Chapter 12
Educational Games Design:
How to Create Adaptive, Engaging, and Fun Learning Experiences

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ABSTRACT

Video games are widely and increasingly adopted in the educational field thanks to their inherent engaging, immersive, and adaptive capacities. Yet, one of the greatest problematic in educational games design remains how to create ludic and adaptive experiences without going astray from the targeted learning objectives. In creating adaptive educational games, modeling the learner/player is a prerequisite. This chapter highlights the importance of educational standards in learning content design and proposes an adaptive mechanism "AMEG" based on IMS learning design and artificial intelligence that model learners using game metrics and adapt the gameplay as well as the learning content. As a practical experimentation of the mechanism, MathQuests, an educational game that helps in teaching mathematical operations for first year middle school students was created.

INTRODUCTION

Video games are well known for their engaging and immersive capacities as well as their motivation enhancement. The new trends of video games that began recently to hold sway are serious games; which do not stop at the purpose of entertainment, but go further to reach other domains. Their uses touch upon areas such as, learning, physical and mental exercises, training, communication and many other occupational fields. Today's students represent the generation that grew up surrounded by an amalgam of contexts and learning situations using video games. As a corollary, educational digital games are

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considered as potentially promising and effective learning tools (Gee, 2003; Prensky, 2006; Squire & Jenkins, 2003; Egenfeldt-Nielsen, 2006). Educational games give immediate and incidental feedback to learners; this allows them to progress at their own pace and gives them the opportunity to explore, by trying new things and taking risks in a safe place without being judged or ranked (Gee, 2003).

Many educational games have been created this last decade but few of them have emerged in the industry. This is due to the fact that they don't offer an equal balance between the educational content and the gameplay (Quinn, 2005; Gunter, Kenny, & Vick, 2008; Garris, Ahlers & Driskell, 2002; Kim et al., 2017). They either focus on the quality of gameplay and graphics while the integration of the learning content is done quickly but not efficiently; those games are generally made by video game experts with consultation of teachers and pedagogues. Or they prioritize the seriousness over entertainment and lose their immersive and engaging capacities. To create effective educational game, pedagogical and learning objectives need to be appropriately integrated in educational games without neglecting video game elements like mechanics, gameplay, rules, graphics and so on. In fact, effective educational games should tailor the learning content to the learners' competencies and preferences while offering adaptive and engaging gameplay (Peirce, Conlan & Wade, 2008; Kickmeier-Rust & Albert, 2010; Andersen, 2012). To reach this adaptive capacity, learners need to be modeled (Brusilovsky & Millan, 2007; Chrysafiadi & Virvou, 2013; Ciloglugil & Inceoglu, 2012). Information like their knowledge, preferences, weaknesses, playing and learning styles need to be determined.

This chapter offers a discussion of how educational games design can benefit from educational standards in incorporating and adapting the learning content, proposes a mechanism that models learners, and adapts the game content. Section I, provides broad discussions of the problematic and incorporates views and works of other researchers. Learning standards will also be presented and their importance will be highlighted. In section II, authors will present existing learners modeling approaches in educational games and reveal their own modeling approach. Learners' models content will be revealed and the importance of game metrics will be discussed. Besides, the importance of playing and learning styles will be tackled and a possible correlation between the two will be exposed. Section III details the adaptive mechanism AMEG, its architecture, components and flow. An implementation of the mechanism will also be described before concluding the chapter and providing insights about future works.

BACKGROUND

The popularity of video games increased conspicuously in the last decades. Now millions of people, regardless of their age, status or interest, witness the advent of video games in their daily lives. Even financially, the global market for video games has known a giant leap from 10 billion dollars in 1990, to more than 99 billion dollars in 2016; to the extent that the entertainment industries of video games beat out, by large, the movie and the music industries. Aspects such as socialization, immersion and achievement are among the recurrent features of gameplay that make video games more enjoyable than other forms of games (Yee, 2006). Players identify with game characters and live in the fantasy world of where they can make relationships and interact with other players overcoming challenges with them or against them to become powerful. Things that cannot be tangibly achieved in real life can easily be achieved in gameplay. In addition to fun, video games also provide interaction, interactivity, problem solving, story and other elements that give the user involvement, structure, motivation and creativity, among other benefits (Prensky, 2001).

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