Validating Gamification Mechanics and Player Types in an E-learning Environment

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Abstract. We present a preliminary user study in an e-learning environment aimed to adapt and validate generic mechanics and player types proposed in the gamification literature. We incorporate well-known gamification mechanics into a number learning activities, implemented them as functionalities of an e-learning system, and investigate the learning effectiveness of the proposed mechanics, as well as the relations between the mechanics and their assumed player types.

Keywords: E-learning · Gamification · Learning style · Motivation · Engagement

1 Introduction

Gamification is defined as the application of game-design elements to non-game contexts with the intention of modifying behaviours, increasing fidelity or motivating and engaging people [3], by leveraging human motivations present in games, e.g. competition, rewards and socializing. In the literature, these motivations have been identified and associated to the so called types of players [1, 6]. Specifically, four main player types may be considered: *achievers*, who are motivated by mastery and rewards, *explorers* or *free spirits*, who are motivated by autonomy and self-expression, *socializers*, who are motivated by social relatedness and status, and *philanthropists*, who are motivated by altruism and care-taking. For each of these player types, particular gamification mechanics have been proposed to support the corresponding motivations [5]. Hence, for example, mechanics that may suit an achiever's motivations are the achievement of certain challenges and levels, and the gain of points and badges.

Although gamification has already been applied successfully in a large number of cases [7], to the best of our knowledge, it still pending the study on how to effectively acquire the users' motivations and player types, and how to select the appropriate gamification mechanics, and translate them into tasks and actions for a given application or domain [2, 8]. As in [4], we focus on Higher Education, and start addressing the above issues through a preliminary user study aimed to validate existing gamification mechanics and player types, addressing the following research questions:

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- **RQ1**: Which gamification mechanics are effective in e-learning, and how can they be implemented by means of generic learning activities?
- **RQ2**: Do the considered gamification mechanics really correspond to the students' inferred types of player?

2 Gamification-Based E-Learning Framework

In the classroom and during several lectures, students were requested to solve a number of assignments related to topics of a subject, working in different ways (alone, in pairs, or in teams) and performing various actions, which were related to certain gamification mechanics and player types. All the actions were supported and recorded by an e-learning system, accessible via web though the students' mobile phones. As shown in

Table 1. Considered student actions, gamification mechanics, and assumed player types.

Student action		Mechanic	Player type
A1	Choosing to work alone for solving the assignments	Challenge	Achiever
A2	Receiving a "victory badge" for being the first student who solved certain assignment		
A3	Receiving a "quest badge" for solving certain number of assignments	Quest	
A4	Receiving a "level-X expertise badge" for solving certain number of assignments with difficulty level X	Level /Progression	
A5	Receiving a "mastery certificate" for obtaining certain number of victory, quest and/or expertise badges	Certificate	
E1	Choosing to work alone for solving the assignments	Exploration	Explorer
E2	Receiving an "explorer badge" for asking (the teacher/system) and solving hidden assignments of high difficulty		
E3	Receiving an "adventurer badge" for asking (the teacher/system) and solving assignments out of the study topics	Unlockable /Rare Content	
E4	Receiving a "customizer badge" for proposing and solving adaptations or modifications of an assignment	Customization	
E5	Receiving a "creator badge" for proposing and solving new assignments	Creativity	
S1	Choosing to work in a team for solving the assignments	Team /Guild	Socializer
S2	Receiving points for the competition ranking by solving assignments	Competition	
S3	Receiving a "colleague badge" (from a member of my team) for being very participative and cooperative	Social status	
S4	Creating a "twinning link" with a student I enjoyed working with	Social networking	
S5	Giving a "gentleman badge" to a student to whom I asked for help on solving an assignment	Social discovery	
P1	Receiving a "gentleman badge" from a student I helped on solving an assignment	Meaning /Purpose	Philanthropist
P2	Helping a student to solve an assignment	Care taking	
P3	Presenting an assignment solution on the blackboard	Sharing knowledge	
P4	Ask (the teacher/system) for an assignment solution	Access	
P5	Interchanging a "ring" with other student	Collecting & Trading	
P6	Giving one of my rings to a student	Gifting	

Table 1, a total of 21 actions were considered, which were specific implementations of existing gamification mechanics [5] for our particular learning scenario. At the beginning of the study and each lecture, the students were presented with the description of the different activities, and they were allowed to freely choose and perform (record) any of them during the study.

3 User Study

The study was conducted in a subject belonging to the 1st-year course of Computer Science studies, which is an introduction to Abstract Data Types and the C programming language. It was done within the classroom and took five 1-hour lectures in which students were presented with a large number of assignments of different (marked) difficulty degrees, and were asked to freely choose and solve any of them. They were also requested to freely perform and record actions (Table 1) available in the system. A total of 40 students participated in the study. A week before the starting of the study, they filled a questionnaire [6] with which their assumed player types were inferred. From their responses, 31.1 % of the students were assigned to *achiever* as their main player type, 15.6 % to *explorer*, 22.2 % to *socializer*, and the remaining 31.1 % to *philanthropist*.

3.1 Effectiveness of Actions and Gamification Mechanics

To obtain initial insights about which of the tested actions and mechanics are more effective (RQ1), we briefly present here two sets of analysis results. First, after the study, the students evaluated several issues about the system and the activity. They stated that, with respect a "typical" assignment solving lecture: they felt to learn more (73.7 %) or the same (26.3 %); they had more (80.0 %), much more (10.5 %), or the same (9.5 %) fun; and would like to have similar activities in the future (84.2 %) or not (15.8 %). Most of them found the system easy or very easy to use (89.5 %), but a significant percentage felt *a bit* stressed (52.6 %), mostly explorers and achievers, who worked alone. This may be due to the fact that the study took place in 1-hour lectures.

Second, we checked the number of times each action was recorded. Most of the used actions were related to the achievement of goals and progression–challenge and certificate–, collaborative work–team and social networking–, and knowledge access. This is in concordance with the students' most preferred mechanics, namely teams (57.9 %), levels (52.6 %), challenges (47.4 %) and quests (36.8 %).

3.2 Relations Between Actions, Gamification Mechanics, and Player Types

To preliminary validate if the freely chosen actions and gamification mechanics really corresponded to the students' inferred player types (RQ2), in Fig. 1 we show the number of students who performed each action, grouped by the main player types assigned to them. Each of the questions had a manually set weight representing the relevance of the question to derive a user's player type. The figure shows the curves of inferred player types applying (a) and not applying (b) such weights. We observe that the students'

actions and mechanics relate quite well with the corresponding player types, except for the *explorer* case. The students neither wanted to spend time accessing to assignments of other topics (E3), nor modifying the given assignments (E4) or creating new ones (E5). Exploration (E2), which was implemented as solving hidden assignments of high difficulty, was conducted by *achievers*, who were motivated to achieve challenges (A1, A2), quests (A3) and certificates (A5) for solving as many (difficult) assignments as possible. *Socializers* decided to use all their assumed mechanics except competition (S2) and social discovery (S5), which did not receive too much interest in the activity. Finally, *philanthropists* not only performed their assumed mechanics (P1-P4 especially), but also decided to work in teams (S1).

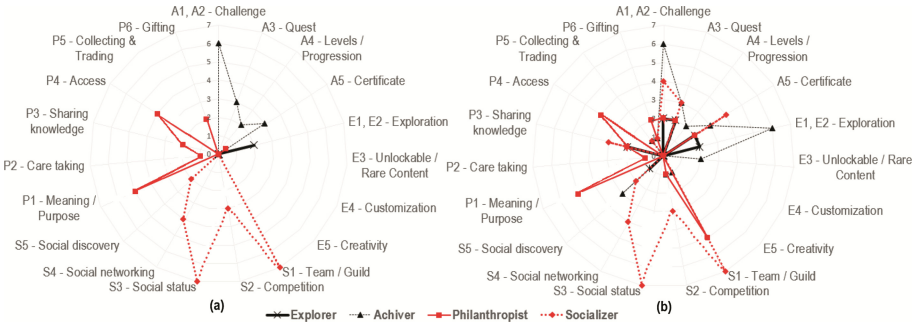

Fig. 1. Number of students who performed each action, grouped by their inferred player types.

4 Conclusions and Future Work

In this paper we have preliminary validated gamification mechanics and player types in education. We have shown that, in an e-learning environment, students freely performed learning actions that really corresponded to inferred *achiever*, *socializer* and *philanthropist* player types, but did not fit with the *explorer* player type. The study has allowed us to identify certain gamification mechanics that are more relevant in terms of their use and student assessments, namely *collaborative-* and *challenge-based mechanics*. Nonetheless, a more rigorous and exhaustive experimentation and analysis is needed to prove the above claims, and work is required to understand and exploit the relationships between the player types with well-known learning styles and personality types.

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