Chapter 13

Capturing the Semantics of Simulation Learning with Linked Data

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ABSTRACT

Knowledge-rich learning environments like simulation learning sessions call for the adoption of knowledge technologies to effectively manage information and data related to the learning supply and to the observation analysis. In this chapter, the authors illustrate the benefits and the challenges from the adoption of Linked Data and Semantic Web technologies to model, store, update, collect, and interpret learning data in simulation environments. The experience gained in applying this approach to a Simulation Learning system based on Serious Games proves the feasibility and the advantages of knowledge technologies in addressing and solving the issues faced by trainers and teachers in their daily practice.

INTRODUCTION

Simulation Learning is a frequent practice to conduct near-real, immersive and engaging training sessions, in which learners are subject to stimuli: they have to learn how to deal with the simulated situation and how to react to it. Simulation Training systems are generally aimed to improve soft skills (Aldrich, 2003). In this context, the learning sessions should be interactive and engaging to challenge the trainees to improve themselves; such simulations need to be effective, in that the

learners do not simply memorise notions, but they actively and permanently acquire skills, practice and knowledge.

Simulation Learning could be classified, on the one hand, as a sort of *formal learning* – because it is aimed to be applied to learning "classes" and it is designed in order to achieve specific learning "objectives"; on the other hand, the distinctive mark of Simulation Learning consists, however, in leveraging *informal learning* traits: it aims at representing a real-world context and it often features some entertainment flavour in order to

attract and engage the learners. As such, Simulation Learning sits at the crossroad of formal and informal learning and can prove to be effective, especially in relation to adult lifelong learning.

Simulation Learning is usually quite an expensive practice, in terms of both organization and tools; for example, exercises on the field for decision making are very effective (Caird-Daley, Harris, Bessell & Lowe, 2007), but they require specialist equipment and could be difficult to organise. Modelling and correlating all the pieces of information required to run a simulation session is a challenge per se; moreover, it is also quite complex to evaluate what the simulation participants actually learn during the sessions.

In this paper, we present our approach to adopt Linked Data and Semantic Web technologies in knowledge-intensive Simulation Learning systems. Ontologies are employed to model simulation knowledge; relevant information and data are described with those ontologies to enable the delivery of simulation sessions and to record the actions and behaviours observed in learners during the simulations; the semantic description of observational data is further employed to support trainers' and teachers' work to assess the learning effectiveness. We also provide our insights and lessons learned from the application of the presented approach in a Serious Game Simulation Learning environment for Crisis Management Decision Making developed within the Pandora EU project.

RELATED WORK IN SIMULATION LEARNING

Simulation Learning, also known as Instructional Simulation or Educational Simulation, consists in a system or environment that mimics a reality or a realistic situation; simulations usually come with features and elements that help the learner exploring, focusing, trying, experimenting and gaining new knowledge about a system or a procedure. In education, simulations are often used to replicate human decision-making processes, helping learners focus on key behaviours, concepts or principles (Gärdenfors &Johansson, 2005). In order to be engaging and effective, Simulation Learning is usually conducted with the help of computer-assisted systems; sometimes virtual learning environments (VLE) are employed to recreate the simulated situation and increase the degree of immersion of the user within the environment.

The adoption of digital solutions for Simulation Learning (Edyburn & Basham, 2008) has a twofold effect: on the one hand, it helps in the delivery of the simulation and the timing of the events and inputs during the sessions; on the other hand, it enables an easier collection of the observational learning evidence, thus improving their monitoring and analysis. Indeed, collecting data during learning delivery has always been a challenge for teachers and trainers, since the dual and contemporary processing of watching and recording is a complex and demanding task even for the most experienced instructor. Thus, in order to collect and code observational data, simple recording systems can be put in place, so to trace any new development while observing learners' behaviour. In this case, the use of computer-based solutions greatly adds to the reliability of observational measurements (Johnson, 1995). The most popular commercial solution of this kind is Noldus Observer XT (http://www.noldus.com/human-behavior-research/products/2/the-observer-xt), also largely employed in learning research (Snell, 2011).

Two other ingredients must be carefully taken into account when designing and realizing a Simulation Learning system: the gaming flavour and the support for collaboration. It is indeed ascertained that games can be successfully employed in learning, as per the success of the so-called serious games (Aldrich, 2009). A serious

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