What is going on in agile gamification?

Extended Abstract

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ABSTRACT

The potential of gamification is based on the hypothesis that it improves user engagement, motivation, and performance. Gamification has already been used in software development with promising results. Our aim is to get a snapshot of the state of the practice of gamification and agile software development, and to discover what evidence there is about the benefits of this integration. A literature review revealed that current research in the field is at the very early stages, and there are very few studies, some of which do not provide empirical evidence of the impact of gamification on the agile process. Therefore, results will always be inconclusive. However, we found that the impact of gamification on agile team performance is perceived to be positive. Examples of other interesting issues that have arisen are that user stories are the most gamified agile practice or that the most frequently adopted gamification elements are points and badges.

CCS CONCEPTS

• Software and its engineering~Agile software development

KEYWORDS

Gamification, agile, agile gamification.

1 INTRODUCTION

One of the maxims of agile development is “motivated individuals”, which is closely linked with agile success [1]. However, agile team motivation is not straightforward [2].

Since 2010, gamification has emerged as a powerful technique for influencing human behavior. It is thought to be motivational and has the potential to increase user engagement [3]. Gamification is based on the use of game elements in non-game contexts [4]. Initially emerging in the business and marketing sectors, gamification has also been used in software development for different purposes, like motivating developers to learn and apply new technologies, or encouraging them to adopt best practices [5].

We view the use of gamification in agile software development as a research opportunity. Agile teams sometimes have to perform tasks that they find repetitive, boring or demotivating (e.g., creating acceptance criteria, writing quality user stories, testing) [2]. We are particularly interested in understanding whether and, if so, how gamification can be effectively used to support and motivate agile practitioners. To do this, we performed a systematic mapping (SMS) to get a comprehensive overview of the field. However, as discussed later, only six primary papers were found to be relevant after applying the SMS protocol. This is consistent with the novelty of the field, but, evidently, the results of the study cannot possibly be conclusive. Nevertheless, they can provide a snapshot of what is going on in the field and insight for agile practitioners who decide to rise to the challenge of improving their agile development process using gamification at this early stage.

2 BACKGROUND

We specifically address gamification rather than other game based strategies like, game-based learning (GBL) or serious games. GBL deals with game applications that have defined learning outcomes [6]. GBL uses serious games, that is, games designed for educational purposes, hence the use of the term “serious” [7]. The key difference between gamification and serious games is that serious games refer to the design of fully-fledged games for non-recreational environments, whereas gamification refers to merely employing game design principles and elements in a particular process in order to improve user engagement and motivation.

Hamari et al. investigated the benefits of gamification and examined 24 empirical studies in different domains [3]. They found that gamification can have a positive impact motivating users to adopt a particular behavior. Nevertheless, Hamari et al. also pointed out that the lack of empirical data.

Gamification has also been applied in software engineering (SE). SE practice entails different processes that are considered repetitive and time consuming, like bug hunting or code reviews; some of these tasks are even considered to be “destructive”, and are, therefore, not very attractive. Consequently, gamification is a potentially promising strategy for enhancing developer interest and motivation [8]. Pedreira *et al.* recently published a systematic

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mapping on gamification in SE [9]. They retrieved 29 primary papers, of which the first was published in 2011. They found that software implementation is the area on which most studies focus, followed by software requirements. The authors highlighted that gamification in SE is still at a very early stage and discussed the shortage of grounded evidence on the impact of gamification in SE.

3 METHODOLOGY

We conducted a literature search according to a SMS protocol [10]. The study covers publications about gamification in agile software development from 2011 until December 2017.

Due to the expected small number of publications, our research questions (RQs) were defined to be general enough to provide a snapshot of the field:

RQ1 – How has gamification been implemented in agile?

RQ2 – What is the evidential impact of gamification on agile?

The search string was built based on two primary terms: gamification and agile. The result was *"((agile OR "extreme programming" OR scrum OR XP) AND (gamification OR gamify OR gamified OR gamifying OR gameful))"*. We ran a metadata search in December 2017, followed by backward snowballing. Table 1 shows the search results per primary source.

Table 1: Summary of search results

Database	Search Results	Database	Search Results
IEEE	15	Web of Science (Core Collection)	16
ACM	5	Web of Science (Inspec)	15
SCOPUS	61	Backward Snowballing	8
Total retrieved	**129**	**Totals after inclusion/exclusion crit.**	**19**
Total without duplicates	**63**	**Primary papers**	**6**

The selection of primary studies was done through two screening rounds: titles and abstracts were read to measure relevance, and the full-text was read to make a decision on inclusion or exclusion (this step also involved applying backward snowballing). Notice that many papers that include in the title the word "gamification or gamifying" do refer to other gamming practices like GBL or serious games, instead of gamification as defined by [4]. As a result, six papers were selected as primary studies (see Appendix).

4 RESULTS

4.1 RQ1 – How has gamification been implemented in the agile software process?

Table 2 summarizes the information provided by the papers related to RQ1. Scrum was the most used agile method in gamified experiences and user stories, the main target of most of these experiences. Regarding the gamification approach, half of the primary studies did not report any particular approach for gamifying the agile process. Two primary studies adopted a general gamification framework [11] to gamify user stories tasks within Scrum [P6], and Scrumban [P5], respectively. Only one primary study designed its own gamification process [P3] to gamify requirements elicitation for user stories.

Fig 1. outlines the gamification elements used. Points and badges were the most frequently used gaming components; all primary studies adopted one, or both, of these components in their gamified agile process. Points were mostly awarded to teams or individuals based on the completion and delivery of user stories or the completion of tasks associated with user stories. Although in some papers no details were provided about the tools used to implement gamification [P1, P5], we identified two possibilities: a gamification plug-in or extension to an existing non-gamified tool [P3, P4, P6]; or a new gamified tool [P2].

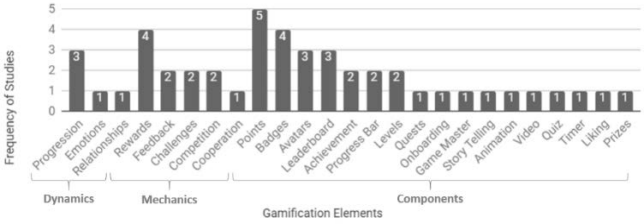

Fig 1: Distribution of primary studies by gamification element.

3.3 RQ2 – What is the evidential impact of gamification on the agile software process?

Table 3 summarizes the information about RQ2. We highlight the positive, negative or non-significant impact of gamification on the different goals addressed. It also lists the research type of each paper [10]. Four of the studies performed an assessment (either validation or evaluation) of their gamification experiment. The remaining two studies merely reported a solution for gamifying agile without any type of assessment.

5 DISCUSSION AND CONCLUSION

These are very preliminary results as there is very little literature to date (the first paper on the topic appeared in 2014). However, they can provide practitioners with clues for understanding how gamification can potentially improve their agile processes at this early stage. Although only four out of six studies performed an assessment of their gamification experience, they all reported a positive improvement in some respect. [P3, P4] and [P5] report improvements in agile practitioner performance. In [P3], the authors analyzed team performance with respect to user stories creation based on three facets: productivity, quality, and creativity. They found that not only did the gamified group produce more unique user stories, but also that their quality and creativity was significantly higher.

In [P4], the authors used sprint velocity to measure the improvement in team performance, which was significant. In [P5], however, the authors provided no details about the metric used to measure team performance, although they did conduct a qualitative survey to measure the team's understanding of and satisfaction with the development process. Other positive effects reported are related to practitioner engagement [P1] and team knowledge of the agile -

Table 2: Summary of information about gamification implementation in agile.

Study ID	Gamified Agile Method/Practice	Gamification Approach	Gamification Elements Used	Supporting Tools
P1	Extreme Programming (pair programming, refactoring, and testing)	No gamification approach was followed. The authors adopted two gamification elements into the gamified experiment and provided no details about the groundwork of their approach.	Dynamics: none; mechanics: rewards, challenges; components: none	No details provided.
P2	Scrum (user stories)	No gamification approach was followed. The authors adopted seven gamification elements into the gamified experiment and provided no details about the groundwork of their approach.	Dynamics: none; mechanics: rewards; components: profile, avatar, points, progress bar, badges, leaderboard	A prototype of a gamified tool was developed. Tool name: Gamified Scrum Development Portal (web application).
P3	Agile Process (user stories & acceptance tests)	The authors designed and followed their own approach to gamify requirements elicitation in the agile process: "Gamified Requirements Engineering Model" (GREM). GREM integrated theories of gamification and engagement in the context of performance.	Dynamics: none; mechanics: challenges; components: points, badges, leaderboard, levels, activity feed, avatar, onboarding, game master, storytelling, video, facial animation, progress bar, quiz, timer, liking, prizes	Gamification platform was developed on top of Wordpress, gamification elements were embedded using Captain-Up API. User stories were captured as blog entries, and acceptance tests were expressed as comments.
P4	Scrum – distributed agile (user stories)	No gamification approach was followed. The authors adopted five gamification elements into the gamified experiment and provided no details about the groundwork of their approach.	Dynamics: progression; mechanics: rewards, competition; components: points, leaderboard	An extension was developed to the company's in-house distributed agile delivery platform: "Agile Workbench".
P5	Scrumban (user stories, cooperation & information sharing)	The authors adopted the "6D" gamification framework designed by [11].	Dynamics: progression; mechanics: rewards, feedback; components: points, badges, quests, avatars, achievements	No details provided.
P6	Scrum (tasks of user stories)	The authors adopted the "6D" gamification framework designed by [11].	Dynamics: progression, relationships, emotions; mechanics: cooperation, competition, feedback; components: points, levels, badges, gems, achievements	The proposed gamification solution was implemented as a JIRA Software add-on.

process [P5], although details about the particular metrics used are missing. We also found that points and badges were the most frequently adopted gaming elements. Some authors discuss the fact that adding a competitive element had a significant effect on the success of the gamified experiment [P1, P3], but most papers do not discuss the grounds for selecting these or other gamification elements. This scenario is related to what, in the gamification literature, is known as "pointification", namely, the sole use of points and badges [12].

User stories were found to be the most gamified practice within an agile process. However, the papers did not discuss the reason for gamifying user stories.

Finally, we can state that agile process gamification is an interesting and potentially promising area. Further experiences including empirical research are needed to generate more grounded results on the effectiveness of agile process gamification, but early results are encouraging. Additionally, some guidelines for integrating gamification into the agile process could help practitioners with this challenge. We conclude that, even though the definition of gamification is simple, its effective application in the agile process may deal with multiple variables.

Table 3: Summary of the reported impact of gamification on the agile software development process.

ID	Reported Impact of Gamification on Agile Process	Research Type
P1	**Positive**: The adoption of XP practices (pair programming, refactoring, and testing) increased participant **engagement** level.	Evaluation
P2	No impact reported.	Solution Proposal
P3	**Positive**: Productivity, quality, and creativity (i.e. overall **performance**) of user stories improved. The group that used the gamified requirements elicitation system produced a larger number of better quality and more creative user stories than the group that used the non-gamified system. Behavioral **engagement** also increased as the participants of the gamified experiment provoked more page visits. **No significant impact**: Emotional and cognitive **engagement** was measured by positive and negative affect schedule and flow short scale, respectively.	Validation
P4	**Positive**: Overall **performance** in terms of more user stories delivered within a sprint improved, sprint velocity increased in comparison with pre-gamification sprints.	Evaluation
P5	**Positive**: Software practitioner **knowledge and understanding** about the software development process (Scrumban) increased after integrating gamification into the process. The integration of Scrumban and gamification also provided an integration of **performance** improvement.	Evaluation
P6	No impact reported.	Solution Proposal

Appendix. List of Primary Papers

[P1] B. S. Akpolat and W. Slany, “Enhancing software engineering student team engagement in a high-intensity extreme programming course using gamification,” 2014 IEEE 27th Conf. Softw. Eng. Educ. Training, CSEE T 2014 - Proc., pp. 149–153, 2014.

[P2] M. Ceska, “Gamification in the SCRUM Software Development Framework,” 2016.

[P3] P. Lombriser, F. Dalpiaz, G. Lucassen, and S. Brinkkemper, “Gamified Requirements Engineering: Model and Experimentation”, Requirements Engineering: Foundation for Software Quality, 22nd Int. Working Conf., vol. 41, no. 4. 2016.

[P4] V. S. Sharma, V. Kaulgud, and P. Duraisamy, “A Gamification approach for Distributed Agile Delivery,” Proc. - Int. Conf. Softw. Eng., vol. 16-NaN-201, pp. 42–45, 2016.

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