

Chapter 5

A First Step towards Integrating Educational Theory and Game Design

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ABSTRACT

As of yet, there is no clear relationship between game elements and deep learning. This chapter used a literature review to create an overview of 25 game elements that contribute to learning. The TOPSIM game, by TATA Interactive Systems, was used in a case study to delve into the educational impact of 16 of these game elements. Using pre-game and post-game tests, it was concluded that the students learned from the game, and that they considered the following elements to contribute to their learning: 'action-domain-link', 'adaptation', 'debriefing', 'conflict', 'control', 'fantasy', 'goals/objectives', 'mystery', and 'safety'. These results will be used in the construction of a game-based learning model that also incorporates theory on education game design, research on educational elements and principles in games, and theory on core elements that make up all games, whether educational or entertaining.

INTRODUCTION

For years games have been used to teach about a wide variety of fields, such as business, military, and policy analysis (Gredler, 2004). Although much is known about games and learning in general, little is known about what components of these games (i.e., game attributes) influence learning outcomes (Wilson, Bedwell et al. 2009).

Kebritchi and Hirumi (2008) argue that synthesis of information on how established learning theories and instructional strategies are being applied to design educational games to guide research and practice, has been limited. Pedagogy and game design currently seem to be two separated worlds.

Concurrently, a growing body of literature emphasizes the importance of applying established instructional strategies and theories to design educational games and to facilitate game-based learning (Quinn, 1994; Squire, 2004; Dickey,

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2005; Egenfeldt-Nielsen, 2005; Kiili, 2005; Amory, 2006; Dickey, 2006; Egenfeldt-Nielsen, 2006; Dickey, 2006b; Bots & Daalen, 2007; Kebritchi & Hirumi, 2008; Hong, Cheng et al. 2009). This, apparently, is a general problem with regards to both level of education and type of game: Egenfeldt-Nielsen's and Squire's work focuses on secondary education, whereas Amory, Bots & Daalen, and Kiili are rooted in higher education; and while authors studied different kinds of games, they reached the same conclusions about design.

Insight into the learning process of games is limited: it is still unclear why, when, how and what participants learn from which phase in a game, or what influence individual facilitators have on the learning outcomes of a game (Peters, Vissers et al. 1998; Squire, 2004; Dickey, 2005; Kiili, 2005; Dickey, 2006; Leemkuil, 2006; Dickey, 2006b; Burgos, van Nimwegen et al. 2007; Oliver & Carr, 2009). If we wish to improve the quality of the learning that occurs while playing these games, we first need to know which elements in games contribute to learning. Game 'elements' are the components that make up the game; in some research these are also called the game 'attributes'.

This chapter describes the outline and results of our literature research into game elements that contribute to learning. We have combined three lines of thinking to construct an initial overview of elements in games that relate to deep learning. These three lines of thinking are theory on serious game design, research on educational elements and principles in games, and theory on core elements that make up all games, whether educational or entertaining. This overview of game elements can serve as a first step in creating a game-based learning model, which would combine theories on game elements, engagement, and learning organization. We used the TOPSIM game, by TATA Interactive Systems, as a case study to delve into the educational impact of some of these game elements.

BACKGROUND

Games and Learning

Gredler (1996) argued that insight in the connection, between educational games and disciplinary theories of learning and knowing, has been limited. Lack of understanding of the learning process of games prohibits structured implementation of instructional design, and control of desired learning outcomes, in game design (Egenfeldt-Nielsen, 2005).

This problem is encountered in the full spectrum of the field of game design. Egenfeldt-Nielsen (2006) points out that overviews of the broader field of learning from video games are limited, because of:

- Underdeveloped theory on facilitating learning through video games, and weak theoretical knowledge of video games (Kirriemuir & McFarlane, 2003).
- Further work still needs to be done to bring the games development and education communities closer together in order to build shared vocabularies and expectations, as well as to inform new learning designs to support effective game-based learning experiences (Freitas, 2006).
- Incomplete use of previous literature owing to the variation in terminology, place of publication, and researcher backgrounds (Squire, 2002).

Egenfeldt-Nielsen (2005) concludes that the inherent learning features of computer games should be maintained when designing and thinking about educational game titles. But the current inability to structure and control learning within games, makes valid statements about the expected effectiveness of a game impossible.

In the past years numerous games have been designed and best practices have come forth from the design processes (Quinn, 1994; Mayer

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