Toward Personalised Gamification for Learning Environments

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Abstract. Many learning environments are deserted by the learners, even if they are effective. Gamification is a growing approach used to raise learners' motivation by adding game elements in their environment, but it still pays few attention to the individual differences among learners' motivations. This paper presents a gamification system designed to be plugged on various learning environments. It can be automatically personalised, based on an analysis of the interaction traces.

Keywords: gamification, learning environment, personalisation.

1 Introduction

Many learning environments have been shown to be effective when used, but are quickly deserted by learners. This paper aims to propose a way to raise motivation in learning contexts that are not intrinsically motivating, by using a gamification system. The difficulty comes from the fact that people do not have the same expectations about games, and do not have the same emotional responses to a given stimulus. That is why we aim at developing a motivational system that can be automatically personalised.

2 State of the Art: User Models in Game Based Learning

2.1 Gamification or Serious Game

Two approaches are used to add fun in game based learning activities: learning games, and more recently gamification. Learning games refers to the use of digital games for learning purposes [1]. Gamification is "the use of game design elements in non-gaming contexts" [2]. These two approaches are often poorly distinguished one from the other. However, they differ by their design process and by the resulting application (Table 1).

In this work, we focus on gamification because, firstly, it can be based on existing environments. Secondly with gamification, the game elements seem not to be central but peripheral, which fosters a generic implementation of the game. This view is a first step toward a "fun layer" that could be plugged on several applications.

adfa, p. 1, 2011.

Table 1. Differences between a learning game and a gamified application.

	Learning game	Gamified application
Design process	The application is designed like a game from the beginning	Gaming elements are added to an existing application.
Resulting application	A game which offers activities for the user to acquire knowledge and skills.	A learning application enriched by game mechanics to motivate the learner.

2.2 A User Model for a Gamified System

Some attention is paid to basic data about users, like their age and gender, as it as an influence on their levels of attention and motivation [3] [4]. Researches on learner models focus on the relation between the learner and the knowledge. For example, Conati et al. [5] built a user model to assess the learner's self-explanations. In the game-based learning field, many studies have been conducted about the way people play games. Bartle [6] identified four player types: killer, achiever, socialiser, and explorer. Yee [7] identified three main motivation components: achievement, social and immersion. Lazzaro [8] observed four motivational factors for playing games: hard fun, easy fun, altered state and people factor. The user model we propose in part 3 is based on these three types of user data (basic data, learner model, and the way people play).

Kobsa et al. [9] suggest distinguishing three forms of adaptation: to user data, to usage data and to environment data. All these parameter types have to be taken into account to personalise the game elements of an environment. Whether they focus on learning features or playing features, usage data should be based on the users' traces of interactions with the environment. Bouvier et al. [10] define a typology of engaged behaviours, to determine if a player is engaged or not. Finally, some research help to understand the influence of environment data, which we can call context. For example, Cheng [11] tried to find the good moments to play at work.

3 Architecture for a Personalised Gamification

In order to personalise the fun features of the system, we need it to be able to work with or without these features. That is why we propose to use epiphytic functionalities: applications that are plugged in another application without being necessary. Giroux et al. [12] describe epiphyte systems as follow: (1) the epiphytic system cannot exist without a host, (2) the host can exist without the epiphyte, (3) the host and the epiphyte have independent existences, and (4) the epiphyte does not affect its host.

By implementing the fun functionalities that way, we can enable or disable them independently for the users, in order to personalise their interface without affecting the learning application. We provide below 3 examples of such functionalities to be activated in some cases:

- A leader board of fast learners for competitive users.
- Badges and cups for achievers.

- A chat feature for users interested in socializing.

An overview of the proposed architecture is presented in Figure 1, which shows the way the gamification system can be plugged in an existing learning environment. Epiphyte functionalities can be part of the existing learning environment, or can be brought with the gamification system. The first option fosters the creation of specific functionalities well integrated in the user activity. The advantage of the second option is the use of generic functionalities, usable by different learning environments. Both types of functionalities can be managed by a gamification engine. The role of this engine is to decide when and how to able or unable the functionalities, based on (1) the static information of the user model, (2) the dynamic information of the user model, and (3) contextual information.

1. The static part of the user model only contains the features "age", "gender", and some administrative information if necessary.
2. The dynamic part of the user model is divided into two parts: the learner model and the player model. We assume that the learner part is handled by the existing environment core that manages the learning activity. The gamification system focuses on the player part. It identifies the player's preferences, to manage motivation by gaming. These features are calculated from the interaction traces with the epiphytic functionalities. As some functionalities do not require interactions, the engine has to find a correlation between the engagement of the learner and the activation of the functionalities, to measure their effectiveness. Thus the level of engagement has to be calculated and communicated to the gamification engine.
3. In addition, some contextual information are crucial for the gamification engine. Firstly, is the learner at school, at work, or on free time? If the learners are all in the same room with a teacher to help them, a chat feature could be useless. We also can look at the device used, as some features are more relevant on mobile devices, and others on computers.

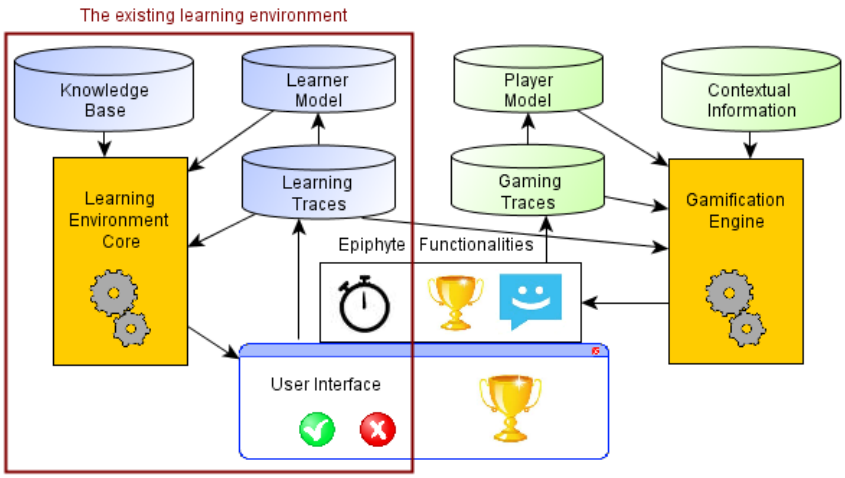

Fig. 1. Architecture of the gamification system, plugged on the learning environment

The Gamification Process is divided into three steps:

1. The interaction traces are permanently collected, and the player model is regularly updated, based on these traces. At the same time, a regular analysis of the user engagement is performed.
2. When the learner seems to be disengaging, the gamification engine starts working and selects an appropriate epiphytic functionality.
3. The selected functionality is introduced and integrated in the user activity.

4 Conclusion

In this article, we propose a system architecture to motivate learners by integrating game elements in existing learning environments. We do not aim to turn every learning activity into a game, because games need to be played voluntary and people in some contexts are already motivated to learn. This system should be used with non-intrinsically motivating activities, like memorizing vocabulary or mathematical rules.

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