Chapter 8
I'd Rather Be Playing Calculus:
Adapting Entertainment Game Structures to Educational Games

Monica Evans
The University of Texas at Dallas, USA

ABSTRACT

Educational games often implement educational theory, but rarely implement the best practices of entertainment game structures. Currently, many educational games have difficulty engaging and immersing players to the same degree as entertainment games without diminishing the level and complexity of the educational content. This chapter discusses seven best practices of entertainment game design: metaphor, visualization, content as mechanic, self-assessment, achievement, repetition, and multi-linear play–as adapted to meaningful educational content in a variety of fields, with a particular focus on university-level and adult learners. This chapter explores these best practices as utilized in the development of the Digital Calculus Coach, an online game intended to teach calculus concepts and problem solving at the university level.

INTRODUCTION

A favorite reference among game studies and educational technology scholars is a line often attributed to Marshall McLuhan, that "anyone who tries to make a distinction between education and entertainment doesn't know the first thing about either." In a traditional classroom setting, a compelling and fun educational experience is a fond hope but not necessarily a requirement. For developers of educational games, this aphorism represents the best possible case for nearly an entire field of research: that computer games, now a multi-billion dollar entertainment industry and a mainstream pastime for most of North America, Europe, and Asia, can be harnessed to become the 21st century's greatest teaching tool, and that the millions of gaming-literate students can directly

DOI: 10.4018/978-1-60960-495-0.ch008

apply their love of gaming to meaningful educational content.

This desire is not limited to academia or to primary and secondary education, but applies to multiple industries in which education and training play a major part, including the military, medical and health fields, business development, and others. In the military, for example, educational games and game structures are already used to teach a variety of skills and strategies to both soldiers and civilians. The first-person shooter America's Army has been in operation for nearly a decade as both a realistic combat simulation and a recruitment tool (Bossant, 2010). At the University of Texas at Dallas, the First Person Cultural Trainer uses living world scenarios to teach cultural norms, non-verbal and gestural communication skills, and situational awareness in graphically-immersive environments created in the Unreal 3 engine (Zielke et. al., 2009). Numerous on-going projects at the Institute for Creative Technologies at the University of Southern California explore post-traumatic stress disorder therapy, speech and language training, disaster-response training, and other forms of virtual training through the use of high-end game engines (2010). In medicine, Virtual Heroes has developed Zero Hour: America's Medic, a true-to-life gaming simulation that trains first-responders in handling real-life natural disasters and potential terrorist attacks, and HumanSim, a healthcare education simulation which provides game-based training in rare, complicated or otherwise error-prone tasks for physicians, nurses, and students in realistic, immersive environments (Virtual Heroes, 2010). These projects and others exemplify the growing interest in and application of educational games in complex training situations.

For primary, secondary, and university education, gaming technology would seem to be a natural fit. There has been a marked rise in research into the potential for educational games in the last few decades, both in and out of the classroom, and for a wide variety of games, genres, and media. From work on intrinsic learning motivation through games (Malone, 1981; Malone & Lepper, 1987; Garris et. al., 2002), to studies on active learning through play (Bonwell & Eison, 2000; de Weck et. al. 2005); play as primary concern for educators (Barab et. al., 2009); the psychological aspects of games and play through computers (Reiber, 1996); and even ways of preventing learners from gaming a play-based educational system (Baker et. al. 2008), there is clearly both an interest and a need for research in the area of games and education. Significant work on games, cognition, and learning is also being pursued, most recently by Bavelier and Green (2004; 2006; 2009), and by Baker and others (2010). This rise in research may be partially attributed to the growing acceptance of game studies as an academic field with strong ties to numerous disciplines.

In terms of development, we can perhaps also attribute this growing interest in educational games to significant changes in the commercial game industry. With the rise of the independent game movement, we have seen that small teams of developers can create polished, sophisticated game experiences with far fewer resources than big-budget, AAA commercial titles. Development tools and engines are easier to acquire and use than ever before. And gaming as a pastime is now clearly mainstream, at least in the United States. The most recently released set of facts from the Entertainment Software Association (2009) states that sixty-eight percent of all American households play computer games; the average game player is 35; forty percent of game players are women; twenty-five percent of Americans over the age of 50 play games; and, perhaps most importantly, sixty-three percent of parents believe that games are a positive part of their children's lives. The leap to games as a positive part of education is not a great one. Why is it that games are not yet a major part of primary, secondary, and university education?

Primarily, there are a number of logistical hurdles to overcome, not the least of which is