International Journal of Game-Based Learning
Volume 11 • Issue 2 • April-June 2021

DOMEGO:
A Board Game for Learning How to Manage a Construction Project

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ABSTRACT

Construction project is a major learning of the civil engineering educational program. However, the related knowledge is difficult to apprehend and assimilate during lectures since it is theoretical and practical work or tutorials on the subject are scarce. To address this issue, the authors developed DOMEGO, a game for teaching construction projects to civil engineering students. This board game aims to provide students with active and experiential learning of the key issues of a construction project. In the game, each player embodies a stakeholder of a construction project and must carry out the project while meeting her/his objectives. DOMEGO has been successfully integrated into an instructional setting of undergraduate students in Civil Engineering at the University of Bordeaux and Polytech, Nice Engineering School. Student feedback collected in the post-game survey was very positive. However, a more thorough analysis with a real evaluation protocol would be necessary to validate the game interest to teach construction project.

KEYWORDS

Board Game, Civil Engineering Teaching, Construction Organization, Engineering Student, Experimental learning, Innovative Teaching, Ready-to-Use Game, Risk Management

INTRODUCTION

Higher education is confronted with a new generation of students having a different relationship to technology and education than the previous ones. Generation Z (born after 2000 (Ozkan & Solmaz, 2015), like generation Y (born between 1980 and 1999 (Lissitsa & Kol, 2016), have known the Internet and smartphones since their young age, inducing both positive (such as collaboration and communication) and negative (for example less concentration and difficulty to learn by heart) effects (Issa & Isaias, 2016). Both students generations demonstrate a low interest in classical lectures (Baker, Matulich, & Papp, 2011).

Learning is an active process in which the learners themselves should construct the required knowledge and understanding (Gagne, 1965). To this end, motivation (Holzinger, Pichler, Almer, &

DOI: 10.4018/IJGBL.2021040102

Maurer, 2001) and joy (Shneiderman, 1998) are important factors to enhance the learning process. One of the answers to the learning problem faced by new students generations is gamification, which consists in using game mechanisms as part of an activity (here teaching) to make it more attractive (J. Hamari, J. Koivisto, & H. Sarsa, 2014a). The gamification process is based on different tools, including serious games.

A serious game is a game used with a purpose other than entertainment: learning and training (R. Michael & L. Chen, 2006). Serious games have many benefits compared to a traditional lecture teaching regarding problem-solving skills, knowledge acquisition, higher cognitive gains and improved attitudes towards learning (J. Hamari, J. Koivisto, & H. Sarsa, 2014b) (Vogel et al., 2006). Furthermore, motivation, engagement, representation and understanding of knowledge is enhanced (Crocco, Offenholley, & Hernandez, 2016) (Sauvé, Renaud, & Gauvin, 2007).

The diversity of fields in which serious games have been used is pointed out in the literature review of P. Backlund & M. Hendrix (2013) on the effectiveness of serious games. Serious games have already been successfully used to teach natural risk management (Taillandier & Adam, 2018a), Information Technology (Carlos Oliveira, Marcos Cintra, & Francisco Mendes Neto, 2013), fire safety (Rüppel & Schatz, 2011) for example. However, there are very few applications to the field of Civil Engineering, and none of them tackles the learning of construction projects.

To fill this gap, the authors designed Domego ("Building" in Esperanto), a serious game that intends to provide students with active and experiential learning of the key issues of a construction project. In this paper, the following specific objectives are addressed: (a) identify the specific play mechanisms necessary for optimal learning in the civil engineering field, (b) provide an innovative game-based approach to teach construction project, (c) investigate to what extent the developed serious-game contribute to student learning and (d) determine the barriers to the adoption of such technique.

Following a literature review on the existing serious games for teaching in civil engineering, the needs for game-based learning are identified and the learning objectives of the serious game are set. Then, the principles and the key play mechanisms of the serious game Domego are presented. Conclusions on its usefulness and applicability are drawn from the experimentation of Domego during a pedagogical sequence.

GAME NEEDS AND GOALS

Serious Games Dedicated to Civil Engineering

The present section intends to collect papers dealing with serious games dedicated to civil engineering. No time restriction has been applied. The exhaustive search has been performed with the international bibliographic database Scopus, ISI Web Science, Science Direct and Google Scholar, with a combination of keywords relating to "civil engineering" and "serious game(s)". Seven articles were found. One of them is a state of the art regarding building services engineering education (Alanne, 2016). The articles extracted from (Alanne, 2016) and (Deshpande & Huang, 2011) related to civil engineering have been integrated into the analysis. Table 1 compares the different serious games dedicated to civil engineering found in the literature.

The serious games that have been developed in the civil engineering field deal with a wide variety of subjects. Three games deal with building design. (Dib Hazar & Adamo-Villani Nicoletta, 2014) proposed a game called Sustainably challenge, dedicated to teaching sustainable building design principles and practices to undergraduate students enrolled in Civil Engineering and Architecture. Din & Gibson (2019) explore the interest of serious computer games for learning risk prevention through building design and expose a game called SafeDesign. Finally, (Merschbrock et al., 2016) developed a game based on BIM (Building Information Model) to support professionals in their learning of the spatial layout of new buildings. A game called IFM (Ebner & Holzinger, 2007) is dedicated to the theory of structure, guiding the students in the learning of dimensioning