

# Chapter 11

## Designing Educational Games: A Pedagogical Approach

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### ABSTRACT

*Play has been an informal approach to teach young ones the skills of survival for centuries. With advancements in computing technology, many researchers believe that computer games<sup>1</sup> can be used as a viable teaching and learning tool to enhance a student's learning. It is important that the educational content of these games is well designed with meaningful game-play based on pedagogically sound theories to ensure constructive learning. This chapter features theoretical aspects of game design from a pedagogical perspective. It serves as a useful guide for educational game designers to design better educational games for use in game-based learning. The chapter provides a brief overview of educational games and game-based learning before highlighting theories of learning that are relevant to educational games. Selected theories of learning are then integrated into conventional game design practices to produce a set of guidelines for educational games design.*

### INTRODUCTION

Computer gaming is an extremely popular trend among youth in the 21<sup>st</sup> century (Pearce, 2006) yet is often seen as a concern by the general public with the potential harm it may introduce based

on studies of video gaming effects in the 1980's and 1990's. But should those concerns neglect the educational potential of computer games? Computer games are able to generate enormous levels of motivational drive for game players as opposed to formal classes which are perceived as

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“boring” or rather “dry” (BECTa, 2006; Prensky, 2002). The energy that game players often invest for computer games is phenomenal. Though some may comment that aspects of learning in computer games may not be suitable for academic learning, e.g. (Adams, 2005), nevertheless exploiting such technology to aid learning is still possible when used appropriately.

*Educational games*, also known as *instructional games*, take advantage of gaming principles and technologies to create educational content. Early versions of educational games were often incarnations of interactive multimedia courseware that incorporated simple mini-games such as puzzles and memory games as rewards attempting to inject fun into learning (albeit often developed by inexperienced educational game designers). Most educational games were developed for children who have lower expectations of interactive content as compared to teenagers and adults. Financial and technological constraints presented major barriers to production of high quality educational games that could meet teenage and adult expectations, and such constraints still exist today. Hence there is a common misconception that educational games are simply for children.

In actual fact, there are a number of educational games for adults aimed mainly in medical (Moreno-Ger, Blesius, Currier, Sierra, & Fernández-Manjón, 2008) and business education (Faria, 1998). *Training simulators* (a term more familiar to the adult population) simulate real-world experience intended for development of skills where the challenges presented accurately replicate real-world scenarios requiring the user to overcome problems using realistic procedural acts defined through hardware interfaces. Training simulators are most popular in the fields of aviation (Telfer, 1993), medicine (Colt, Crawford, & III, 2001) and military applications (Nieborg, 2004). *Serious games* is a more recent term used for representing software applications that employ gaming principles and technologies for non-entertainment purposes including education and training (Sawyer & Smith, 2008; Zyda, 2005).

Designing games with good game-play is not a science or an art, but often quoted as a ‘craft’ requiring skills to engage and immerse game players in a realistic setting while also encouraging replayability. Game designers are brilliant at creating “hooks” to engage gamers, but in the context of game-based learning it is important to emphasize the aspects of academic value that can develop skills that are useful to the learner. This chapter presents a general model and guidelines for designing educational games by incorporating theories of learning into games design practices. Variables influencing learning and a selection of theories of learning related to educational games design are described before being mapped to elements of game design to form guidelines for designing educational games. Some conclusions from this work are presented at the end of this chapter.

## **VARIABLES INFLUENCING LEARNING**

Learning is generally perceived as the process of acquiring new knowledge which often takes place in a formal classroom setting. However, learning can also take place informally after school hours through interactions with peers and the surrounding environment making learning a constant process. The ability to learn and adapt are crucial in our daily lives and has a direct relationship with human performance when executing tasks. Learning is enriched us with knowledge and skills gained through experience from direct and indirect interaction with the subject matter which proves useful in future similar events and scenarios.

Learning as a cognitive process is affected by a number of psychological factors which can be categorised as internal or external. Internal factors are factors originated by the learner themselves and are closely related to the functioning of the human mind and emotions (Bransford, L., & Crooking, 1999). External factors can be those that are sourced from teachers, peers or the

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