Computers & Education 96 (2016) 29–41

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Lifestyles, innovation attributes, and teachers' adoption of game-based learning: Comparing non-adopters with early adopters, adopters and likely adopters in Taiwan☆

Shu-Chu Sarrina Li [a, *], Wei-Chun Huang [b]

[a] Institute of Communication Studies, National Chiao Tung University, 1001 University Road, Hsinchu City, Taiwan, ROC
[b] Degree Program of E-learning, National Chiao Tung University, 1001 University Road, Hsinchu City, Taiwan, ROC

ARTICLE INFO

Article history:
Received 21 April 2015
Received in revised form 5 January 2016
Accepted 20 February 2016
Available online 23 February 2016

Keywords:
Game-based learning
Rogers' diffusion of innovations
Non-adopters
Lifestyles
Innovation attributes

ABSTRACT

The purpose of this study was to understand the factors that affected teachers' adoption of game-based learning (GBL). In particular, this study paid special attention to the non-adopters who did not have any intentions to adopt GBL in the future and examined how these non-adopters differed from the early adopters, adopters and likely adopters. Based on Rogers' diffusion of innovation model, this study identified three factors–lifestyles, perceived attributes of GBL, and demographics–as significant predictors for adoption. Two methods were adopted by this study: First, this study conducted 15 intensive interviews to construct questions regarding the perceived attributes of GBL. Second, using a purposive sampling method, this study mailed 347 questionnaires to teachers in Taiwan's elementary schools and obtained 307 valid questionnaires.

Two conclusions were drawn from the data analysis: (1) lifestyles and perceived attributes exerted a strong effect, whereas demographics only had a moderate effect in discriminating non-adopters from adopters and likely adopters; (2) the non-adopters in this study were more likely to be males instead of females, to have more teaching experience, to be older, to have no experience with video games, and to be better educated.

1. Introduction

With the rapid development of Internet technologies, computer games have been popular with young people in Taiwan. A recent study conducted by the government (R.D.E., 2013) found that Taiwan's elementary school students spent approximately six hours per week using computers, including five hours for playing online games. Computer games have been found to affect students' learning in terms of their cognitive processes and motivation (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). In the past decade, increasing academic attention has been devoted to understanding the use of computer games in classroom instructions, which is referred to as game-based learning (GBL). Empirical studies have confirmed that integrating games into classroom instructions allows students to adapt learning to their cognitive needs and to stimulate their interest in learning, which is considered a more effective teaching method than conventional methods (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Wouters & van Oostendorp, 2013). Most existing studies of GBL investigated the effectiveness of student learning in terms of knowledge acquisition, motivation, and cognitive and behavioral skills, but only a few

☆ This manuscript was supported by a grant from the Ministry of Science and Technology of Taiwan (NSC 103-2511-S-009-005-MY3).
* Corresponding author.
E-mail addresses: shuchu@mail.nctu.edu.tw, shuchuli@gmail.com (S.-C.S. Li), hs1310@nc.hcc.edu.tw (W.-C. Huang).

http://dx.doi.org/10.1016/j.compedu.2016.02.009
0360-1315/

studies have examined the acceptance of game-based learning by teachers who were the true change agents of classroom instruction (Bourgonjon et al., 2013; Connolly et al., 2012; Proctor & Marks, 2013; Wouters et al., 2013; Wouters & van Oostendorp, 2013). This study aimed to understand the factors that affected teachers' adoption of GBL in classroom instructions. In particular, this study paid special attention to non-adopters who did not have any intentions to adopt GBL in the near future and examined how these non-adopters differed from the early adopters, adopters and likely adopters.

Rogers' diffusion of innovation model has been widely used to predict technology adoption, and empirical studies have confirmed it to be a powerful model (Atkin, Neuendorf, Jeffres, & Skalski, 2003; Chan-Olmsted & Chang, 2006; Egenfeldt-Nielsen, 2010; Jung, Chan-Olmsted, Park, & Kim, 2012; Kebritchi, 2010; Proctor & Marks, 2013; Wang, Lockee, & Burton, 2011; Wei, 2001, 2006; Zhu & He, 2002). For example, Proctor and Marks (2013) used a survey to investigate the adoption of computer-based games by American exemplar teachers and found that 60% of K-5 primary school teachers had adopted GBL, which was in Rogers' late majority stage, whereas only 25% of the 6–12 secondary school teachers adopted GBL, which was in Rogers' early majority stage. Rogers' model (2003) classifies individuals into five types based on when they adopt a technology. Innovators are the first 2.5% in a society to adopt a new technology, and early adopters are the next 13.5% to adopt the technology, followed by adopters of early majority, who represent 34% of all individuals in society. Adopters of late majority also constitute 34% of all members of society, and laggards are the last 16% to adopt this technology. Empirical studies have found that laggards differ significantly from the other four types of adopters; For example, Wei (2001) examined the non-adopters of cell phones in Hong Kong and found that the laggards tended to be older and less affluent, they were more likely to be female, and they read newspapers and magazines less often than the other types of adopters did (pp. 710–712). With promotion from the government, the use of GBL has been prevalent in Taiwan's schools, and most teachers consider the use of GBL to be a future trend in classroom instructions (Huang, 2014; Liu & Lin, 2013). This study expects that the adoption of GBL has reached critical mass in Taiwan and thus predicts that the rate of GBL penetration in Taiwan will be greater than 50%. Therefore, non-adopters of GBL will be the laggards identified in Rogers' model and will differ greatly from the early adopters, adopters and likely adopters in terms of their demographics and personalities (Rogers, 2003). Therefore, it is critical to examine the phenomenon of non-adoption and the characteristics of non-adopters to assist the government in identifying the barriers that prevent teachers from adopting GBL in their classroom teaching.

According to Rogers' model, individuals adopt technologies not only for their practical functions but also for the social identity conferred by technologies. When technology adoption is driven by social rewards, lifestyles become an important predictor of adoption because people express unique characteristics of themselves by adopting different types of lifestyles to show their social differentiation (Mazzoni, Castaldia, & Addeob, 2007; Wei, 2006). Social rewards correspond to relative advantage, one of the five perceived innovation attributes identified in Rogers' model (2003). Innovation attributes are the most powerful element among those identified by Rogers' model because these attributes explain the greatest amount of variance in technology adoption.

The purpose of this study is to compare the differences among early adopters, adopters, likely adopters, and non-adopters with respect to teachers' lifestyles and perceived attributes of game-based learning in Taiwan's elementary schools and thus to identify the factors that prevent non-adopters from adopting game-based learning in classroom instruction.

2. Literature review

Existing studies of GBL have identified several factors affecting teachers' acceptance of GBL, such as teachers' professional development (focusing on attitudes and self-efficacy), attitudes from peers and administrators, technology knowledge (affecting self-efficacy), teachers' self-efficacy, teachers' attitudes, school cultures (existing values), teachers' time and space, and teachers' psychological variables (Bourgonjon et al., 2013; Connolly et al., 2012; Davies & West, 2014; Ertmer & Ottenbreit-Leftwich, 2010; Holden & Rada, 2011; Ketelhut & Schifter, 2011; Wouters et al., 2013; Wouters & van Oostendorp, 2013). A close examination of these studies shows that these variables can be further classified into four types: (1) teachers' psychological variables including self-efficacy, personality, and demographics; (2) teachers' attitudes, including their beliefs; (3) attitudes from peers and superiors, including school cultures; and (4) teachers' resources, including time and space. Among the four variables investigated in this study, lifestyles and demographics are teachers' psychological variables, but this study did not examine teachers' self-efficacy because past studies have concluded that this variable has a significant effect on teachers' technology adoption (Clark, 2000; Ertmer & Ottenbreit-Leftwich, 2010; Holden & Rada, 2011; Sang, Valcke, van Braak, & Tondeur, 2010; Vannatta & Nancy, 2004; Wong, Teo, & Russo, 2012). For example, Holden and Rada (2011) examined 378 K-12 teachers who were from two rural public school districts in Virginia of the U.S. Their study found that teachers' technology self-efficacy directly influenced their attitudes toward using technologies in classroom. Sang et al. (2010) investigated 727 teacher students in China and discovered that teacher students' self-efficacy strongly predicted their computer self-efficacy, which in turn predicted their prospective computer use in classroom. Wong et al., (2012) adopted the technology acceptance model to examine the effect of student teachers' computer teaching efficacy on their intentions to use computers in classroom. They recruited 302 student teachers from an education university in Malaysia and found that the respondents' computer teaching efficacy positively predicted their attitude toward computer use, which in turn positively affected their behavioral intention to use computers in classroom. Vannatta and Nancy (2004) also found that teachers' self-efficacy was one of the indicators that predicted technology use in classroom. Furthermore, one lifestyle–life expansionists–is closely related to teachers' self-efficacy, which is a major variable examined in this study. Therefore, teachers' self-efficacy has been indirectly investigated in this study. This study's perceived attributes correspond to teachers' attitudes or beliefs about