Chapter 19
Game Dimensions and Pedagogical Dimension in Serious Games

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ABSTRACT

Designing serious games is a complex process because finding the right balance between the 'serious' and the 'game' dimensions is vital, as pointed out in some meta-analyses (Wouters, et al. 2013). If educational content prevails over the entertainment element, users' motivation may decrease and this can have a negative impact on the effectiveness of learning. On the other hand, if entertainment predominates over content, this can also limit learning opportunities. Another major concern identified regarding the use of digital games in education is the difficulty in assessing effectiveness in achieving the learning goals. This chapter discusses and analyses different models for guiding the design cycle of serious games with the aim of supporting not only the design process but also the implementation and assessment of serious games in education. This contribution emphasises the importance of in-game assessment and the need for further research on adaptive serious games.

INTRODUCTION

Electronic games were initially developed in the entertainment market without considering their impact on learning. However, in recent years, educators and researchers have gradually focused their attention on the use of digital games for educational purposes. Since the 1980s, several studies have identified the potential of games for learning (e.g. Arnseth 2006; Clark, et. 2014; de Freitas & Oliver 2006; Gee 2003; Hainey et al. 2011; Kafai and Chin 1996; Malone 1981; Prensky 2001; Squire 2002;). In general, it is believed that video games offer virtual environments in which players can become engaged in learning activities (Connolly et al. 2012; Gee 2003). Some authors consider that video games help to develop strategic thinking, group decision-making and higher cognitive skills (Arnseth 2006; Clark, et. 2014; de Freitas & Oliver 2006). Researchers claim that games permit constructive, situated and experiential learn-

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ing, which is enhanced by active experimentation and immersion in the game (Squire 2008). Moreover, it is hoped that the use of games might not only increase motivation but also improve specific abilities, such as problem solving and collaboration (Sánchez & Olivares, 2011).

Important developments in producing digital games and the increasingly positive view that digital games are a useful tool for supporting learning have helped to extend the production and use of gaming beyond formal learning. It has spread as a common resource in training at all levels and for all ages. According to the Serious Game Market (2015), North America has the largest market for serious games and this trend is expected to continue during the next decade. Meanwhile, Europe is the second-largest market for serious games. The U.S. government has continually supported the serious game market, with serious games mainly being developed for training purposes by the military and in the healthcare sector, as well as for a broad spectrum of industry, such as government, education and corporate. This explicit support has helped to boost the development of serious games.

Before the development of computer games, the term 'serious game' was introduced by Abt (1970; p.9) to refer to games that have "an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement." The term was primarily used in regard to board games and card games. Later, Michael and Chen (2006) promoted serious games initiatives which consider that serious games are those "in which education (in its various forms) is the primary goal, rather than entertainment." (Michael & Chen, 2006, p.16) These serious games may be differentiated from educational games because of their focus on the post-secondary market and training. According to Djaouti, Alvarez and Jessel (2011), serious games can be designed from scratch but there are also some serious games that are built as software modifications of successful entertainment video games. For example, *Escape from Woomera*[1]is a serious game that provides information about living conditions inside an Australian immigration centre. It is based on the video game *Half-Life*[2], which originally referred to fighting an alien invasion. Both games use similar gaming mechanics, but the content and aim have nothing in common.

The growing interest in serious games is also linked to economic considerations. Many companies need to instruct employees and individuals need to update or innovate their skills from a lifelong learning perspective. In addition, serious games are also entertaining and this should encourage people to spend their free time on educational activities. While most research focuses on the use of serious games in formal contexts, the use of serious games in lifelong learning is also important. Current trends in professional development are committed to active learning models, including serious games (Usart & Romero, 2013). Serious games must offer specific help to learners for planning, organising and directing their research and exploration, as well as for evaluating their own progress.

The chapter is divided into three sections. Firstly, we describe different ways to classify serious games. Secondly, we analyse the relationship between the game and the pedagogical dimensions to support learning. Finally, we discuss different assessment strategies in serious games.

CLASSIFICATION OF SERIOUS GAMES

The major distinction between video games and serious games is the purpose. Video games are designed for entertainment; there is no intention for them to serve for educational purposes. Whereas 'serious games' is a label that refers to applications featuring both a 'serious' and a 'game' dimension within the software. It is possible for teachers to use entertainment digital games in their classes. In this case, they are creating pedagogical scenarios in which the game is a tool to support learning. This 'serious'