Chapter 13
Create-and-Learn: Education “in” a Synthetic Learning Environment

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ABSTRACT

The aim of this chapter is to argue how create-and-learn pedagogy can be used to direct and drive the development of virtual reality applications in academic settings. The chapter discusses the development of a synthetic learning environment that provides a context for new learning and twenty-first century education. A case study of an interdisciplinary project by university undergraduates in Japan designing, modeling, and programming a rudimentary virtual nuclear power plant provides the scenario for reflecting on the learning experiences. The chapter attempts to answer the question: How can education-appropriate virtual reality technology support students in their learning endeavors? The participation “in” technology, described in this chapter, advances the development of particular skill sets, applies knowledge to innovative situations, empowers positive attitudes to active learning, and promotes ethical considerations of the impact of technological implementations.

INTRODUCTION

The developments of technology and the ubiquity of digital media in recent years has accelerated the dynamic paradigm shift in education from ‘sit-and-listen’ didactic tuition to a ‘create-and-learn’ discursive pedagogy. To illustrate and make sense of this, the chapter will discuss the design and development of a Synthetic Learning Environment that provides a context for new learning and 21st century education, and subsequently present a case for interdisciplinary education informed by the development of a virtual environment.

The implementation is enacted by a ‘try-and-explore’ approach to support a ‘create-and-learn’ pedagogy. This is supported in Japan. For instance, the Japanese government is concerned about the skill sets of its declining workforce in adapting to the new world of work, despite continuing high Math and Science rankings in the global PISA assessments (OECD, 2016). Accordingly, to implement its ‘Overhaul

of Organization and Overall Operations of National University Corporations’ the Japanese Ministry of Education, Culture, Sports, Science and Technology (Monbu-kagaku-shō) is requiring all universities to reform their Diploma Policy to meet the needs of a changing demographic. This National University Reform Plan (2015) requires universities to consider knowledge, skills, attitudes, values, and ethics, which have been categorized into four broad classifications: Ways of Thinking; Ways of Working; Ways of Living in the World; Tools for Working.

Being located in Japan, the project outlined in this chapter is accordingly contextualized by the Fukushima Dai’ichi nuclear plant accident of March 11, 2011. The disaster revealed much about Japan’s lack of preparedness for nuclear accidents (Lochbaum et al, 2014). Despite the brave efforts of its labor force leading up to, and in the aftermath of, the reactor explosions, it became apparent that coordination and communication were disorganized. Moreover, the citizens of Fukushima needed to be better informed and equipped to make sense of the official and social information in order to have a better understanding of the causes of the accident along with its long-term effects. An accessible virtual environment was consequently considered a safe technology space to engage students and the general population (i.e., non-experts) in learning about the Fukushima Dai’ichi nuclear plant situation. It was therefore decided to develop a virtual environment for effective, experiential learning of elementary nuclear power concepts conceptualized by a nuclear accident scenario, and subsequently test users’ understanding.

The chapter reports the work-in-progress and is organized as follows. First, an interpretation of learning as a social constructivist effort is provided. Then the notion that technology is now so pervasive that arguments for and against technology use have become irrelevant is presented. Mixed reality environments are then illustrated, in particular a Synthetic Learning Environment. The research project and its implementation are then summarized as a Case Study contextualized by the Fukushima nuclear accident of 2011. A surprising diversion from the project’s original goal is then discussed, with implications for future research in Synthetic Learning Environments.

CONSIDERING LEARNING

Active Learning

The process of learning is the acquisition of new skills or new forms of knowledge and understanding (Selwyn, 2017). Bloom (1956) described learning in terms of three overlapping domains involving the manual and physical skills of ‘doing’ (the psychomotor domain), emotions, attitudes as ‘feeling’ (the affective domain), and capability and knowledge as ‘thinking’ (the metacognitive domain). Bloom and colleagues subsequently proposed a taxonomy of knowledge consisting of factual knowledge (relating to a specific discipline), procedural knowledge (techniques and procedures), declarative knowledge (relationship between concepts) and meta-cognitive knowledge (knowledge of one’s cognitive demands, limitations and strategies). Anderson et al. (2001) updated the taxonomy by mapping the cognitive processes of creating, evaluating, analyzing, applying, understanding and remembering onto the four knowledge dimensions of metacognitive, procedural, conceptual, and factual knowledge. The rationale is that where the two dimensions intersect, a learning objective can be identified. For example, the learning objective that may be associated with ‘metacognition’ and ‘evaluate’ could be ‘reflect’. The object of the
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