**CHAPTER 2**

**Review of Related Literature**

Informatics (computer science or computing) as a science discipline, and in particular programming as an important part of that, is gaining at a lot of popularity these years in the field of education. As core subjects in a computer science (CS) major, programming subjects play an important role in a successful CS education.One of the greatest challenges faced by most students is the understanding of programming basics, especially for novices or for those who are in their first year of studies. Students develop algorithmic thinking or computational thinking at secondary and even at primary school. Using simple programming languages such as Scratch became accessible to young children (Maloney *et al.,* 2004).

Games have been used for educational purposes for decades. The popularity of games has led to the idea of using them in the learning of programming, taking advantage of the engaging features of games. In a very broad sense, two different approaches are used when using games or game-like elements in educational contexts: 1.) gamification and 2.) serious games. The term *gamification* is commonly defined as the use of game design elements in non-game contexts (Deterding*et al.,* 2011). Serious games are associated with a standalone game or platform, as well as indicated as a computer game (Djaout*et al.,* 2011). In this paper, we are going to use the general term to refer to game-based learning with main focus on teaching programming.

Game-based learning is concerned with using games not for entertainment, but for education purposes. Those who work within the field of gamification focus on identifying the context and conditions that support the integration of digital games within informal and formal learning environments. Educational scientists have pointed up several features of games that allow them to be used as learning tools. For example, games are engaging (Dickey, 2005) and motivating (Prensky, 2003). They also provide a lot of experiences (Arena and Schwartz, 2013) and an excellent feedback on performances (Shute, 2011). Finally, games support very well the learner centred education (Gee, 2005).

A contest can be seen as a part of game-based learning. Contests make the teaching of programming more attractive for students. Furthermore, programming with computer is one of the appropriate and effective ways to develop problem solving skills and computational thinking. During contests, students have the possibility to compare their abilities and learn from others. There have been many contests in programming throughout all over the world; most of them focus on algorithmic problem solving. Many teaching environments already contain game-like elements such as points, instant feedback and goals. However, there are engaging aspects in games that could be used in educational settings more widely. In well-designed games, even a failure can be a reward and triggers positive emotions (Ravaja*et al*., 2005). There is no off-the-shelf formula for designing successful games, nor is there one perfect learning environment. However, by deepening our understanding of the effects of games and game-like environments in educational settings, we can design and support more effective learning activities; and ultimately improve the learning of computer science.

The move from classical learning platforms to online contests and games can be explained as a way to ensure the best motivation as possible for their users. The online platforms can provide tools such as rankings, duels, discussion rooms, etc. to motivate their users to participate regularly. Finally, research on gamification in all its forms has proven that educational games improve the engagements of learners if the game is designed properly (Barata*et al.,* 2013; Nah *et al.,* 2014). Online platforms where students can learn programming are being developed all over the world, ranging from simple direct learning platforms to platforms of games that indirectly teach programming (Combéfis and Wautelet, 2014).

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