"Everybody is playing the game, but nobody's rules are the same": towards adaptation of gamification based on users' characteristics

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Abstract — **Nowadays it is usual to implement game elements and design in non-game contexts to promote user´s motivation and engagement. This process is called gamification. However, gamification is being implemented in a one-size-fits-all approach, considering that all users react the same way for the gamification elements. The purpose of this work is to explore some characteristics that influence the gamification success and could be considered to adapt the use of these elements in an adaptive educational hypermedia system. Some influencing characteristics found were player type, age, gender, motivation, personality and culture. Based on these findings, we present a conceptual model for the gamification of educational environments. This is the first step to an approach to adapt the gamification elements in an adaptive educational hypermedia named AdaptWeb®.**

Index Terms —**Adaptation, Adaptive Educational Hypermedia System, Conceptual Model, Gamification, Users' Characteristics.**

I. Introduction

THE use of game elements and game design in non-game contexts (i.e., gamification) is increasing each day more by the motivation it provides to achieve an specific goal [1]. These non-game contexts include shopping (e.g., eBay gives badges to the best sellers), hanging out (e.g., Swarm levels up the users who share their experiences about places), working out (e.g., Nike+ gives points for each workout the user does), recycling (e.g., RecycleBank gives points to users who recycle and use less resources like water, electricity and fuel) and learning (e.g., Duolingo rewards users while they learn a new language) [2]. But, despite being widely used, gamification has been applied using the traditional one-size-fits-all approach and ignores that users' characteristics can influence their behavior within the system and, consequently, in gamification success.

Based on it, the purpose of this work is to expose some users' characteristics that influence the success of gamification elements and to present a conceptual model to gamify educational environments considering why gamification would be important (what are the wanted behaviors?), who would be influenced (what are the students' characteristics?), how this influence would be (what are the most recommended gamification elements?) and what must be changed (what implementation requires?). To achieve this goal, section 2 provides a conceptual foundation about gamification and adaptive hypermedia systems. Section 3 exposes the related works, describing some characteristics that influence users' behavior in the system. Section 4 describes the conceptual model for the gamification of educational environments. Section 5 concludes with final remarks obtained with this work and our future work.

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II. Conceptual Foundation

A. Gamification

Gamification can mean different things to different people because it brings together all the disparate threads that have been advanced in games for non-gaming contexts [3]. Generically, it can be defined as the process of game-thinking and game mechanics to engage users and solve problems [3]. In the educational context, gamification is "a careful and considered application of game thinking to solve problems and encouraging learning using all the elements of games that are appropriate" [4].

Currently the term "gamification" has become equal to the concept of rewards [5]. To promote this reward, gamification uses a series of elements that, when correctly applied, promises a meaningful response from the players [3]. These elements can be divided into three categories: i) Dynamics: big-picture aspects considered but which can never directly be applied to the game; ii) Mechanics: basic process to drive action forward and generate player engagement and; iii) Components: specific instantiations of mechanics and dynamics [6]. Some of the most used gamification elements are described below.

Challenges, customization, feedback, cooperation and competition are examples of Dynamics. *Challenges* are tasks that

require effort to be solved [6] and they direct players for what must be done in the system (i.e., the goal to be achieved) [3]. *Customization* allows the user to change the environment and even a simple player headshot or screen name provides an opportunity to customize [3]. *Feedback* consists of returning information to keep players motivated and they are generally seen in the interplay between points and levels [3]. *Cooperation* and *Competition* put players in touch with others, requiring them to work together to achieve a shared goal or competing against others [6].

Constraints, narrative and progression are examples of Mechanics. *Constraints* impose characteristics (hard limitations or forced trade-offs), defining what actions players can and cannot do [7]. *Narrative* brings a consistent or ongoing storyline to interconnect the gamification elements used [6]. *Progression* demonstrates the player's growth and development in the system over time [6].

Badges, leaderboards, levels, points and virtual goods are examples of Components. *Badges* reward users after the completion of goals and can be used to measure progress [3]. *Leaderboards* give meaning to other components (e.g., points and levels) by putting them in a context (how the player is when compared with others) [7]. *Levels* structure the tasks users must complete to finish the level, usually giving the sense of progression [8]. *Points* are a numerical representation of the user progression [6] and they can be divided into *Experience Points* (reward for everything the player does), *Redeemable Points* (used in exchange for things), *Skill Points* (assigned to specific activities), *Karma Points* (that a player can give to another player) and *Reputation Points* (used to indicate trust between players) [3]. *Virtual Goods* are a component with perceived or real-money value [6], generally used for customization or as a reward of a challenge and possibly encouraging cooperation.

B. Adaptive Hypermedia Systems

Adaptive Hypermedia Systems (AHS) are hypertext or hypermedia systems that store data of the user's profile in a model to be used throughout the interaction in order to adapt the system according to the needs of a particular user [9]. AHS are an alternative to the traditional one-size-fits-all approach, where all users receive the same contents and materials, and access the same set of links [10].

The user model stores data from various sources: by observing the user interaction (implicitly) or by requesting data through a form to be filled out manually by the user (explicitly) [11]. The amount and type of information stored in depends on the type of adaptation of the AHS. Some examples of information are goals, tasks, knowledge about the subject or about the hyperspace structure, background, point of view and perspective and preferences [9].

Through the user model, the AHS can adapt the presentation or the navigation. The presentation of content is based on the user and the context of the human-computer interaction to organize and present the information to users [12]. This adaptation can be done in the content level (which defines the most relevant contents to the current user and how to structure these contents before presenting them to the user) or in the presentation level (which defines how to adapt the presentation of content selected more efficiently to the user) [12]. To adapt the navigation, the AHS can use various elements to suggest the best path to continue the navigation, to prioritizing certain links or even to hide, remove or disabling irrelevant links [13].

AdaptWeb® (Adaptive Web-based Learning environment) is an open source and web-based adaptive system for distance education that adapts contents, presentation and navigation [14]. To do so, it stores information about course, knowledge, navigational preferences and history of each student. The AdaptWeb® architecture is based on four modules: authoring, storage, content adaptation and adaptive interface. The authoring module involves structuring and organizing of instructional content in an authoring tool. The storage module receives the authoring module structure and stores data in an XML file that will serve as the basis for generation of the files that are used in the other two modules. The content adaptation and the adaptive interface modules work in an integrated way, adapting the content and the menu through the XML generated in the storage module based on the user model [15].

III. Related Work

In this section, it is discussed some studies and experiments that reported the influence of the users' characteristics on the success of gamification elements used.

Some of them indicate that **player type** is one of these characteristics. The work of Barata *et al.* [16], for instance, classified the students of a engineering course by their performance and gaming preferences: i) *Achievers*, students who do their best to earn points and are benefited by most gamification elements; ii) *Regular Students*, students who are motivated by challenges and achievements; iii) *Students halfhearted*, students motivated only by challenges and; iv) *Underachievers*, students who are not motivated by the gamification elements and do just enough to pass.

Another work about player type, applied in general context, makes a correlation between five personality types and traits and eight player types. As a result, Ferro *et al.* [17] proposed a classification unifying all personality traits and player types analyzed into 5 types: i) *Dominant*, users with a strong need to be visible and usually confident, egotistical and self-driven (motivated by badges and leaderboards); ii) *Objectivist*, users who seeks to achieve and build upon their knowledge through demonstrating their dexterity and intelligence (motivated by levels and progression); iii) *Humanists*, users more inclined to be social and involve themselves in tasks that rely on social engagement (motivated by customization and narrative); iv) Inquisitive, users who like to explore and investigate new things (motivated by challenges and narrative) and; v) Creative individuals like to create and develop things through utilizing skills that they obtain through experimentation (motivated by challenges and customization).

Besides the player type, the **age** of the user may interfere in the gamification process. For instance, the work of Atalli *et al.* [18] evaluated the effect of points on the students' performance in an assessment about basic mathematics concepts. To do this, they conducted two studies. The first one (with adults) found no effect of the point manipulation on accuracy of responses, although the speed of responses increased [18]. The second one (with 6 e 8 grade middle school students) found the same results for accuracy and speed [18]. But, in the second study, the students' reactions revealed higher likeability ratings for the test using points [18]. This indicates that teens can be more engaged than adults when using a gamified system.

There are also studies evaluating the influence of the **gender** of the users in gamified educational systems. One of them is the work of Christy *et al.* [19] which used leaderboards to assess the engagement of female students in a math class, separating the students into two groups: the first group visualized a leaderboard with a predominance of male names and the second group visualized a leaderboard with the predominance of female names [19]. In this experiment, the first group had higher scores on knowledge tests than second group, but also, the second group had a better academic identification (which involves academic preferences such as liking or not going to class) according to a questionnaire [19]. Su *et al.* [20] performed an experiment with three classes of fourth grade students that were studying the fundamental knowledge of insects in a natural science course. When using the gamified system, male students have higher learning performances than female students [20].

The **motivation** of the users may also influence on the gamification process, as explained by Hakulinen *et al.* [21]. They analyzed students based on the "achievement goal orientation", which is a psychological conceptualization that characterizes students' preferences to different goals and outcomes [21]. Typically, goals are classified into mastery goals (to master a task) and performance (to show competence in relation to the others) [21]. These goals can be further divided into intrinsic mastery (learning new skills), extrinsic mastery (succeed in school), approach valence (being better than the other students) and avoidance valence (avoid situations where mistakes may occur) [21]. They are not mutually exclusive but each individual has a mixture of goals with varying intensities [21]. Their work states that the users' motivation can interfere with gamification process, because students motivated by intrinsic mastery, extrinsic mastery and approach valence tend to be more engaged by the badges than the students motivated by avoidance valence [21].

The **personality** is another characteristic being studied in the gamification process. Codish *et al.* [22] made an experiment with an undergraduate information systems course to examine the students' perception of playfulness. Students completed a five-factor personality test and answered questions about their gaming preference. Their analysis concluded a higher preference level for badges by introverts and higher preference for progression by extrovert personalities [22].

When talking about feedback, the **culture** may also be considered. One study applied in general context conducted by Almalik et al. [22] identified some key differences between Western (United Kingdom, Netherlands and Spain) and Middle Eastern (Saudi Arabia, Iran and Egypt) users on what motivated them to provide feedback and what could have an influence on the feedback they gave. They found that Middle Eastern users consider feedback more important than Western users and there are some gamification elements that motivate more Middle Eastern users (e.g., badges and customization) than Western users [23].

All exposed related works are studies that evaluated the reaction of the users over the gamification elements and all of them used the same gamification elements for all users. Our proposal is to use an adaptive educational hypermedia system to adapt the gamification elements based on these characteristics. It is important to identify who the users are and what are their preferences to make possible to add the most recommended gamification elements to each user [24].

IV. Towards to Adaptation Of Gamification

As described in the previous section, the users' characteristics may influence the gamification process. Based on this, we believe there are gamification elements more suitable and motivational for each user/student and that it is possible to adapt them to promote a user-centered experience. This adaptation can further motivate the students instead of possibly demotivate if the "wrong" elements were applied.

AdaptWeb® has different gamification elements based on our gamification conceptual model [25]. This conceptual model proposes that, to gamify a virtual learning environment, it must be known these four dimensions: i) ***Why?***: defines what behaviors to be stimulated in students and it has three facets – create new habits (e.g., access the system, good performance), engage in activities (e.g., create and answer exercises, forum participation, use of communication tools) and content access (e.g., studying the concepts, examples, exercises, complementary material and links); ii) ***Who?***: defines who the students are and prepares the environment to have the game elements they enjoy most. It is related to student's identification (by surveys, interviews, observations, personas, focus group, interaction in the environment, etc.), and profile (e.g., player type, age, gender, motivation, personality, culture); iii) ***How?***: defines how stimulate these behaviors (i.e., why) on each specific student (i.e., who), based on the desired type of motivation (e.g., positive and negative stimulus, intrinsic and extrinsic motivation, short or long term) and how to convert them into gamification dynamics that can be achieved through some mechanics and components; iv) ***What?***: defines what must be changed to gamify the environment, such as data and architecture. Some prototypes can be made to define these changes and they can also be tested using HCI methods like usability testing, heuristic evaluation, surveys, etc. The results would guide the implementation and the improvement of the proposed gamification.

The conceptual model is shown in Fig. 1. These dimensions are related to each other in an iterative cycle towards an adaptive gamification.

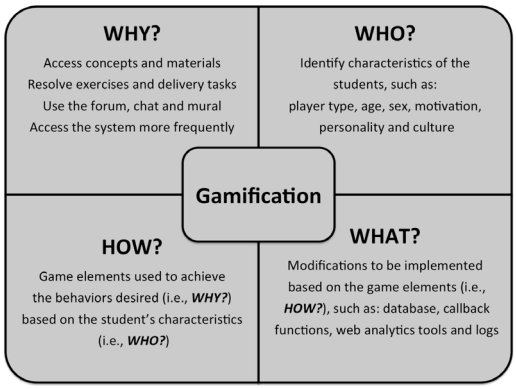

Figure 1. Conceptual Model

As it is a work in progress, some other dimensions are being considered. For instance, "**How much?**" would evaluate how much gamification really works (in a quantitative and/or qualitative way, by designing experiments with actual students). A protocol of evaluation must be established to ensure the same conditions to all students (e.g., control group versus students engaged in the gamification process).

V. Conclusion

Gamification is being each day more present in our everyday life, but the motivation factor is considered during its application. This study exposes some characteristics of the users (such as player type, age, gender, motivation, personality and culture) influence in the success of gamification. Based on the related works, this paper proposes a conceptual model to gamify educational environments, considering different student´s characteristics as potential features to adapt gamification elements to each student. This is the first step to an approach to adapt the gamification elements in an adaptive educational hypermedia system named AdaptWeb®. As future work, we will improve the proposed conceptual model and conduct some experiments with actual users to demonstrate if the characteristics analyzed really influence in the experience of the user.

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