Chapter 1.3
Augmented Reality Gaming in Education for Engaged Learning

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ABSTRACT

In augmented reality games, game experiences combining electronic game content take the form of narrative materials and game-play elements exchanged through a wide range of communication media that are used in a related physical setting. Educational game developers design these games to maximize transfer of learning through close approximation of the game-scaffolded skills and the game environment to real skills and contexts. The games immerse players in electronic and actual learning situations using features that make them effective learning experiences for fostering meaningful learning. The situated learning experienced by augmented reality game players transfers to deep learning, often in social contexts. Research into the uses of these games as educational platforms has focused on developing the technologies for the games and on studies of games for learning. Results demonstrate the strengths and areas for continued development in the application of augmented reality games for childhood and adult learning in formal and informal settings.

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INTRODUCTION

As portable media platforms, social networking, and context-aware devices approach ubiquity, the potential expands for game content to be delivered and used anywhere in real time. Augmented reality (AR) games are innovative digital games framed by the real world that enable players to

interact simultaneously with both a fictional world and the real world. Augmented reality games immerse players in a game scenario through visual augmentation such as head-mounted displays or others forms of digital augmentation in the form of e-mail, text messaging, or the World Wide Web. In AR games, the electronic game content is a combination of designed media intended to enhance an experience in an authentic setting. "Unlike virtual reality, augmented reality does not create a simulated reality. Instead, it takes a real object or space and uses technologies to add contextual data to deepen students' understanding of it" (EDUCAUSE, 2005, p. 1).

Research into the uses of AR games as educational platforms has focused on developing the technologies for the games and on studies of games for learning applications. This chapter reviews the literature on the effectiveness of AR games for learning and describes implications and recommendations for research, design, and implementation at primary and secondary levels.

BACKGROUND

Augmented reality games have been used in military and corporate environments for a semi-realistic form of simulation training, and they recently began to find a K-12 audience. AR games are very well suited for educating people in the new Conceptual Age, an era identified by Pink (2005) as a period in which strengths in creativity, synthesis, and contextualization are in increasing demand to solve complex new problems. The education community has recognized that Agricultural, Industrial, and even Information Age models are no longer the most effective paths to facilitation of meaningful learning (Pink, 2005). In the Conceptual Age the analytical and logical abilities valued for the Information Age will be joined by inventive and empathic abilities, which will enable global citizens to serve emerging social needs, become independent lifelong learners, and excel in the new professional marketplace. A curriculum centered on a single approach to solving problems will not effectively prepare students in the Conceptual Age, but must evolve into a learning ecology that more accurately reflects the demands of working with multiple data sources to address problems (Siemens, 2006). The flexible, socially interactive, globally connected capabilities afforded by AR games make them among the best designs for understanding the complex challenges facing us (Dede, Dieterle, Clarke, & Ketelhut, 2007).

For a learner's perception to transform to conceptual learning, the learner must actively interpret messages and scenarios (Goldstone & Wilensky, 2007) and must experience learning that is meaningful (Jonassen, 2002). Recent brain research draws attention to the ways that students' neural networks function as they make determinations of the meaning of their learning and thereby foster engagement and commitment to the learning process (Rose & Meyer, 2002). Meaningful learning refers to learning that is *active, constructive, intentional,* and *authentic.* It "includes reciprocal intention—action—reflection activities," as proposed in Jonassen's (2000, p. v) views of activity theory, and occurs when learners make meaning in the context of solving novel problems (Rose & Meyer, 2002). Among the strengths, then, of AR games is their built-in capacity for posing problems to players that are continually novel as a function of the actions and interactions of the players. AR games have features that make them effective learning experiences for fostering meaningful learning: AR games depend on players actively solving problems, they provide information that builds on the players' prior knowledge, they require players to intentionally act in order to succeed in game tasks, and they are set within authentic contexts.

Active learning engages learners in cognitive effort, facilitated by instructional transactions (Merrill, 1992) designed to guide the learner toward acquisition of specific knowledge and skills.