



We don't need no stinkin' badges: The impact of reward features and feeling rewarded in educational games



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ABSTRACT

Drawing from recent research on the ability of video games to satisfy psychological needs, this paper identifies how the presence of rewards influences learning complex concepts and tasks using an educational video game. We designed and developed two 60-min educational games with and without a range of reward features and examined learning outcomes among 242 participants in university laboratories. Although both games improved learning, analyses suggest that the quantity of in-game rewards did not have an impact on biased behavior avoidance or knowledge about biases. To further illuminate these findings, we examined perceptions of feeling rewarded and found that those who felt more rewarded had more favorable views of the gameplay experience, but they did not demonstrate different learning outcomes.

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1. Introduction

Over the last two decades, prominent figures from a variety of fields have explored how features that account for video games' massive popularity may also make them powerful educational tools (Gee, 2007; McGonigal, 2011; Squire, 2011). This work has consistently identified in-game rewards as an important source of video games' overarching appeal (Wang & Sun, 2011; Yee, 2006), leading scholars to suggest that the reward systems in popular commercial games should also be used in educational games (Garris, Ahlers, & Driskell, 2002; Kelle, Klemke, & Specht, 2013). Indeed, rewards such as points, badges, or achievements have become key components of proposals for "gamifying" education (Kapp, 2012; Lee & Hammer, 2011). Only limited research has explored the impact of rewards on learning, however, and few authors distinguish between perceptions of *feeling* rewarded and in-game reward features themselves.

Drawing from recent research on the ability of video games to satisfy psychological needs (Przybylski, Rigby, & Ryan, 2010; Przybylski, Ryan, & Rigby, 2009; Ryan, Rigby, & Przybylski, 2006), this study examined how the presence of rewards influences learning complex concepts and tasks using an educational video game. We designed and developed two versions of a 60-min educational game, one with and one without a range of reward features. We examined learning outcomes among 242 participants in university laboratories. Analyses suggest that although both versions of the game had significant and strong effects on participants' behavior and knowledge, the quantity of in-game rewards did not have an impact on these outcomes. To further illuminate these findings, we examined perceptions of feeling rewarded and found that there was no difference in how rewarded participants felt when in-game reward features were and were not present. Rewards affected how favorably participants viewed the game play experience, but they had no impact on learning outcomes. We examine the implications of these findings for educational game design in the concluding sections.

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2. Literature review

2.1. Theories of rewards and feeling rewarded in game-based learning

The scholarly literature on learning identifies two separate, but interrelated, reasons why educational games should include reward systems. First, scholars suggest that rewards may strengthen learning outcomes by motivating individuals to pursue challenging tasks or goals that they otherwise would be less interested in or attempt less diligently (Cameron, Pierce, Banko, & Gear, 2005; Mesch, Johnson, & Johnson, 1988; Pierce, Cameron, Banko, & So, 2012; Skinner, Williams, & Neddrenrip, 2004). According to this logic, in-game features that players find appealing such as unlocking new challenges, earning accessories to customize their avatar, or receiving trophies may motivate players to both continue to play the game and to play the game more carefully than they otherwise would.

Second, many game-based learning scholars treat certain in-game rewards as providing a valuable form of performance feedback. For example, Garris et al. (2002) hold that game score-keeping may motivate players to replay the game in order to improve their performance. Similarly, Kelle et al. (2013) suggested that point systems allow players to gauge their skill level and thus encourage them to ameliorate deficiencies. McGonigal (2011) identified performance feedback systems as a defining feature of all games and suggested that it provides players with a sense of progress or accomplishment that motivates them to pursue the game's ultimate goal.

Overall, many scholars consider some reward mechanisms to be vital components to game-based learning. Kelle et al. (2013) examined this relationship and found that rewards in the form of a score system strengthen learning outcomes only when combined with a time limit. Much of the other research on this topic emphasizes the importance of rewards in educational games without empirically examining the particular impact rewards have on learning outcomes (Huang, Huang, & Tschopp, 2010; Wang & Sun, 2011). More generally, Garris et al. (2002) warned that without more rigorous empirical and scientific testing, the field runs the risk of “designing instructional games that neither instruct nor engage the learner” (p. 442). Bedwell, Pavlas, Heyne, Lazzara, and Salas (2012) and Guillén-Nieto and Aleson-Carbonell (2012) issued similar warnings ten years after Garris et al.'s original critique. In this work, we attempt to remedy this gap in the literature by testing whether or not rewards influence learning outcomes in educational games.

Recent research has drawn from the basic psychological needs literature to help explain video games' considerable popularity (Przybylski et al., 2009, 2010; Ryan et al., 2006). The basic psychological needs literature posits that individuals are intrinsically motivated to pursue activities that satisfy their basic psychological needs (see Deci & Ryan, 2000). Accordingly, video games may provide players with a certain degree of freedom in setting goals or selecting strategies, thus satisfying players' psychological need for autonomy (Przybylski et al., 2010; Ryan et al., 2006). Successful games may satisfy players' need for competency by including challenges that are optimized to players' abilities without being unfair (Ryan et al., 2006). For many game designers and scholars, providing players with a meaningful sense of control over their actions and challenges that are progressively difficult without being unfair are fundamental principles of quality game design (Fullerton, 2008). Consequently, these perceptions of autonomy, challenge, and control may allow a game to feel rewarding to players even when features game designers identify as in-game rewards are not present or are minimal.

2.2. Games for teaching cognitive biases

Scholars have suggested that games may be particularly effective for training behaviors relevant to complex conceptual tasks such as decision-making due to their tendency to generate Intrinsic Motivation among players (Garris et al., 2002; Gee, 2007; McGonigal, 2011; Ricci, Salas, & Cannon-Bowers, 1996; Salen & Zimmerman, 2004). Individuals are said to be intrinsically motivated to engage in a task or activity when they find the activity itself to be pleasurable or enjoyable (Deci, 1971; Deci & Ryan, 1985). Many scholars consider the majority of players to be intrinsically motivated to play non-educational games given that players do so voluntarily and usually receive no financial rewards in return. Scholars and developers in this area endeavor to make complex and challenging subject matter more enjoyable for students by adopting mechanics and features of popular commercial games into educational games.

The process of learning about cognitive biases and the necessary steps to avoid them can be considered a complex task. Cognitive biases are systematic errors in judgments that are often the result of heuristics used in decision-making, and they are especially common when people examine large amounts of information or when they have to make quick judgments (Larrick, 2004; Tversky & Kahneman, 1974). Cognitive biases are especially pervasive and resistant to change because they are often unconscious (Kahneman, 2011). Various techniques for reducing biased behavior have been explored in experimental settings, although many have had only limited success (Dale, Kehoe, & Spivey, 2007; Sanna, Schwarz, & Small, 2002; Simmons, LeBoeuf, & Nelson, 2010). Psychological research has examined how these biases manifest and ways to overcome them, but little research has addressed the use of games for this purpose, with the exception of projects associated with the present study (Shaw et al., 2013; Martey et al., 2014).

3. Our game

The game designed for this study trains players to change their decision-making behavior and increase their knowledge of three specific cognitive biases. *Anchoring bias* occurs when an individual is influenced by a number or topic (an *anchor*) before making an assessment and results in estimates that resemble the anchor too closely (Tversky & Kahneman, 1974; Wilson, Houston, Etling, & Brekke, 1996). *Projection bias* is defined as assuming others share one's own values, preferences, skills, or habits (Loewenstein, O'Donoghue, & Rabin, 2002). *Representativeness bias* is a term that refers to a set of errors that ignore or miscalculate the actual likelihood of events, such as drawing conclusions based on a limited (non-representative) or misleading set of examples (Ajzen, 1977; Kahneman & Tversky, 1973; Micallef, Dragicevic, & Fekete, 2012).

To examine the impact of in-game rewards on players' ability to recognize and avoid these three cognitive biases, we built a 60-min educational game with a professional game company. The game is based on Transformative Learning Theory (Mezirow, 1990), a cognitive learning theory oriented around behavior change through task-oriented problem solving and understanding others' values, ideas, and decisions. Further, the game was structured with learning taxonomy by Bloom (1956; see also Anderson & Sosniak, 1994) to train cognitive, affective, and psychomotor skills. Two versions of the game were developed for this experiment: one with frequent in-game rewards and one with very few of these features.

Games scholars generally define a reward as any game item or feature that reinforces particular in-game behaviors (Fullerton, 2008; Hsu, Wen, & Wu, 2009; King, Delfabbro, & Griffiths, 2010;

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