

Development of Novel Gamified Online Electrocardiogram Learning Platform (GaMED ECG^{@TM})

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Abstract. Following the advances of new technologies such as social networks, digital media, and the Internet, numerous learning materials nowadays incorporate multimedia technology to maximize the student learning experience. Greater student engagement, increased motivation and higher satisfaction of students using technology-enhanced learning can be achieved by gamification. Electrocardiogram (ECG) is a graphical image of cardiac electrical activity which needs to be interpreted timely and accurately in order to diagnose various types of lifethreatening conditions in clinical practice. There is a call for innovative ECG instructional method that can actively engage learners and motivate them in order to interpret ECG correctly in a timely manner. In this case, we proposed and developed a gamified ECG learning platform in which ECG teaching materials were incorporated into gamification tool. A GaMED ECG@TM prototype was developed for ECG learning and then, GaMED ECG@TM software practicability was tested. An instructional design Analysis, design, development, implementation and Evaluation (ADDIE) model was followed in developing an online gamified learning platform GaMED ECG@TM. The GaMED ECG@TM platform incorporates a game-based technique as a strategy to deliver positive learning outcomes to students. In view of the need for technological innovations in medical education, this gamified learning platform provides the interactive self-paced activities structured as gamified lessons to enlighten the students with ECG knowledge.

Keywords: Instructional Gamified Design; Gamified learning platform; online learning, Electrocardiogram learning

1 Introduction

Traditional teacher-centered learning is perceived as ineffective and boring by 21stcentury students [1]. Following the advances of new technologies such as social networks, digital media, and the Internet, much learning material nowadays incorporates the multimedia technology to maximize the student learning experience both in synchronous and asynchronous learning environment [2]. However, many technology-enhanced student-centered learning systems do not attain the desired students' engagement due to some users stopping usage after initial enrolment [3]. One of the major factors of poor satisfaction of students in electronic learning platform is due to the use of inappropriate motivational techniques [4]. Several studies found out that not only greater students' engagement but also increased motivation and higher satisfaction of students using technology-enhanced learning can be achieved by gamification [3,5]. Gamification does not imply creating a traditional game for entertainment per se but it, in fact, uses game-like features such as points and coins to educate [6].

Application of the game mechanics, dynamics and aesthetics allow technology-enhanced learning to move towards gamification design in order to reinforce learning[7]. Gamification enables students to gain inspiration towards studying, and due to the achievement, they become more absorbed and encouraged to learn. Gamification can represent an influential encouragement to govern them to read more. Therefore, in recent years, gamification has drawn the consideration of medical educators due to the possibility of making medical learning more motivating and engaging; this led to an increase of research in the medical education field [8].

Electrocardiogram (ECG) is a 3D graphical image of cardiac electrical activity which needs to interpret timely and accurately in order to diagnose various types of life-threatening conditions in clinical practice [9]. ECG learning is therefore very possible to assist learning with digital interactive multimedia teaching materials like ECG simulator. Little et.al., (2001) pointed out that despite the emphasis of ECG learning as a crucial learning outcome in undergraduate curriculum [10], the interpretation of ECG among graduating medical students has deteriorated to an unsatisfactory level [11-13]. One of the psychological factors is lack of confidence to interpret ECG that demotivates them to study ECG more [14].

To date, no teaching strategy is effective in delivering lessons on electrocardiogram interpretation [15]. Over the years, some of the methods that have been used in teaching electrocardiogram interpretation skills include lectures, tutorials, self-directed learning and teaching rounds. Recently, there has been rising interest in the use of web-based packages to deliver ECG lessons. However, there is a paucity of information about the most promising and engaging method that can be used to teach medical students electrocardiogram interpretation. Therefore, there is a call for innovative ECG instructional method that can actively engage learners and motivate them in order to interpret ECG correctly in a timely manner. In this case, we proposed a novel gamified ECG learning platform in which ECG teaching materials were incorporated into design idea of gamification. In this paper, we will discuss how a GaMED ECG@TM prototype was developed for ECG learning and then, GaMED ECG@TM software practicability was tested.

2 Literature Review

Gamification is the use of game design elements in non-game contexts [16]. These game elements refer to those usually found in most games, such as points, badges and leaderboards. The non-game contexts imply to health, education, and business settings [17]. As per Dominguez et al., (2013), gamification enhances user experience [18]