

Digital Mobile Games in Education

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INTRODUCTION

Digital games, hereafter games, remain a powerful learning platform due to the features such as motivating, engaging, and immersive (de Feritas, Savill-Smith, & Attewell, 2006; Maleno, 1981). Digital games on mobile devices provide a unique learning opportunity that is ubiquitous (anywhere, anytime). This chapter focuses on a review of current literature on educational use of digital games on mobile devices, that is, mobile game based learning.

With the fast development of mobile technologies, we are observing a trend that moves the traditional video games or computer games to digital games played on mobile devices like smartphones, Personal Digital Assistants (PDAs), or handheld consoles. A mobile game is defined as “an electronic game played on a mobile phone, smart phone, PDA, handheld computer, or any type of handheld or wireless device” (Demirbilek, 2010, p. 237). An educational mobile game, sometimes known as Mobile Serious Games (MSGs), is an integration of mobile games and educational content. It connects education to the daily life experiences of learners and their learning styles with the main purpose of delivering specific learning goals, outcomes, and experiences (Demirbilek, 2010; Proserpio & Viola, 2007; Sanchez & Olivarez, 2011; Stone, 2005; Vahey, Tatar, & Roschelle, 2007).

Researchers (e.g. Montola, Stenros & Waern, 2009; Broll, Ohlengurg, Lindt, Herbst, & Braun, 2006) have identified some advantages of mobile games over traditional videogames and conven-

tional computer games. Mobility is one of the vital aspects of mobile game based learning that gives it more advantages than other types of learning. For example, mobile technologies allow just-in-time and just-in-place learning to occur. Mobile games also allow players higher degrees of freedom to interact with the game and other players because they are no longer limited by location, time, or space. Another unique benefit, when compared with conventional computer games or console games, is that mobile technology can easily blend the real world with the virtual game world. This advantage of mobile games has led to the establishment and development of a new field: pervasive game where the virtual game world integrates with our real physical world (Montola et al, 2009). According to Broll and his colleagues (2006), pervasive games can bring out the best of digital games, the traditional board games and outdoor games. One such development is the genre of location-aware games and in particular, Pervasive Augmented Reality (AR) games, defined as “a special type of location-aware pervasive games, which use AR to enhance the real world of the players by virtual objects” (Broll et al., 2006, p. 1).

Pervasive games can be indoor only, outdoor only, or a combination of indoor and outdoor game play. Many of these games use the existing internet services combined with GPS devices. Earlier AR games include the famous PS2 game *EyeToy* (www.eyetoy.com), the *Invisible Train*, *Human Pacman* (Cheok et al., 2004) among others. The *Invisible Train* is an indoor game where PDAs are used to control a virtual train (Broll et al., 2006). *Human Pacman*, on the other hand is

an AR outdoor game where wearable computers with different sensors are used for the game play (Cheok et al., 2004). Pervasive games will be further discussed later.

OVERVIEW

Educational mobile games aim to engage players for extended periods and foster learning through the appeal of games (Gee, 2003). A number of research projects have studied the educational effects of a variety of mobile games: *Weatherlings*, *Frequency 1550*, *EcoRangers*, to name a few. Findings suggest that a well-designed mobile game attracts and maintains attention (e.g., Huizenga, Admiraal, Akkerman, & Dam, 2009; Klopfer, Sheldon, Perry, & Chen, 2012; Schwabe & Göth, 2005), motivates students' interest in academic content (e.g., Huizenga, Admiraal, Akkerman, & Dam, 2009; Klopfer, Sheldon, Perry, & Chen, 2012), and promotes critical thinking and problem solving skills (e.g., Klopfer, Sheldon, Perry, & Chen, 2012; Lim & Wang, 2005; Sánchez & Olivares, 2011). Current research also suggests the need to thoroughly evaluate the cognitive benefits of mobile games.

CURRENT SCIENTIFIC KNOWLEDGE IN EDUCATIONAL MOBILE GAMES

The use of digital educational games on mobile devices remains relatively new. The literature we have reviewed addresses the following aspects of educational mobile games: a) learners and educators' attitudes, b) educational values, c) integration of mobile game design into learning, and d) challenges.

Learners and Educators' Attitudes toward Educational Mobile Games

When educational mobile games are integrated into teaching and learning activities, how do stu-

dents feel about it? Would they like them? What about teachers? Do they eagerly embrace the new technologies? Since our attitudes determine our actions, stakeholders' attitudes and beliefs are such an important aspect of educational research. Limited studies exist that have explored the attitudes of students and educators. Using both quantitative and qualitative approaches, the study by Allsop (2011) examined elementary children's (ages 9-10 years) perceptions of learning with math games using iPod Touches in a primary school in London. The author utilized classroom observations, student work (concept maps of their discussions), group interviews and a survey to gather data. Students' overall perspective on learning with games via iPod Touches was positive. Many of the participating students stated that the technology helped them learn better and made learning more interesting. They described their learning experience as fun and interactive. They were also motivated because prompt feedback was provided, allowing them to take control of their learning pace and tasks. Students also reported issues with playing games on iPod Touches. Some of them commented that too many game choices had distracted their learning. A few students also addressed technical issues such as slow connection, short battery life, and difficulty with typing using the on-screen keypad. It is worth pointing out that even though a majority of the students agreed that using an iPod Touch made their learning more fun and interesting, there were a number of them who commented that they did not know if using an iPod Touch helped them to learn better. The author suggested that the iPod Touch might not be the most appropriate tool for teaching all students. Teachers need to consider using a variety of tools in their instruction.

Whether or how educational mobile games will be used in classrooms is largely dependent on educators' beliefs about and attitudes toward this technology. Not surprisingly, in addition to exploring students' perceptions of mobile games, some researchers (e.g. Demirbilek, 2010) focused their attention on the examination of educators'

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