Chapter 5
The Design of Immersive Virtual Learning Environments Utilizing Problem-Based Learning Templates

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ABSTRACT

The purpose of this chapter is to describe the design of template for the design of an immersive virtual learning environment that includes collaborative learning virtual worlds as problem-solving scenarios that engage students in virtual explorations of worlds. The problem-based learning 3d model incorporates a curriculum design model that includes a real-world issue that correlates to the virtual scenarios or games. This virtual PBL design model also includes a learning assessment process that utilizes sociocultural learning theories to develop an ongoing feedback model for assessment of learning in a 3d problem-based learning environment. This problem-based learning model combines the benefits of games, such as high-levels of learner engagement, real-life simulations, with research on cognition and instructional design to create a design model that can be modified to develop advanced knowledge, skills and concepts in multiple educational settings.

INTRODUCTION

The potential of educational games that are designed based on constructivist learning theories, a problem-based learning educational model and assessed using holistic assessment rubics is to redefine what education and learning is today from a passive learner model to an active immersive learning model where engagement and meaning-making result in effective and efficient learning. This chapter will define the core learning theories that underlie problem-based learning, the design protocol for a virtual problem-based learning educational forum and discuss future trends for games in education.

Problem-Based Learning (PBL) is an instructional method that addresses the complex knowledge and skill applications that students will face

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in the future by participating as problems solvers to tackle complex, ill-structured problems that mirror real world problems. One of the tenets of PBL is that it is difficult to give meaning to knowledge once it is removed out of context. PBL immerses the students in a context similar to the one the problem would normally occur outside the classroom. The students additionally can consider themselves active members of their community of students within the context of the problem but respond with less risk and intensity than those in actual practice, a phenomena Lave and Wenger (1991) called legitimate peripheral participation (LPP). Although the there are varied designs of PBL environments the design of the problem space should involve an ill-structured problem of "wicked" complexity (Rittel, 1984).

Problem-based learning (PBL) has gained attention as a potential for educational settings as a result of several recent developments including

1. An increasing need to correlate theoretical models and practical realities into varied educational settings,
2. Increasing information accessibility and the resulting knowledge age,
3. The increased use of multidisciplinary approaches to problem simulations,
4. Emphasis on multi-dimensional modeling and virtual reality, and
5. New developments in cognitive science

Problem-Based Learning proposes that learning experiences build on the interdependent attributes of meaningful learning including authentic, intentional, active, constructive, and cooperative learning and involve meaningful application of knowledge and skills (Jonassen, Peck & Wilson, 1999). In PBL environments a problem triggers cognitive engagement including the psychological processes of context for engagement, curiosity, inquiry and a quest to address a real-world issue. Examples of cognitive processes embedded in PBL design include confronting ill-structuredness and novelty, active search for information, proactive immersion in task, conscious and subconscious investment of time on task, motivation to solve the problem, need for meaning and explanation, a learning goal orientation, and a requirement of generative thinking, analytical thinking, divergent thinking and synthesis (Tan, 2003). In productive problem-based learning environments, learners consider themselves active members of their community of learners within the context of solving the problem, a phenomena Lave and Wenger (1991) call legitimate peripheral participation (LPP). As a result problem-based learning has an incredible potential to develop advanced learning and knowledge responses. When integrated into immersive virtual learning environments, educational game, PBL becomes the core design feature for developing advanced learning processes and skills necessary for the knowledge workers of the future.

BACKGROUND

Constructivist Learning Principles

Research in constructivist learning environments suggests that instructional design grounded in constructivist principles engaged students in purposeful activity as the students attempt to respond to a complex problem in a guided learning context, overcome an obstacle, or negotiate a contradiction in their thinking (von Glasersfeld, 1998). In addition, instructional design based on constructivist learning principles allows students to apply their knowledge more effectively under appropriate conditions (Brown, Collins, & Druguid, 1989). In studies of constructive learning environments research have shown that learners can develop higher levels of awareness and knowledge as a result of their dialog and interactions in online environment (Russell, 2005a). When students have the opportunity to articulate what they have learned and reflect on the process they went through and