Guest Editorial: Game Based Learning for 21st Century Transferable Skills: Challenges and Opportunities

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Digital serious games (SGs) (Gee, 2003; Prensky, 2003) offer a high potential to foster and support learning in educational and training settings. SGs aim at improving learning processes by providing attractive, motivating and effective tools. So far, effectiveness of SGs has been shown by recent studies (e.g., Connolly et al., 2012; Wouters et al., 2013), but the potential of SGs in education is still far to be fulfilled, in particular concerning higher-order learning goals (Connolly et al., 2012) and there is a growing need for educational technology research in this field. Moreover, education, cognitive and engineering methods and tools are needed for efficiently building and evaluating games as means that can provide effective learning experiences (Marfisi-Schottman, Labat & Carron, 2013; Bellotti et al., 2012).

This special issue focuses on analysing how digital SGs can contribute to the knowledge society's higher demand towards acquiring transferable, transversal skills, that can be applied in different contexts, dealing with various scientific disciplines and subjects. Examples of such skills, often referred to as 21st century transferable skills, include, for example, collaboration, critical thinking, creative thinking, problem solving, reasoning abilities, learning to learn, decision taking, digital literacy (Voogt & Pareja Roblin, 2010).

This special issue explores particularly the challenges and opportunities presented by the use of digital SGs in formal learning contexts. The idea is to look not only to the tools (namely, the SGs) but also to the definition of meaningful practices through which such tools can be used effectively to reach specific learning goals (Bottino, Ott & Tavella, 2011). This means considering the whole learning environments in which games are integrated (including curricular/training goals, tools, tasks, methodologies, assumed roles and the context of use), which is in line with current research studies in technology enhanced learning, where technology design and use is increasingly considered in relation to the whole teaching and learning process.

This special issue was conceived in order to provide significant insights from the latest research work and to stimulate a fruitful dialogue between researchers engaged along the joint perspectives of educational SG design and use. The topic met a great interest from authors, as the call for papers received 50+ papers, out of which the guest editors, in collaboration with 113 reviewers, selected the following five papers.

The paper by Cowley et al. reports on a laboratory experiment combining evaluation methods from the fields of subjective learning assessment and of psychophysiology, considering various neurophysiological signals. The study identifies a relationship between learning outcomes and physiological measurements of mental workload, which opens new perspectives for SG user assessment.

The paper by DiCerbo presents an evidence model for assessing persistence, which is an important skill, in particular for goal achievement. Evidence extracted from log files of a commercial children game was used to identify players' goals and to create a measure of persistence toward those goals. The results support the argument for a game-based measure of persistence.

Two papers (by Shah and Foster and by Eseryel et al.) concern pedagogical models ad-hoc developed to support effective use of SGs in formal education settings. Shah and Foster explored the ecological conditions necessary for implementing a system-thinking course in a 5th and a 6th grade classroom using a well established commercial game. The teacher successfully adopted a teaching model for game-based learning, and students showed statistically significant knowledge gains.

The paper by Eseryel et al. presents a theoretical model and describe an empirical investigation aimed at examining the interplay between learners' motivation, engagement, and complex problem-solving outcomes in game-based learning. Findings suggest that learners' motivation determine engagement, which in turn determines development of complex problem-solving competencies.

A last paper, by Di Blas and Paolini, presents the outcomes of a large case-study of four formal education programs exploiting serious games based on multiuser virtual environments. The programs proved to be highly effective in fostering a number of transversal skills - in particular collaboration.

The guest editors are proud of presenting a balanced mix of papers, especially in terms of perspectives and addressed topics. The special issue shows that a large amount of work is being done in order to develop models and methods for effective serious game deployment, especially in formal education contexts. We believe that more in-depth analysis and extensive/comparative user studies are necessary for a better validation of serious game effectiveness, also concerning 21st century skills, and for understanding when and how to use games to complement other educational means and approaches. This will be key to developing a new generation of serious games that - improving aspects such as assessment (Bellotti et al., 2013), feedback (Hays, Lane, & Auerbach, 2013), analytics (del Blanco et al., 2013) and collaboration support (Hummel et al., 2011) - should lead to increasing effectiveness in terms of content presentation/adaptation and user motivation and coaching.

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