**ABSTRACT**

As *Human Computer Interaction* technologies evolve, they are supporting the generation of innovative solutions in a broad range of domains. Among them, *Serious Games* are defined as new type of computer game that is capable of stimulating users to learn, by playing and competing against themselves, against other users or against a computer application. While it could be applied to a broad range of fields and ages, these games are becoming especially relevant in educational contexts and for the most recent generation of students that is growing in a new technological environment, very different from the one we had some years ago. However, in order to become fully accepted as a teaching/learning tool in both formal and informal contexts, this technology has still to overcome several challenges. Given these considerations, this chapter makes a state-of-the-art review of several works that were done in this field, followed by the description of two real world projects, helping to understand the applicability of this technology, but also its inherent challenges.

**INTRODUCTION**

The term “serious games” refers to the use of computer games for training and education with a purpose that extends beyond pure entertainment. They have been gaining popularity for some time now, to deal with real world problems by modeling and simulating them. While being used in a broad range of applications, including Military Training (Numrich, 2008), Humanitarian and Environmental Games, Health (Macedonia, 2009; Blackman, 2005; Sawyer, 2008) or Political Games (Democracy 2, 2015; President Forever, 2015) they perform an important role in education, branded as Educational Games (von Wangenheim & Shull, 2009; Mayo, 2007; Kelly et al., 2007; Zyda, 2007; Westera, Nadolski, Hummel DOI: 10.4018/978-1-5225-0435-1.ch016

**Developments of Serious Games in Education**

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& Wopereis, 2008). Moreover, they are starting to be applied to other innovative fields. For instance, they are seen as a way of instructing and motivating citizens to participate in energy management, as in the game 2020 Energy (2015).

But how do we broadly define “game”? Klopfer (2008) defines it as goal-oriented activity, based on specific rules that players perceive as enjoyable. In terms of Serious Games, Zyda (2007) define them as “a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives.” In this definition the term entertainment may collide with the concept of a serious game. However, considering that “ludic” is not usually a priority in most activities of the educational context, a game may be the motivating factor that is needed in many learning resources.

In education, the research in innovative ICT solutions for Human Computer Interaction extends far beyond the conventional inclusion of multimedia contents, to include and recognize the role of new learning experiences. In this field, ludic learning models can cover various scientific fields, not only in formal educational contexts, but also in informal ones.

However, in order to become fully accepted as a teaching/learning tool in both formal and informal contexts, game technology has to overcome some challenges. One of the main issues is how to measure their actual learning effects. In this field some studies (Backlund & Hendrix, 2013) while evaluating the effectiveness of game-based learning concluded that, among the several studies analyzed, serious games had shown a positive effect on learning. The results of such studies are important to overcome a second difficulty related with the acceptance of these teaching tools by teachers, students and parents allowing it to be integrated in the curricula.

Given these considerations, in this chapter we analyze and describe current developments in serious games, with a special focus in education. This includes a state-of-the-art review of serious games applications, together with the description of two implementations aimed to help illustrate their applicability in real world scenarios. In one of these implementations we describe a solution that integrates the structure of a simple game in the last generation of ebooks. The idea is to create an electronic book that enables dynamic integration of text with images, audio, video and animations, but that may be used as a game. As serious games can be used in informal contexts, in the second implementation, we describe a solution that uses 3D electronic sensors in a wearable device (glove) to create a game capable of teaching sign language alphabet to any person who wants to learn it.

BACKGROUND

So far, serious Games have been used in several educational contexts that include natural sciences (Liu, Tan & Chu, 2009; Wang, 2008), mathematics (Chow, Woodford, & Maes, 2011; Kablan, 2010; Ke & Grabowski, 2007; Ke, 2008; Kordaki, 2011; Liao, Chen, Cheng, Chen & Chan, 2011; Main & O’Rourke, 2011; Panoutsopoulos, H. & Sampson, 2012; Sung, Chang, & Lee, 2008; Rosas et al., 2003; Wilson et al., 2006), problem solving (Huang, Yeh, Li & Chang, 2010; Yang, 2012), computing (Papastergiou, 2009; Sindre, Natvig & Jahre, 2009), software development (Gresse von Wangenheim, Thiry, & Kochanski, 2009), language learning (Connolly, Stansfield & Hainey, 2011), geography (Asaolu, 2012; Tüzün, Yılmaz-Soylu, Karakuş, İnal & Kızılkaya, 2009; Virvou, Katsionis & Mános, 2005), history (Huizenga, Admiraal, Akkerman & ten Dam, 2009; Kennedy-Clark & Thompson, 2011) and health (Tüzün, 2007;