Interactive Data Structure Learning Platform

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Abstract. The advent in technology in the past few years allowed an improvement in the educational area, as the increasing in the development of educational system. One of the techniques that emerged in this lapse is called Gamification, defined as the utilization of video game mechanics outside its bounds. Researchers in this area found positive results in the application of these concepts in several areas from marketing to education. In education, there are researches that covers from elementary to higher education, with many variations to adequate to the educators methodologies. Among higher education, focusing on IT courses, Data Structures can be considered an important subject to be taught, as they are base for many systems. Based on the exposed this paper describes the development and implementation of an interactive web learning environment, called DSLEP (Data Structure Learning Platform), to support students in higher education IT courses. The system includes basic concepts taught on this discipline as stacks, queues, lists, arrays, trees and was implemented to receive new ones. The system is also implemented with gamification concepts, as points, levels, and leader boards, to motivate students in the learning process and stimulate self-learning.

1 Introduction

The advent of technology in the latest years stimulated the development of various techniques to improve and analyse human behaviour. This can be seen on the emergence of a diversity of applications to monitor, analyse and manage several social aspects in many areas, from health and business to educational.

In education, computers are able to assist teachers and students in several ways from junior high to higher education. In the last one, there are many researchers that aims to minimize the evasion and failure rate, mainly focused on IT courses where these statistics are higher.

In order to prevent that, studies were made based on the development and analysis of tools to aid students, focusing on Programming lessons [2]. As for Data Structures lessons, which are also an important subject to IT courses, and sometimes considered an extension of Programming lessons.

Data Structures is considered an important subject in many IT syllabus, as it involves concepts of non-trivial algorithms that are utilized within many systems. Improving the learning of these concepts is crucial to enhance the formation of professionals in the area [12].

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In order to improve the educational process, it is necessary to motivate and engage the student. This can be done with the aid of Gamification concepts, defined as the utilization of game mechanics outside its bounds to improve and modify user behaviour [3], [7], [14].

The utilization of those concepts is achieving positive results in the past few years, and studies comproved that those mechanics can be used within several areas [6]. The outcomes of the Gamification tied with educational methods proved to be efficient in many studies ranged in junior to higher education [11],[5] [4].

The observations exposed above stimulated the main objective of this work, which aims to develop an Interactive Data Structures Learning Platform. This tool aims to improve the learning process for the lessons, addressing some main concepts as stacks, queues, lists, trees and arrays.

Among those are also the Gamification concepts that aims to improve the interactions between users and the platform, in order to engage and motivate them to study by themselves. Also, it is important to point that this tool is not made to replace the Professor but to aid in the learning processes and methodologies of their disciplines.

This paper is divided as follows: section 2 describes some concepts involving gamification in education through motivation theories. Section 3 follows describing the project, architecture and tools utilized in the system and section 4 describes the results obtained by implementing it. Finally on section 5 there are the conclusions, discussions and future works of this project.

2 Gamification

The concept of gamification consists in utilizing game mechanics outside of its bounds with the perspective to improve user engagement [6] [7] [14]. It is possible to find some work reporting successful cases in areas as economy, marketing and health [6],[7].

According to [6] the utilization of these concepts must be well planned in order to obtain a positive effect and to not let the users get addicted to it. The author also focus on three major areas that are directly affected by Gamification in education: cognition, emotional and social. This happens because these areas influence the success or failures in a students academical progress [10].

The cognition area comprises the interactions of the user with the systems. As the games have a set of rules, the user is stimulated to learn these through experimentation, trial and error. During classes, the student may become reticent since the chances of failure are generally higher [6] [9].

These methods of experimentation generates the emotional transformation, as the user is compelled to overcome his challenges in a game. The transformation occurs by changing a positive emotion into a negative one and vice versa. For example, when frustration becomes pride after overcoming an obstacle inside the world of the game.