Chapter 21
Learning Geography Through Serious Games:
The Effects of 2-Dimensional and 3-Dimensional Games on Learning Effectiveness, Motivation to Learn and User Experience

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ABSTRACT

Serious games have gained momentum during last and current decade and research findings indicate they can be fertile and effective learning tools. While there are several studies dealing with 2-dimensional and 3-dimensional serious games in education, there is a dearth of relevant empirical research in formal educational settings that compares their effectiveness. In this study, two versions (2-dimensional and 3-dimensional) of a serious educational game on geography, were developed and offered in eight elementary schools. An experimental process was set up and the investigation was focused on the impact of using the two game versions, regarding motivation to learn and user experience. Both versions had a positive impact on learning, confirming thus the advantages of serious games in education. 2D version had a greater impact comparing to 3D, regarding learning, while 3D version had a greater impact on motivation to learn and user experience.

INTRODUCTION

The widespread popularity of digital games for people of all ages, especially young ones, has increased interest in their use, in formal and non-formal educational processes. Researchers and educational practitioners have shown a great interest in using serious games in educational process; practice and research evidence confirm that these games can attract and motivate students to the extent that typical formal education fails to do (Klawe, 1998; Prensky, 2001).

Extant literature supports the strengths of serious games in several fields, and scholars report they provide a fertile environment which increases learners' achievements and enhances their motivation to learn. Numerous empirical studies have focused on the impact of serious games on learning and motivation. Several types of knowledge (conceptual, procedural and declarative) may result from playing serious games (Miller et al., 2011; Gee, 2005; Prensky, 2001). Other works focused on serious games effectiveness and cognitive skill development (Vogel et al. 2006), students' science knowledge retention (Clark et al., 2009), self-efficacy, engagement and gameplay behaviors (Rowe et al., 2010).

However, there is a body of research which indicates that games are not always effective, in terms of learning gains and evidence for the relationship between learning performance and gameplay is not clear (Hays, 2005; Lim et al, 2006; Harris, 2001). The above contradictory views necessitate further empirical investigation regarding the effectiveness of serious games as educational tools. Moreover, despite their growing popularity, there is lack of empirical relevant studies of serious games in formal educational settings such as primary schools, while the majority of games under investigation are 2D (Kebritchi et al., 2010). As during the last decade 3D game implementations have gained a lot of momentum, many game developers adopted with enthusiasm the possibilities 3D technology can provide. At the same time, there is a growing skepticism whether 3D technology adds value to the gameplay (Gamespot, 2010; Screwattack, 2012). Game industry is still struggling to find out the right balance between 2D and 3D implementations. There is a lack of clear answers and this debate is also evident in the serious gaming research community as well. In a systematic literature review performed by Hainey et al. (2012) with 18,928 studies, only one study utilized a 2D/3D game comparison which was the study conducted by Harrington (2012). Harrington (2012) found the use of a 3D game to be beneficial and leading to the most powerful knowledge gain as a result of combining higher navigational freedom and higher visual fidelity, both of which can be achieved more easily with a 3D game rather than a 2D game. It seems that 2D games have different pedagogical benefits from 3D games (Hainey, 2016).

Further study should be carried out to address issues in terms of comparing 2D games and 3D games and to determine which ones are more applicable in terms of learning and motivation. This study identifies this research gap which motivated authors to conduct an empirical study of a serious game on a rather neglected topic, such as geography in primary schools. In this paper, an experimental study is described where two design versions of the game have been developed, 2D and 3D, and their effects are examined regarding three dependent variables: learning effectiveness, motivation to learn and user experience (UX). Especially, the later concept, UX has received little attention in other empirical studies of serious educational games.

To this end, the following research questions have guided this study:

1. What effects do 2D and 3D versions of the game have on learning effectiveness?
2. What effects do 2D and 3D versions of the game have on motivation to learn?
3. What effects do 2D and 3D versions of the game have on user experience?

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