

Inclusive Gamification: An Exploratory Study in Software Development Enterprises (SCE)

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Abstract—Gamification is the incorporation of game elements into non-game settings. Software designers increase user motivation by introducing adequately engaging elements, such as leaderboards and badges, into an existing system. In recent years, few studies have examined the risks associated with gamification inside the business systems sector, especially within software development organizations. Yet, this issue must be addressed more systematically to build gamified solutions that take individual gamification risks into account. This research introduces "Inclusive Gamification" as contextually aware gamification that highlights individual risks. The purpose of this paper is twofold: 1) to identify the gamification risk factors that could cause the emergence of risks in software development organizations; and 2) to develop a list of risks with consideration of various contextual factors, namely tasks, personality type, adopted game element, and organizational cultural aspects. 15 employees from three software development companies participated in an exploratory study in which their perspectives on the negative effects of gamification were collected. As a result, we were able to identify several risk factors and associated risks. Our findings assist software engineers throughout the design process in identifying potential threats. Thus, create gamified solutions that better situate employees at their workplaces.

Keywords—Gamification; Software Development; Contextual Factors; Unexplored game elements; Gamification Risks; Risk Factors; Personality Types

I. INTRODUCTION

Deterding et al. define gamification as the "application of game element in non-gaming context" [1] to engage users and motivate them to achieve goals [1-3]. Gamification in Enterprise Systems (ES) has been the most intriguing and successful [3, 4]. We focus on gamification in software development enterprises within their internal software development life cycle phases, activities, roles, and tasks[5-9].

Gamification has been adopted in the field of software development to address challenges related to the software engineer's motivation, performance, and engagement in their tasks [5, 10] such as bug fixing, freeing up the backlogs or writing unit testing, and documentation [6, 11, 12] but also

related to achieving organizational objectives as developing higher product quality and project performance [5, 7, 8].

Gamification works best when personalized to its users [9, 13, 14]. However, using only one personalization aspect as the user type model to determine game element preferences is insufficient [15]. Most gamified software engineering studies use PBL (point, badges, and leader boards) as game elements [5, 8], omitting a broad group of game elements and using a "one size fits all" strategy, which defeats the core aim of gamification, which is adaptability and variety. Hence, [14-16] advised tailoring gamified solutions to game elements, environment, and users to improve user acceptance and system efficiency[13]. As for enterprise systems, factors such as user type [17], culture [5, 18-21], task [5, 17, 21], role[19], goals [19], motivational elements [22, 23], and organizational context [24, 25] were utilized. In our analysis, we resort to the GLOBE model's organizational culture dimensions[26].

Several studies examined gamification risks and risk variables for enterprise gamification [21, 27] and software (engineering) development organizations [4, 5, 7, 8] in particular. In [5] challenges included decreasing autonomy, people being cheated, demotivation, and decreased creativity. Yet, there was no additional emphasis or research on these challenges. That is, the primary causes for the emergence of the risk, when and how these challenges would occur, and the personalities who have encountered these risks. Hence, a significant gap exists, namely the inability to tie gamification risks to personal and contextual characteristics. Risks and risk factors for enterprise gamification systems in general and teamwork were presented[21]. They provided a checklist for identifying and mitigating risks. The risks were classified as either ethical and well-being, performance, or productivity risks.

In our study, we investigate the negative effect of other game elements that are more applicable to be used in software development enterprise systems, as previous studies [5] have neglected to consider who is susceptible to these risks and in what contexts, i.e., it is unknown which personality factors are more prone to experience such risks. This work investigates the interaction of four diverse contextual factors: 1) game elements

with a particular emphasis on unexplored game elements 2) personality traits 3) organizational culture 4) the nature of the task, for a more tailored software development life cycle that accommodates all personality types and their motivators.

II. RESEARCH METHODOLOGY

In this research paper we introduce the term “Inclusive Gamification”. It is introduced as gamification with consideration of risk factors. This approach emphasizes equal considerations for all users in gamification design, including personalized risk identification. Four contextual factors, including game elements design, task nature, personality type, and organizational culture, are considered in the study. We followed a qualitative approach [28] due to the exploratory nature of the study, the interview approach was adopted to gather qualitative data in software engineering, providing in-depth insights from participants. Semi-structured interviews were chosen for their flexibility, allowing for core questions and exploration of relevant areas, and the opportunity to pursue ideas or responses in greater depth. In our study we strive to address two research questions: **RQ1**) what are the gamification risk factors that could cause the emergence of risks in software development organizations? And **RQ2**) what are the associated risks with consideration of various contextual factors, namely tasks, personality type, adopted game element, and organizational cultural aspects?

The study included 15 participants, consisting of 7 males and 8 females, aged between 25-34, from the USA and Egypt, with varying roles and seniority in software development companies. Participants had roles such as software engineers, software architects, project managers, product managers, quality assurance engineers, and UI/UX designers. Participants were recruited from three distinct software development companies that utilized gamified systems for managing internal processes and tasks. All three companies shared cultural values of innovation, openness, team loyalty, and cohesion, with a preference for group work and projects over individual work, indicating high collectivism. However, there were differences in cultural aspects such as power distance and uncertainty avoidance among these organizations.

Participants were recruited and interviewed individually. To ensure that we covered all the personality types prior to the interviews, we sent a personality traits quiz via email to each interviewee to answer the 44-item BFF questionnaire [29] to determine their personality type. We conducted 15 interviews, averaging 1.5 hours each, with one researcher conducting all sessions. audio recordings and transcriptions were made and saved in the following link <https://rb.gy/k81v37>. Two pilot interviews were conducted to assess study viability.

The interview transcripts were analyzed using thematic analysis[30]. The results of the interview analysis, which are depicted in figure 1, helped us understand how to reach conclusions about the key contextual themes of the investigation, which are risk factors that are personal,

organizational, task-related, performance-related, and game-element related. These are the primary causes of the rise of gamification risks in software development organizations.

III. RESULTS

Since we presented the term "Inclusive Gamification" in the previous section, we seek to identify the risks and clearly state the personal and contextual reasons behind them to extract and define how to develop inclusive gamification enterprise systems. Figure 1 addresses RQ1 and RQ2 is discussed in the rest of this section.

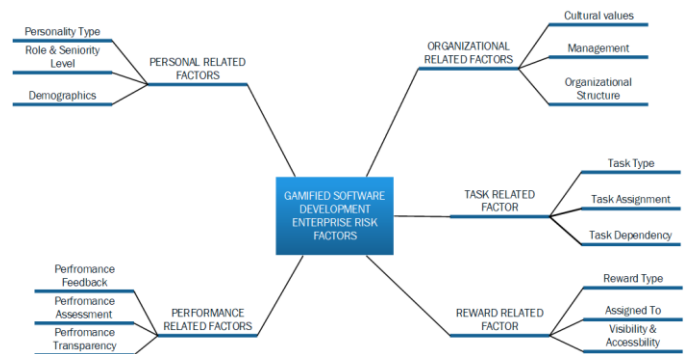


Figure 1 Thematic map for gamification risk factors in gamified software development enterprises

A. Organizational Related Risk Factors

The term organizational related factors encompass all influences on organizational behavior. Identifying and categorizing these factors is crucial in mitigating gamification risks, which may arise if organizational aspects like culture, management strategies, and structure are neglected. Participant interviews provided insights that allowed for conclusions to be drawn about organizational culture and its influential cultural dimensions, such as collectivism, power distance, and uncertainty avoidance. In a collectivism culture “*I collect as much **points and badges** as I could just to appear on my team’s **Leaderboard**. We are competitive to do more, not to compete” leading to being self-centered.*

The management style which was the manager’s style for planning, organizing, delegating the employees and how they announced and acknowledged the employees about the gamification rules and its adoption. Managers following authoritative management style in a gamified ES could lead employees to experience gamification risks such as effort-misinterpretation. “*I earn **points** on x no of commits per day and changed x number of lines of codes on source control systems and get judged on them.*”

The term organizational structure defines a strict chain of command within the organization. It describes who oversees what inside an organization and how its goals are to be met. In a flat and decentralized organization, “*Being an agile project manager and working in a gamified environment, where earning and collecting **points, badges and, Easter eggs**, is one of my getaways during work to keep me engaged and immersed into work” leading to Procrastination, Addiction, and ruining work life balance.*

B. Task Related risk Factor

The term task refers to a specific piece of work with clear parameters, and task factors encompass task type, assignment, and dependency, which are crucial aspects of an organization's workflow involving employee task allocation. Task type can be categorized as Core or Non-core, with core tasks being essential to business success including typical and innovative tasks like bug fixing, data modeling, testing, creating wireframes, and required trainings. Non-Core tasks refer to routine tasks that do not directly contribute to the company's success. Examples include fixing low priority bugs from backlog. In a typical core task, *"I shouldn't get **rewards** on my daily jobs as bug fixing. I could've solved more low priority bugs and get more rewards."* leading to infringe ethical mentality/responsibility.

Task dependency refers to the relationship where the completion of tasks must occur in a certain order. *"I sometimes overlook the quality of the outcome of the preceding task from my colleague in order to achieve my **reward**"* leading to lower task quality.

Task assignment refers to the assignment of tasks to employees either explicitly by the project manager or implicitly by the employees themselves during the sprint. The choice of the task assignment depends on the team dynamics and team members being involved in the project. Each task is assigned to one individual to hold him/ her accountable for. Some employees are prone to experience gamification risks, when they are not being explicitly assigned by the project manager to do the task. *"**Progress bar** assigned for the whole sprint is demotivating and is not accurate can lead to conflicts and problems between team members. Especially if I wasn't assigned by the project manager to do the task"* leading to Peer conflict & inaccurate achievement.

C. Performance Related risk factor

The term performance encompasses the efficiency and effectiveness of employees in carrying out assigned tasks, along with factors such as conduct, productivity, and overall value to the organization. Performance is monitored and assessed as a crucial aspect of evaluating employee performance at the workplace. Performance Feedback: refers to the feedback related factors such as feedback source, feedback comparison and the feedback timing and frequency. *"**Levels** can underestimate my work. I could be working hard and efficient, yet this could not be reflected on the system"* leading to feeling demotivated & stagnant.

Performance Assessment refers to the formal assessment used to assess the employee's performance at their workplaces and the format of the feedback being adopted at the formal assessment. Due to the automated feedback from the system *"I can easily cheat on the system and do some mechanical refactoring, renaming methods and file name with no impact at the end just to increase the commits number and increase the points I earn"* leading to cheating to the system.

Performance Transparency refers to either the employees decide to be voluntarily transparent about their performance on communication channel amongst their team members during their task accomplishment or transparency within the company regarding their awareness and acknowledgment about the

gamified platform being adopted. *"On **slack**, others announce what tasks they finished. I for sure feel pressured if I haven't finished my tasks"* leading to increased pressure.

D. Personal related risk factor

This section defines the employee's perception towards game elements and the emergence of gamification risks would differ according to some personal related factors. For example, personality type, seniority level, role and demographics are the personal related factors that we need to consider when designing inclusive gamified system. Participants were given the BFF 44-questionnaire prior to their interviews to determine their personality type.

Conscientiousness is motivated by either achievement elements as points, badges, leader boards, levels, progress bar and rewards or by gifting and sharing knowledge. *"We have a **leader board** for showing our daily progress of the team, I set my targets to beat the best numbers of others"* leading to Anchoring bias". **Agreeableness** are motivated by social competition, teams/guilds, social network feature, knowledge sharing, and gifting. *"In an optional training or fixing an optional task no need to be stressed and have a **time pressure**"* leading to quitting task. **Neuroticism** Motivating elements: Easter eggs, customization, un-lockable content, voting mechanism and anonymity. *"**Competition** at work shakes my confidence, it affects me mentally"* leading to feeling unconfident. **Openness** personality type is motivated by immersion elements such as Easter eggs, un-lockable content, and avatars. *"I want to help others just to get recognized Publicly on **slack**"* leading to Ego-centric. **Extraversion** employees are motivated by immersion elements as Easter eggs, unlock able content and socially related elements as social competition, teams, social network feature and gifting and sharing knowledge. *"I keep looking for the everyone's achieved **badges and Easter eggs** keep trying to find them, I leave important tasks unachieved when the systems allow for such things to occur"* would fall into a Rabbit hole trap (addiction).

Role & Seniority refers to the employee's role (Software engineer, Designer, Project manager, etc..) and seniority level (junior, senior or an executive) at their workplaces and how they could be one of the reasons behind the emergence of gamification risks. *"I would be stalling when I couldn't reach higher **levels** in my training as other managers"*. leading to managers being stalling & disengaged.

Demographics refers to the employee's age and how would they affect the emergence of gamification risks. Employees with different age groups would respond to gamification differently. A misfit between the organization culture and demographics would result in gamification risks. *"Overaged board members 50 + wouldn't like to participate, they don't have their **gamified profiles** accessible like us"* leading to lack of participation.

E. Game element Related Risk factor

This section describes the game elements related factors as the reward type, the reward assignment level and the visibility and accessibility of the rewards.

Reward Type refers to the nature of the rewards being incorporated into the ES either tangible (bonus, vouchers),

virtual incentives (as avatars, points, leaderboards, and badges), social influences (competition, teams, gifting) and challenges. *“I send kudos to my friends daily” leading to unfair judgment, clustering groups and intimidation amongst employees.*

Assigned to refer to the how rewards could be assigned to various levels either company, team, or individual level. *“Labeling us with Levels on a company-level is unneeded” leading to jealousy and employee inequality.*

Visibility & Accessibility: Visibility refers to featuring and displaying of the employee’s performance publicly on leaderboards for the whole company or teams could be the reason behind the reason on some social well-being risks. Accessibility refers to accessing all the employee’s earned incentives on their public profiles on the ES, to their colleagues, could be one of the main reasons that could lead to gamification risks. *“I feel embarrassed and ashamed of my achieved badges if I am level 1 in something, and I wish to hide them”, leading to embarrassment.*

IV. CONCLUSION AND FUTURE WORK

In this work, "Inclusive Gamification" is introduced as a concept that considers contextual elements in gamification. The study presents risk factors and associated risks in the software development industry, taking into account various contextual aspects. This work aims to provide a systematic method for identifying and mitigating gamification risks, and future work will focus on developing an engineering method for evaluating and mitigating these risks in enterprise systems.

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