Chapter 14
Motivating by Design: Using Digital–Game Based Learning Techniques to Create an Interesting Problem–Based Learning Environment

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ABSTRACT
This chapter describes how to design a motivating educational game for middle school students using digital-game based learning techniques in a problem-based learning environment. Specifically, The Alien Rescue Game (TARG), a problem-based digital-game based learning program, is compared to commercial digital games to determine how to design a motivating educational game. Results showed that students believed that their interest in learning science was influenced by their self-efficacy, attainment value, intrinsic value, utility value, cost perceptions, and knowledge. Furthermore, these same influences affected players’ perceptions of and experience with commercial digital games. Thus, these motivational constructs should be considered when developing educational games, with self-efficacy, intrinsic value, knowledge, and cost being the most important based. Intrinsic motivation sources were found to be control, challenge, immersion, and socializing. Considerations and implications for the design of motivating digital game-based learning programs, recommendations, and future research directions are presented.

INTRODUCTION
Computer and video games (digital games) have increasingly captivated the minds of our youth (Malone, 1981; Randel & Morris, 1992; Rosas, Nussbaum, & Cumsille, 2003; Ryan, Rigby, & Przybylski, 2006). The significance of digital games in our society is evidenced by the fact that more than two-thirds of all American households play games and 42% of households have video game consoles (Electronic Software Association, 2010). The youth, those under 18 years old, are major players of digital games accounting for 25% of the most frequent game players with nearly 50% of these players being female. Furthermore, parents are playing with their children, identifi-
Motivating by Design

ing “fun for the entire family” as the top reason to participate in this activity (Electronic Software Association, 2010). Finally, adult gamers have been playing digital games for an average of 12 years. Clearly, digital games are a major form of entertainment in the 21st century because they are fun and engaging.

Beyond just entertaining, most digital games require extensive learning in order to succeed. Digital game players must plan and execute strategies, problem solve, manage resources, and adapt rapidly to changing circumstances. In many ways, digital game players learn skills that can be useful in everyday life. The combination of fun and engagement in digital games with the potential of learning useful skills has made digital games a promising opportunity as an educational media and interactive learning environment.

Unfortunately, the design for and the use of digital games in classroom settings to leverage their motivational power have not been extensively studied (Dickey, 2005; Hoffman & Nadelson, 2006). This chapter investigates whether a digital game could be designed to enhance motivation to learn academic subject matter while playing, and promote continuing interest to learn after playing has ended.

The aim of this chapter is to provide insight on how to design digital games for the purposes of engaging middle school students and developing interest in academic subject matter. That is, this chapter describes the theoretical model of how to design a digital game to engage students in solving complex problems, such as those required in mathematics and science. In particular, a problem-based learning (PBL) digital game, The Alien Rescue Game (TARG), that was designed specifically to promote students’ learning, motivation, and interest in a middle school science class will be described and assessed, along with findings from motivational studies of commercial digital games. Furthermore, this chapter attempts to determine if students can be motivated by playing TARG to become interested in academic subjects and toward the development of a personal interest in the academic subject matter.

BACKGROUND

Theoretical Framework: Model of Motivation

To understand how to design motivating digital games, one must understand motivation and the sources of motivation. Motivation is the psychological construct driving an individual’s choice of behavior, intensity of behavior, latency of behavior, and persistence of behavior (Graham & Weiner, 1996). Furthermore, motivation both influences and is influenced by cognition, such as goal setting, and emotional reactions, such as the feeling of fun. Motivation is often considered to promote learning (Gottfried, 1985; Lepper, Corpus, & Iyengar, 2005).

Currently, the expectancy-value motivational theory is the predominant theory of achievement motivation, which posits that motivation increases with the expectation of reaching the goal and the goal’s value (Graham & Weiner, 1996; Liberman & Forster, 2008). Furthermore, extensive research on motivation for classroom academic achievement has been performed using the Eccles’ expectancy value model of motivation (Schunk, Pintrich, & Meece, 2007). According to Wigfield and Eccles (2000), achievement motivation influences the choice, engagement, and performance of individuals. A simplified version of this complex and elaborate model is shown in Figure 1.

In this model, expectancy and subjective task value predicts achievement behavior, which is the intention to approach or avoid engaging a task, and, once engaged, the quality of effort and persistence. Though expectancy and subjective task value are often independently measured, they influence each other and build reciprocally together for a subject or activity (Eccles & Wigfield, 2002). That is, an individual is willing to expend
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