Chapter 17
A Framework for Designing Mainstream Educational E-Simulations

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ABSTRACT

This chapter describes the knowledge, skills, and technology needed for the effective design of educational e-simulations. It reviews the features and functionality of a typical experiential e-simulation and discusses approaches useful in its design, with impact on its subsequent construction and deployment in the field. The chapter reports a conceptual study examining development experiences gained in the construction of several educational e-simulations and folds these experiences into a framework for understanding e-simulation design. The chapter finally uses the framework to compare and contrast different approaches taken while designing and delivering two e-simulations, based on the same technology and business case, but delivered to distinct cohorts of university students.

INTRODUCTION

E-simulations, digital games, and e-learning are slowly becoming part of the mainstream of modern education (Moreno-Ger, Burgos, & Torrente, 2009). Readily accessible and increasingly affordable computer and Internet technologies provide developers and educators with tools to create new classroom and online resources. With the sophistication of virtual spaces and artificial environments, often come highly focused visual and auditory stimulation, interactivity, and immersion that are all capable of drawing students to the learning tasks and activities, and which provide opportunities for developing a sense of authenticity and personification that sustain the learner’s engagement. By interacting with virtual objects, simulated people, and imaginary spaces, learners construct their knowledge and acquire skills and experiences that can later be transferred to the

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real problems, tasks, and environments (Lainema, 2003b). Learning in such simulated environments is often pushed to the sphere of subconscious and is capable of becoming a collateral artefact of student engagement (Zyda, 2005). These technical, cognitive, and pedagogical factors — previously unheard of in a traditional face-to-face education — create uncertainty and complexity for educational developers and demand new approaches to the planning, design, and implementation of novel curriculum with educational e-simulation tools.

There exist a large variety of e-simulation types, each with its own peculiar mode of interaction, task virtualisation, and user experience (Aldrich, 2004). There are also a great many conceptions of effective utilisation of e-simulations in teaching and learning (Jeffries, 2005). A vast array of commercially available tools can be easily obtained to support the creation of these e-simulation and e-learning archetypes (Swain, 2005). Approaches to designing and later construction of these e-simulations and games, and their deployment in the field, unfortunately are very few. This chapter strives to close this apparent gap in research and practice of e-simulation design.

Over recent years, taxonomies of simulation and game design have emerged to assist better understanding of interaction components and learning styles (Thavikulwat, 2004). Theoretical work has been laid to deal with cognitive load of e-simulation users engaged in constructivist learning (Gerjets & Hesse, 2004). Cognitive models are being developed to guide simulation and game designers in the creation of believable learning spaces (Funge, 2000). New devices are being designed to assist user direct manipulation of virtual objects (Fishkin, Gujar, Harrison, Moran, & Want, 2000). Issues in the design of simulated people and authentic interaction with virtual characters are vigorously pursued (Hutchison, 2006). Creation of a total e-simulation experience (Rosenbloom, 2003), seamless incorporation of the specific domain knowledge (Goosen, Jensen, & Wells, 2001), augmenting virtuality with elements of the real world (Billinghurst & Kato, 2002), as well as effective blending of these simulated phenomena into a cohesive learning environment (Kirkley & Kirkley, 2005) are all still at the cornerstone of educational research.

We are still at the very beginning of a path leading to a model suitable for the better understanding of educational simulation and gaming (Squire, 2002) and yet we are searching for a unified theory of e-simulation design (Shedroff, 2000). While some researchers are actively expanding the horizons of game and simulation design (Swartout & Lent, 2003), and others actively pursue the connections across research fields to close the gaps in the understanding of simulation and gaming design artefacts (Klabbers, 2006), there are still few consistent methodologies that successfully capture all aspects of e-simulation development (Hall, 2005). This chapter aims to further assist this pursuit of understanding e-simulation development and outlines a framework that conceptually maps and inter-relates the tasks typically taken in building e-simulations and their subsequent use. While the framework was not intended to serve as a rigorous and prescriptive development methodology, it was conceived to enhance developers and teachers’ understanding of e-simulations and to provide them with a guide to e-simulation planning, design, constructions, and deployment. Its richness and the lack of methodological constraints were intentional to encourage flexibility and adaptability of the framework elements.

DESIGNING AND USING BLENDED EXPERIENTIAL E-SIMULATIONS

Experiential learning is a participatory method of learning, which demands from a learner a variety of mental capabilities, and which is supported by an active and immersive learning environment (Feinstein, Mann, & Corsun, 2002). Experiential learning allows individuals to learn new skills and knowledge by reflecting on the completed tasks and processes. Such learning may occur in