

Ace That Game: Educating Students to Gamified Design Thinking

Experience Report

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Abstract. Undergraduate information system (IS) and software engineering (SE) students are required to plan and deliver a project in their last year of study. These projects are intended to enhance business processes in firms, but often are not in use later on. One reason that can explain this is the fact the employees in the firm do not want to use the system created by the students, due to various reasons. In recent years, several persuasive technologies, and in particular gamification, were offered to enhance employees' motivation for using new tools. This paper presents a teaching of gamification workshop, where undergraduate students were presented with gamification mechanisms, and were asked to embed them in their design of final project. The results were interesting, and can contribute to the design of projects in information systems and software engineering.

Keywords: Gamification, collaboration, education

1 Introduction

As an integral part of information systems degree curricula, software engineering and information systems students are required to design and implement a final project. The project is developed for a firm, chosen by the students. Its main goal to enhance business processes in that firm. These projects often include the writing of requirement documents, implementing a prototype, and several iterations of development, according to the development methodology used. Students often use predefined templates for designing the product and its requirements. However, though much effort is invested in various project tasks [6], there is no guarantee that the product will be used by the firm.

Any software system that has extensive interaction with human beings becomes part of a bigger socio-technical system. Not all software engineers are aware of this fact, which results in software systems poorly adapted to be part of a socio-technical system. The use of the product depends on human factors such as how the employees of the firm are motivated to contribute to innovation in the firm, perceive the product

and its contribution to their business processes, and their perception of their role in the firm [16]. The success of software development processes and their enhancement have been vastly researched in recent years. Software engineers increasingly rely on professional social networks in their organizations in order to complete their tasks [4]; methods of gamification are being developed and used in order to evaluate team and individual performance [ibid]; many metrics have been proposed to monitor software development projects success [12,14]. However, the human factors affecting users' motivation to use the software product, require additional attention. Persuasive technologies, in particular Gamification, has been acknowledged as affecting employees' motivation and behavior. Gamification is defined as "the integration of Game Mechanics in non-game environments to increase audience engagement, loyalty and fun" [4, p.2], and has been found to encourage users participation and contribution in computer-supported applications. In recent years various gamification elements have been embedded in different information systems and applications in general and in applications intended for software engineers in particular.

This paper proposes a new direction for enhancing software engineering via gamification. IS students who are in the stage of designing their final projects, participated a three-hours workshops, where they learned about gamification principles, and the use of gamification mechanisms to enhance motivation among users of software products. Students worked in teams, designing an outline for embedding gamification mechanisms in their final projects' business processes. Each group presented their outline to other students in class, justifying the need for gamification. Each student was asked to share thoughts on each presentation, using an online form. Finally, each student was asked to express their opinion about embedding gamification in software products.

The next section presents the background for the gamification workshop. Section 3 details the workshop outline and principles. Section 4 presents students' perceptions toward gamification in general, and in which business processes they believe they can use gamification. Section 5 concludes and presents lesson learned.

2 Scientific Background

2.1 Gamification

Coined by Nick Pelling in 2002 [7] the term "gamification" is used in order to describe how any task can be performed as a game. In recent years, research has been conducted with regard to gamification, its mechanisms, and their use. Gamification includes several elements, including levels, points, badges, social recognition, and leaderboard [4]. While the early use of gamification was intended for games and application for users, research from the last few years has been targeted on using gamification mechanisms for changing behaviors of specific populations. In the context of software engineering, several attempts to use gamification techniques in software projects were conducted. Sheth et al. [8] gamified a number of software engineering activities in educational settings in order to engage software engineering students in development, documentation, bug reporting, and test coverage using social rewards. The students who used the system showed statistically significant improvement in their work results [1].

The system helped the students to be exposed to the complete lifecycle of software development, and encouraged students to choose software engineering as a major in their studies. Another effort to gamify software development in educational settings was done in the context of early stages of software development, successfully integrating gamification elements into requirement elicitation [15]. This study identified three types of activities needed to be performed when integrating gamification into software engineering: analysis, integration, and evaluation and found that students performing these activities produced better outcomes.

2.2 Motivation Theories

Several cognitive theories address the topic of encouraging motivation for work tasks. Here we briefly present three of the most influential theories in this field.

The Self Determination Theory (SDT) [8] presents a continuum of motivation types, from intrinsic motivation that emerges from the employee, to extrinsic motivation created by rules and regulation in the workplace. Although intrinsic motivation is considered to be linked to positive human behavior, SDT suggests that proper use in extrinsic motivation can lead to motivated behavior. According to the Theory of Flow [3] there are five elements of reaching to a state where the individual is immersed into the performed task (some of which can be extrinsically induced): Clarity, Centering, Choice, Commitment, Challenge. Sawyer [9] extended these elements to the context of group flow, to contain, among others, the following characteristics: A compelling, shared goal, a sense of being in control, blending egos, equal participation, familiarity, constant and spontaneous communication, and the potential for failure. We relied on these characteristics when designing our solution, creating an environment that would encourage group flow. The proposed solution is described in the next section.

2.3 Gamification and Motivation Theories

Using gamification is strongly linked to enhancing motivation of the users to particular behavior [11, 14]. However, as gamification is being incorporated into business processes, there is no distinction between using proper gamification elements for each particular business goal, and adjusting the gamified solution to business' needs.

Thus far, gamification for software engineering has focused on education and student training, using gamification principles borrowed from the domain of applications and website usage. To the best of our knowledge, there is no research in this context relying on cognitive theories in order to design games for software engineers, or developing gamified environments in industry, on the basis of cognitive principles, in order to motivate practitioners to enhance work performance.

3 The Gamification Workshop

This section describes the gamification workshop I designed and lectured, intended for last year SE students, in the midst of their work on the final project. The workshop is three hours long, where I first explain about gamification in general, and also about motivation theories and then give them a task - to think of any process they know, and to gamify it.

The workshop consists of three parts, each of them that was 50 minutes long, which can be described by the acronym ACE:

Audit gamification principles and examples – a presentation, presenting the principles of gamification, the frequent use of game elements in various domains in last years, and some guidelines to designing a business process using gamification-oriented thinking. The lecture also included an analysis of gamification principles, based on cognitive theories [10]. Students were asked to think of gamification examples from their personal experience. Then we had a discussion about how gamification can be used in various aspects of daily routines.

Collaborative design of gamified processes – students worked in the teams, same work teams as their final projects. Their task was to design a gamification framework for one business process from their projects. They were free to choose any process they wanted, as long as they can justify the choice and to explain why gamification can contribute to the process. They were instructed to address the gamification design framework [11]: The goals of the game, the identity of the players, success metrics, activity loops, and "fun" elements.

Embed gamification in the business process – as this part of the workshop, students created an outline for embedding gamification in the business process. The outline included references to all gamification mechanisms which students plan to embed in the process, and also a preliminary sketch of the gamified process. In some cases, students created full screens of their application, containing gamification mechanisms. Each group presented their work to the entire class. The other students evaluated the proposed solution using questionnaires.

Figure 1. The ACE model for the gamification workshop



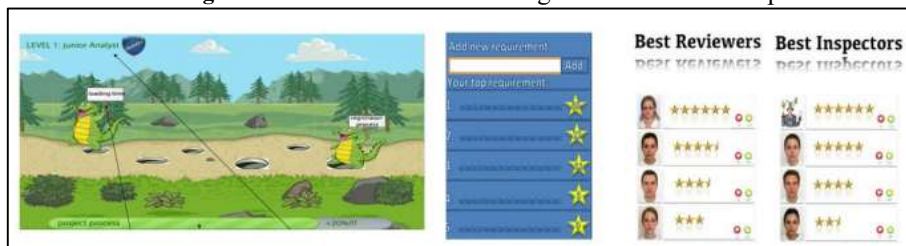
To conclude, the workshop presented the topic of gamification to SE students, and provided them with a hands-on task to embed gamification in their projects. The next section describes students' reflections on this experience, and their perceptions towards embedding gamification in SE products.

As can be seen, students chose various business processes, usually related to their projects. Some interesting ideas were presented, such as gamifying couples therapy

process (by granting points to each of the participants for following the therapist' advice), or improving quality of service in an airline company. Students suggested SE related games as well, such as a programming contest where the prize is a job interview in a high-tech company.

In some cases, several groups chose to focus on the same topic. Figure 2 presents three different examples of proposed gamification mechanisms for requirement engineering (RE) process. One group focused on leaderboards, the other on grading new requirements, and the third group created an animation game where progress is made when requirements are properly classified.

Figure 2. The ACE model for the gamification workshop



To conclude, students perceived the use of gamification as a motivation enhancer, and proposed many interesting and novel ways to embed gamification in various business processes. Some students chose to focus more on the appearance of the game, while others focused on the embedding various gamification elements they have just learned in the workshop.

4 Students perceptions toward gamification

The workshop was held five times, where the audience consisted of last year information systems and software engineering undergraduates. Each group consisted of 15-30 students. At the end of the workshop, students were asked to review the other teams' solutions, and to express their opinion about using gamification.

The students wrote mostly positive comments on the other teams' gamified processes. The students were also asked to give a likert-scale grade to their peers, concerning issues such as was the game appealing or fun. Most scores were very high, probably due to social desirability [12].

Table 1 describes several quotes of the students reviewing their peers' work, categorized by elements from the motivation theories described in section 2.2. It can be seen that the students addressed in their reviews the aspects of motivation, competence, fun and collaboration. All of these issues were discussed during the first phase of the workshop, while presenting them the motivation theories.

Table 1. The gamified processes from the reviewers' perspective

Quote	SDT	Flow theory	Group flow theory
<i>"Increases interest, and motivation"</i>	✓		
<i>" That is challenging "</i>	✓	✓	
<i>" The game is fun to play with"</i>		✓	
<i>" Motivates employees to play the game"</i>	✓		
<i>"Collaboration among employees, convenient tools"</i>	✓		✓
<i>"Easy"</i>	✓	✓	

It should be noted, that students also wrote less positive reviews of the other teams' work. Comments such as "no user stimulation", or "it seems banal" suggest that some students expected their peers to create fun and creative games, and were disappointed where they encountered games which did not match their expectations. Another interesting critique was "it feels like a competition and not a game", which suggests that for some students, the games developed seemed highly competitive and would probably decrease their motivation to participate.

In addition, the students were asked to express their opinions of the gamification workshop. All students who answered the questions, said that this was a good experience, and that they learned that gamification elements can indeed be beneficial in increasing employee motivation. In their comments, they often addressed the issues which were discussed in the first part of the workshop.

Table 2 describes several quotes of the students regarding the workshop, categorized by elements from the motivation theories described in section 2.2.

As can be seen, students mostly addressed the issue of employee' motivation, and how gamification can increase motivation of the individual employee, and the collaboration among employees.

Table 2. The gamification task from the student' perspective

Quote	SDT	Flow theory	Group flow theory
<i>" Inspires good atmosphere in the organization "</i>	✓		✓
<i>" Contributing to collaboration "</i>			✓
<i>" More people are involved in organizational activities "</i>	✓		✓
<i>" Encourages contest over promotions "</i>	✓		
<i>"Prizes encourage motivation"</i>			✓
<i>"Encourages 'employess of the month'"</i>	✓		
<i>" Everyone can participate and suggest ideas"</i>	✓		

<i>" Encourages creativity"</i>		✓	✓
<i>" The scoring system encourages participation and motivation"</i>	✓	✓	

5 Conclusions and lessons learned

The paper concerns education of the new generation of software engineers who are aware of socio-technical nature of the bigger system. In particular, this is done via teaching them gamification techniques. The paper reports on the experience of introducing such teaching into the bachelor program for software engineers.

Gamification is one of the approaches to make a software system more suitable to be part of a socio-technical system. Thus far, although gamification has been quite thoroughly researched among users, only a few examples of gamification research are intended for software developers. Moreover, gamification principles are not presented to students as a mechanism to enhance motivation among potential users. This paper presented a workshop intended for last year undergraduate students, in order to introduce them gamification principles and mechanisms, and to encourage them to use these mechanisms in their final project design, and later on in industry. As the aim is to contribute to the software engineering industry, further elicitation of information is needed, according to the principles of field study in education [2].

This paper presented the gamification workshop which was developed to present third year IS and SE students with gamification elements, and their contribution to employee motivation. The goal of the workshop was to introduce to the students the possibility of gamifying some or all of the business processes they need to implement in their final project. Judging by the responses of the students to the workshop, it appears that the students indeed understood the potential contribution of gamification.

Further study should be performed on how gamification was indeed embedded in final projects, and how employees responded to gamification. The results of such study could help organizations in increasing software developers' motivation to complete their tasks successfully and efficiently.

6 References

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