Introduction to the Special Section on Game-based Learning: Design and Applications

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Technology Enhanced Learning (TEL) is a very broad and increasingly mature research field. It encompasses a variety of research topics, ranging from the study of different pedagogical approaches, teaching techniques, and strategies for online learning to the application of advanced technologies in educational settings (e.g., different kinds of mobile devices, sensors, and sensor networks that provide the technical foundation for context-aware, ubiquitous learning). One of the areas in TEL is *game-based learning*. Researchers have found that educational and/or computer-based games have real potential as learning tools (Amory, 2001; Chiong, 2010; Gros, 2007; Quinn, 2005; Squire, 2005). It has been shown, for example, that games can help players to improve their problem-solving and negotiation skills, narrative and communication skills, as well as non-linear thinking patterns.

Game-based learning has already been successfully applied to both school and workplace settings and its adoption is continually increasing. In addition, there has recently been some increasing interest in "gamification" of education as a means to increase students' motivation for learning. Gamification refers to the use of game design elements, or the so-called game mechanics, in non-game contexts and applications with the aim of increasing users' engagement with those applications (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Zichermann & Cunningham, 2011). Game design elements are often very efficient in increasing motivation as they are grounded on research results of positive psychology (McGonigal, 2011). Although the term was originally coined with the focus of integrating social and/or reward aspects of games into software (Mangalindan, 2010), more recently its use has been extended to incorporating simulations as well.

This special section on "Game-based Learning: Design and Applications" provides a glimpse of the design and applications of video and simulation games in teaching and learning. Three papers related to the theme of game-based learning have been included. Each of these papers was comprehensively reviewed by two to three reviewers over two rounds of rigorous review cycles and thoroughly checked by the editors.

In the first paper of the special section, *Life Skills Developed by Those Who Have Played in Video Game Tournaments*, Thirunarayanan and Vilchez reported on an empirical study that was aimed at exploring whether the competitive nature of video game tournaments affects the development of some important life skills, including cognitive (memorization, decision making, and

arithmetic skills) and social (leadership, communication, coordination of a group's activities, and team work) skills, as well as work performance. The study was based on a comparison of the effects that video games have on the aforementioned skills as perceived by the students who participated in video game tournaments and those who did not. The collected data demonstrated that statistically significant proportions of the participants who had played in video game tournaments reported positive influence of video game play on the development of their life skills, compared to those who had not played in such tournaments. These findings indicate that the use of video games tournaments could facilitate the acquisition of life skills, though the level of competitiveness in such tournaments should be adaptable to the characteristics of the given study group.

The second paper by Šimić, *Constructive Simulation as a Collaborative Learning Tool in Education and Training of Crisis Staff*, describes how a constructive simulation can be used to train members of a local community to react properly in situations of natural and man-made disasters. This paper has focused particularly on disasters caused by floods, and Šimić proposed a combined use of a constructive simulation system and a flood simulator to present as reliably as possible the dynamics of the rising water level and its effects on the surrounding environment. Simulations of this type require highly elaborated scenarios with well-defined roles and associated responsibilities for all the participants (i.e., learners and teachers). During the simulation, learners face many challenging situations that have to be dealt with in limited time and restricted resources and acted upon in a coordinated and collaborative manner. Learning takes the form of an iterative process through which learners gain skills required for performing evacuation and rescuing tasks. Through a case study of a flood in the South Morava region, Šimić reported on the details related to the set up and execution of such a constructive simulation and provided some evidence of its educational benefits.

In the last paper of this special section, *Innovative Teaching Using Simulation and Virtual Environments*, Barjis et al. discussed their experience in using simulations, game-based and virtual environments to introduce some innovation in their own teaching practices in the broad domain of systems engineering. The primary motive for introducing these novel technologies, combined with appropriate pedagogical approaches, was to enable students to better perceive and comprehend the objects of their study, including the components, relations, and the underlying dynamics of those objects, as well as to provide students with opportunities to interact with those objects and related processes. Each of the co-authors reported on their own innovative approach that had been based on either the use of one of the aforementioned technologies or a combination of them. Besides the description of the applied approaches, both in terms of the applied pedagogy and technology, Barjis et al. also provided some evidence of and their self-reflection on the pros and cons of each approach. An important finding they derived from their experience is that the use of novel virtual interactive tools/environments requires a clear distinction of the course topics that could be supported by each particular tool, so that the position and role of a tool in the course curriculum could be clearly defined. To support educators in building such a curriculum, i.e., a curriculum that makes the best use of modern systems and tools for the attainment of the course objectives, an approach based on Causal Mapping has been presented in the paper.

To end, we would like to thank all the authors for their contributions to this special section. We also wish to acknowledge the reviewers involved for their expertise and time, in particular those who have provided constructive comments and suggestions. Finally, we hope the readers will enjoy reading the papers in this special section as much as we have enjoyed putting them together.

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Biographies

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