonell, 2012; Hwang & Wu, 2012). Liu and Lin (2009) pointed out the key role of digital games in living, learning, and education. Dempsey, Rasmussen and Lucassen (1994) considered that games present

the functions of instructing, entertaining, exploring new skills, promoting self-esteem, practicing skills, and changing attitudes, making their application valuable in education. It appears that the application of digital games to learning is likely to become an educational trend.

Jonnavithula and Kinshunk (2005) considered that games could assist learners in learning and enhancing interest and that game-based learning could promote motivation (Chamillard, 2006; Huang, Huang, & Tschopp, 2010; Pivec, 2007). Huang, Tseng, Weng and Ho (2008) discovered that games with educational meaning allow students to learn while playing, enhance their learning interest, and let them happily learn the required knowledge. Hung, Hwang, and Huang (2012) developed a project-based digital storytelling approach to enhance students' science learning motivation, problem-solving competence, and learning achievement. Accordingly, applying digital games to instruction could promote learning interest, motivation, and achievement.

On the other hand, researchers have pointed out the potential effectiveness of engaging students in designing or developing digital games (Robertson & Howells, 2008). For example, Hong and Liu (2003) indicated that the process of designing games is highly related to the cognitive process of problem solving; that is, students are likely to construct their knowledge via involvement in game development.

As a consequence, this study utilizes game development software, which is suitable for elementary pupils to develop digital games according to the learning contents provided by the teacher. It aimed to understand whether the game development-based learning approach could enhance the students' learning motivation, problem-solving skills, and learning achievement.

2. LITERATURE REVIEW

Many researchers have considered that appropriate materials or instruction allow children to learn happily while playing games (Hwang, & Wu, 2012; Norman, 1981). Compared to other modes of learning, games are considered more acceptable and accessible to children and could assist pupils in developing their thinking skills (Hwang, Wu, & Chen, 2012; Seonju, 2002). Bourgonjon, Grove, Smet, Looy, Soetaert, and Valcke (2013) investigated the factors that influence the acceptance of commercial video games as learning tools in order to understand teachers' perceptions and beliefs in the secondary school classroom. Moreover, researchers have mentioned that actively exploring and acquiring knowledge in situations is practical and could be referred to other situations. For this reason, the provision of abundant learning situations allows practical exploration by learners through observation and action, thus leading to further acquisition of problem-solving skills (Hwang, Kuo, Chen, & Ho, 2014; Young, 1993).

Prensky (2001) has indicated that an educational computer game is a game that includes instructional objectives in games for providing interactive learning among learners and triggering intrinsic learning incentive. Much research has indeed indicated that computer games could enhance learning achievement (Ebner & Holzinger, 2007; Garris, Ahlers, & Driskell, 2002; Hwang, Wu, & Chen, 2012; Hwang, Yang, & Wang, 2013) and learning motivation (Burguillo, 2010; Dickey, 2010; Ke & Grabowski, 2006; Liu & Chu, 2010; McFarlance, Sparrowhawk, & Heald, 2002; Papastergiou, 2009; Rosas et al., 2003). Hwang, Wu, and Chen (2012) proposed an online game approach and found that this approach not

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