How to Engineer Gamification: The Consensus, the Best Practice and the Grey Areas

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Abstract

Gamification typically refers to the use of game elements in a business context in order to change users' behaviors, mainly increasing motivation and engagement, towards a certain task or a strategic objective. Gamification has received a good deal of emphasis in both academia and industry across various disciplines, e.g., psychology and human computer interaction, and application areas, e.g., education and marketing. Despite the increasing interest, we still need a unified and holistic picture of how to engineer gamification including: the meaning of the term; its development process; the stakeholders and disciplines which need to be involved in it; and the concerns and risks an ad-hoc design could raise for both businesses and users. To address this need, this paper reports on a review of the literature on a range of gamification techniques and applications, followed by empirical research which involved collecting expert opinions using qualitative and quantitative methods. Based on the results of this research, we provide a body of knowledge about gamification and highlight good practice principles and areas of gamification that are debatable and require further investigation.

Keywords: {Gamificaiton, Human-centered Design, Persuasive Technology, Expert Study}

1 Introduction

Games have long been a part of culture as a means of entertainment, building relationships, and learning and training (McGonigal, 2011). In recent times, the digitization of games has caused a spike in their use and involvement in everyday lives of many people. According to ESA (ESA, 2014), the average game player is now aged 31 years, 48% of players being female thus shaping the gamers population. The success of games in keeping their users engaged and motivated has led researchers studying the phenomena in more depth to identify constructs in games that enable such engagement and sustainability in users' motivation and utilize them for goals beyond mere entertainment (Seaborn & Fels, 2015). These studies have resulted in various strategies, such as *gamification*, to pursue these goals.

Gamification is used to increase motivation and engagement in its target users in favor of changing their behaviors towards desired ones. There are several successful applications of gamification available in the literature encouraging various goals, such as adopting a healthier lifestyle (Johnson et al., 2016; Pløhn & Aalberg, 2015), increasing students' engagement with class activities in order to achieve better results (O'Donovan, Gain, & Marais, 2013; Simões, Redondo, & Vilas, 2013), or increasing quality and productivity in a business environment (Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2016; Rodrigues, Oliveira, & Costa, 2016). For example, in a business environment, such as a call center, various game elements such as points and leader-boards could be used to reflect the performance of employees, e.g., the number of calls answered, the number of issues solved, the time taken for finishing tasks, and the customers' satisfaction (InterAksyon, 2012).

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In order to understand gamification, the differences between *play* and *game* need to be addressed. According to Caillois & Barash (1961), play (paidia) is described as free-form, expressive, improvisational behaviors and meanings. Game (ludus), on the other hand, is rule-based engagement with pre-determined goals. Gamification, as the name suggests, is more focused on ludus, nevertheless, as (Alfrink, 2011) suggests, users are not given much flexibility to improvise their behaviors, and they have to do/achieve pre-determined tasks/goals. Despite the opinions of (Abt, 1987; Bogost, 2011) for excluding playfulness, playful design, and playful interaction from gamification, it is believed that gamification can also facilitate playful behaviors and entertainment to achieve its goals (Groh, 2012). However, including entertainment in a gamification design does not guarantee its success (Berkling & Thomas, 2013).

Since coining the term, several attempts have been made to establish a standard and commonly accepted definition (Deterding, Dixon, Khaled, & Nacke, 2011; Huotari & Hamari, 2012; Werbach & Hunter, 2012). However, there are still many gaps, debates, and ambiguities within the literature that are yet to be investigated. For example, it is not clear which constructs and properties shape gamification, and how it can be differentiated sharply from other similar concepts, such as serious games or games with purpose. Moreover, despite some attempts made towards introducing a methodology for designing gamification from a business-oriented point of view (Herzig, Ameling, Wolf, & Schill, 2015a), it is not yet clear which stakeholders and which fields of study need to be involved in the design process of gamification in a wider perspective, e.g., impacts on social and mental aspects. In addition, there are several debates on when gamification can be introduced to an environment, what concerns it produces and which considerations may lead to a successful design of gamification in that environment. Finally, what issues, from legal or ethical perspective, may arise by the use of gamification and how these issues need to be tackled.

In this paper, we conduct empirical research to gather opinions from experts in the domain of gamification and reflect on that to identify best practice guidelines and point out dissimilarities and areas that need further investigation. Finally, we provide a body of knowledge with regards to gamification design, which informs researchers and practitioners in their future work.

2 Literature and Research Motivation

Deterding et al., (2011) define gamification as "the use of game design elements in a non-game context", emphasizing that the final product will not be a game. Despite this emphasis, there are several instances of considering gamification as serious games or even considering both to be the same concept (Kapp, 2012). An alternative definition of gamification is introduced by Huotari & Hamari (2012) as a rules-based service system that provides feedback and interaction mechanism to the user with an aim to facilitate and support the users' overall value creation. In addition to increasing motivation and engagement, their definition of gamification emphasizes that adding gamification to a working environment should lead to the creation of added value to the business, for example., increasing staff engagement with the affordance of graceful experience. However, Deterding et al., (2011) criticize this definition for being not specific enough, indicating that with this definition, even a touch screen on a vending machine would be considered as a gamified application.

Other criticisms to gamification, mainly from experts in gaming, suggest that gamification is focused on the least important aspects of games and is being used as a tool for mere "pontification", whereas

games have storylines and valuable contents for their players (Chorney, 2013) that are missing in gamification. The lack of aforementioned features removes the entertainment and makes the task only challenging, whereas games should be "interestingly hard and difficult", giving players joy while performing and achieving a goal (Robertson, 2010). In addition, Antin & Deterding (2012) suggest and stress the importance of intrinsic motivation and "meaningful play" for gamification and state a gamification design that does not understand the needs and requirements of its stakeholders is destined to fail.

The design of gamification can target both intrinsic and extrinsic motivation. A design of gamification that targets the intrinsic motivation can deepen the motivation and engagement. It is argued that introducing extrinsic motivation through gamification in order to motivate users may only have short-term positive results (Antin & Deterding, 2012; Lazzaro, 2011). Despite this argument, it is suggested that extrinsic motivation should not be excluded or should not be considered as a separate a source of motivation, considering extrinsic motivation to be equally important as intrinsic motivation (Reiss, 2012; Ryan & Deci, 2000). This suggestion is made based on the fact that not everyone is intrinsically motivated and the presence of extrinsic motivation can persuade these people to be more engaged.

Gamification is a multidisciplinary field and research on gamification has been conducted within computer science (Pedreira, García, Brisaboa, & Piattini, 2015), psychology (Linehan, Kirman, & Roche, 2015; Scekic, Truong, & Dustdar, 2013), sociology (Huotari & Hamari, 2012), health (McCallum, 2012; Pløhn & Aalberg, 2015), and marketing (Hamari & Lehdonvirta, 2010; Hofacker, de Ruyter, Lurie, Manchanda, & Donaldson, 2016). Regarding the discipline, gamification is focused on changing the behavior of its users and is mainly based on software technology. Therefore, it is crucial for the design to consider the needs and requirements of end-users in the design process. This aspect of gamification urges a user-cantered design process. An ad-hoc design of gamification, without considering its compliance with its users' needs and perceptions, not only may hinder the ultimate goal of motivating users, but also may cause adverse side effects such as discouragement or demotivation, or even threaten the well-being of its end-users in a business context (Shahri, Hosseini, Phalp, Taylor, & Ali, 2014). Therefore, it is necessary for a successful gamification design to follow a systematic approach towards implementing gamification to avoid such pitfalls.

(Herzig, Jugel, Momm, Ameling, & Schill, 2013) provided *GaML,* which is a modelling language intended for designing gamification. GaML is built on atomic motivational elements that is based on (Deterding et al., 2011) taxonomy, and adds visual motivational elements, such as avatars. Moreover, Herzig et al., (2015) have proposed a methodology specifically designed for gamification, suggesting four high-level phases of business modelling and requirements, design, implementation, and monitoring and adaptation. They consider gamification as a software development and define five main stakeholders to be involved in the gamification process; end-users, gamification experts, domain experts, business experts, and IT experts. These methods and languages are acceptable from a business point of view, aiming at increasing user engagement and productivity. However, it is argued that measuring the success of a gamification design should not be narrowed down to the business goals of the environment, and should consider the social and mental well-being of its users in addition (Shahri et al., 2014). Gartner Group in their report (Gartner.com, 2011) predicted that "more than 50 percent of organizations that manage innovation processes will gamify those processes", and later suggested that poor design will lead to 80 percent of gamified applications failing to meet their organizational

and business goals (Gartner.com, 2012). Therefore, we argue that a systematic approach and involving more stakeholders should lead to a better design of gamification.

3 Methodology

We adopted a sequential mixed methods approach (Creswell, Plano Clark, Gutmann, & Hanson, 2003). Initially, interviews with six experts were used to collect rich qualitative data and form the basis for the survey questions. The survey, completed by 40 experts, was used to collect quantitative data and analyzed using descriptive statistics. The survey was followed by interviews with 12 gamification users, namely five managers and seven employees, to enable a variety of perspectives to be included..

Exploratory Phase

Semi-structured interviews were used, which allowed some flexibility in both the order that questions were asked and the prompts required to request elaboration, stimulate discussion, or creation of new questions. The new questions were used in the next interviews and were also added to the survey.

Identification of experts for interviews

The aim of this phase was to gather important aspects of gamification from a design perspective. To identify experts, we looked for high impact peer-reviewed publications available in the literature, and to gather a diversity of viewpoints, we invited experts from different affiliation types (academia and industry), fields of expertise (business, management, gaming, education), and countries. To prevent biased or skewed results, the selected interviewees had no work in common. Since we were looking for opinions from different perspectives, we invited people who have implemented gamification in practice, along with those who only worked with theoretical foundations of gamification.

Six experts agreed to participate in the interview phase of our research; four from academia (with one of them collaborating closely with industry), and two from industry. Three were involved in developing theoretical frameworks for gamification, and three others had developed and applied gamification in practice. Experts with more focus on academic and theoretical aspects had also implemented gamification in practice as part of their studies for evaluation purposes. Hence, they also encountered practical complications. The experts came from different countries and had different level of expertise with gamification; UK 4 years, South Africa 3 years, USA 4 years, Portugal 3 years, Germany 4 years, and Canada 10 years of expertise.

Interview process

The average time per interview was 39 minutes (minimum 27, maximum 50). Questions were sent to the interviewees in advance which made the actual interview more efficient and focused. After describing the aims of the study, interviewees were asked for their consent for recording the conversation. Once ethical procedures were confirmed, interviewees were asked to talk about their expertise with gamification, to ensure we had gathered the correct information through their public profiles (e.g., for how long they worked on gamification, where and in which domain). Before the interviews started, we tested and refined the interview questions via one pilot interview.

Data analysis

The recorded interviews were transcribed and the text was content-analyzed to extract important issues. These issues were then grouped together to form a number of sub-themes. Two researchers worked on the analysis and when a disagreement emerged, a third researcher was consulted to take a final decision. The questionnaire items, discussed in the next section, were formed based on the agreed themes.

Confirmatory Phase

This quantitative phase used a survey study designed to confirm and enhance the findings of the first qualitative phase, i.e. the interviews. The questionnaire included multiple-choice questions and an open text box at the end of each general question for participants to add any additional comments. The questionnaire was piloted on two participants and refined to ensure any ambiguity was removed.

Identification of participants

We invited authors of peer-reviewed and published papers via email to take part in the survey. The survey was designed to do find consensus, grey areas, and debatable aspects of gamification amongst the experts. A link to the questionnaire was then sent to each expert who accepted the invitation. The characteristics of the participants are summarized in Table 1. Given the novelty of the concept, the participants who specified their level of practical experience with gamification as medium are still experts in areas which are core for gamification, e.g., incentive-centered design, cyber-psychology and HCI. One expert stated low practical expertise, since their expertise was on the psychological aspect of gamification. However, their participation was valuable as it helped in balancing the view and opinions elicited from industrial and academic perspectives.

Table 1 Characteristics of the Participants

Years of Experience	
Min	1
Max	10
Mean	3.12
Median	3
Mode	3

Level of Practical Experience		
Expert	7	18%
High	18	45%
Medium	14	35%
Low	1	3%
None	0	0%

As in the qualitative phase, experts from different affiliations were invited to ensure diversity of perspectives and opinions. The distribution of participants based on their field of study and country can be found in Table 2.

Table 2 Distribution of Participants

Participants per Country				***Participants per Area of Expertise***			
UK	11	Switzerland	2	Education	11	Exertion Interfaces	1
USA	6	China	1	Psychology	7	General	1
Netherlands	6	Italy	1	Enterprise	4	HCI	1
France	3	Japan	1	Tourism	4	Marketing	1
Germany	3	Taiwan	1	Linguistics	3	Modelling and	1
Portugal	2	Norway	1	Game Design	2	Sociology	1
Spain	2			Software	2	Software	1

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Survey procedure

Forty eight experts started the survey and 40 of them successfully completed it. In addition to the descriptive statistics, we have analyzed the comments given by the experts at the end of each question to identify further insights and explanation for the statistics.

4 Results

The data from the two phases have been integrated and therefore the results are presented here under the following eight areas:

- Defining gamification;
- Relevant fields and disciplines;
- Stakeholders;
- When to use gamification;
- Concerns and considerations in development;
- Systematic approaches;
- Ethics and;
- Best practice recommendations.

In the following, we present the results of our study in percentages. Hereafter, we use **SD** for strongly disagree, **D** for Disagree, **N** for neutral, **A** for agree, and **SA** for strongly agree throughout the paper.

Definition and differences in the perception of gamification

The interviewees were asked to give their definition of gamification, its core elements and peculiarities in comparison to other closely-related concepts such as serious games and games with purpose. We asked these questions as we observed different definitions and understandings in the literature about gamification. There is no agreed definition currently available, or a taxonomy which accommodates the commonality and variability of those definitions, although attempts to put a standardized definition have been made (Deterding et al., 2011; Groh, 2012; Huotari & Hamari, 2012). We extracted 10 themes from the interviews which were developed into 10 statements, see Table 3.

The results show there is a considerable amount of diverse opinion on the nuances of some statements. Experts do not share a common view on gamification relation with serious games and games with purpose. One debatable statement was S1.1 where there was a belief that gamification will convert a task into a game. Despite several statements in the literature that gamification only uses game design elements, and is not a game per se, a considerable proportion of opinions (29%) did not agree with this statement. Moreover, S1.9 shows that despite gamification being reasonably defined in the literature, still it cannot be differentiated from serious games and games with purpose. Only eight per cent disagreement was observed on S1.10, while the same question was debatable when applied on serious games and games with purpose in S1.8. One view believed that there is a "grey area between gamification and serious games" and deciding whether it is gamification or serious games depends on the "perspective of people who are making the decision". On the other hand, some others believed that "gamification is about adding game elements to a non-gaming context" where serious games are "applied games used to deliver more than just entertainment".

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Another debatable statement was S1.4 where an uncertainty amongst the opinions can be observed about should gamification be added to an already designed business process or it can be designed and added to an environment before or while designing the business processes.

Table 3 Statements for Definitions and Perspectives

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S1.1	Gamification will convert a task to a game	28	31	13	21	8	0.12	2.42
S1.2	Gamification is meant to achieve a certain users' behavior when doing certain tasks, e.g., more engagement and motivation	0	5	5	56	33	0.25	4.15
S1.3	Gamification is not standalone and it should be always designed to work in conjunction with certain task(s)	0	0	8	39	53	0.26	4.51
S1.4	Gamification should be applied on tasks which are being used already (not before or in parallel)	10	21	21	33	15	0.09	3.12
S1.5	Gamification has its own added value, i.e., it is a part of user value creation at work, not only those related to behavior change when performing specific tasks	0	15	26	49	10	0.17	3.55
S1.6	The main goal of gamification is to increase motivation	3	18	15	49	15	0.17	3.56
S1.7	Gamification must lead to enjoyment	5	18	13	49	15	0.18	3.53
S1.8	Serious games and games with purpose are games by nature	5	21	21	38	15	0.13	3.50
S1.9	Serious games and games with purpose can be considered a kind of gamification (when you make the task as a game, then you gamify the task)	10	36	13	26	15	0.09	2.82
S1.10	Gamification is not a game.	0	8	10	49	33	0.19	4.08

Relevant fields of study

The next question in the interview was designed to collect opinions about the fields of study that should be involved in the development process of gamification. From the interviews, we retrieved seven different fields of study, and then confirmed and enriched the list through the survey. The statements and the results are provided in Table 4.

User experience, HCI, psychology, and game design seem to be highly recommended fields to be involved in the development process of gamification. The percentages suggest that management and human resources, behavioral economics, and software engineering could be involved in the process as well, perhaps with less importance in comparison to the others. It was signified that gamification might not be always software-based, e.g., bulletin boards with ticks for points in small teams, or it might use technology very limitedly, such as screens in public places with some indicators of collective performance. These settings make software engineering and HCI less relevant. Finally, by analyzing the added comments, social science was recommended by a number of respondents as a relevant field, e.g., to study group dynamics.

Table 4 Statements for Relevant Fields of Study

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S2.1	User Experience: e.g., to understand users' behavior towards the business and tasks and also game mechanics	0	0	0	36	64	0.28	4.58
S2.2	HCI: e.g., gamification requires careful, sometimes novel, design of Human Computer Interaction	3	3	10	36	49	0.22	4.26
S2.3	Psychology: e.g., for motivation and engagement, and also deciding when a task or a gamification technique becomes boring	0	3	5	36	56	0.24	4.43
S2.4	Game Design: game mechanics come originally from Gaming. Expertise in Game Design is thus needed, e.g., game rules and reward mechanisms	0	0	10	36	54	0.25	4.49
S2.5	Management and Human Resources: e.g., gamification could have an impact on the performance and the social relationship between employees (users)	3	8	36	38	15	0.16	3.58
S2.6	Behavioral Economics: e.g., whether competition and leader- board would increase the performance and quality of doing a certain task for certain groups of users	3	10	21	46	21	0.18	3.71
S2.7	Software Engineering: e.g., to systematically construct gamification from requirements, to design, to implementation and testing	0	25	26	38	21	0.16	3.61

Stakeholders

After enquiring the fields of study that should be involved in the design process of gamification, we investigated the stakeholders that should be involved in the design process. This information would aid gamification developers to know whom to consult. We deduced a set of eight main stakeholders which are presented in Table 5 with their respective results.

It was highly agreed by participants that end-users, IT developers, researchers, and domain experts should be considered as stakeholders or consultants. However, the degree of consensus seems that there is less need for strategy makers and management, legal departments, security and privacy engineers, and behavioral economics experts. In this research, we tend to consider these areas as part of the eco-system to which gamification belongs. They would inform its decisions and maximize the chance of its correct implementation and integration. An interesting insight came from one expert who further added that it is mandatory that the legal department should be involved, since "gamification may be used as exploitation-ware" and gamification is not just about "[the technical side] of designing BPL [(badges, points, and leader-boards)]". It was also suggested that a professional game designer could also be considered as a stakeholder or consultant, given that gamification borrows most of its techniques from game industry.

Table 5 Statements as to Who are Development Stakeholders

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S3.1	Strategy makers and management: e.g., gamification may lead to changes of behavior and thus affect the organization social structure (when using leader-boards, reputation, etc.)	0	10	18	46	26	0.16	3.84
S3.2	Legal department: e.g., collected points indicate whether the employee is doing the work. Can that be used by managers when deciding to promote an employee?	5	28	28	23	15	0.13	3.07
S3.3	Security and privacy engineers: e.g., listing the top 10 in leader- boards, means others are not in the top 10. Points reflect a person's performance.	3	32	18	26	21	0.14	3.10
S3.4	End-users: e.g., for testing and validation and feasibility study	0	0	5	44	51	0.24	4.36
S3.5	Behavioral economic experts: e.g., for gamification design which is informed by the effect of social and psychological aspects on business objectives.	5	5	16	45	29	0.16	3.91
S3.6	IT developers: for managing the development and maintenance of information technology e.g., real-time communication, video server, communication channels	0	5	23	38	33	0.19	4.04
S3.7	Researchers: e.g., research is needed in most gamification projects as we still do not have ready-to-use solutions or templates for such an emerging field	0	5	18	36	41	0.17	4.06
S3.8	Domain experts: e.g., experts in the business being gamified will inform the design of correct gamification	0	3	8	44	46	0.23	4.27

When to use gamification

When to apply gamification in an environment was another aspect we investigated. The knowledge about this will help organizations to decide whether they need to apply gamification and whether it is feasible and cost-effective to apply it. We retrieved five insights which are presented with their respective results in Table 6.

A high rate of agreement on all the statements in this section was observed and no additional recommendation was made by any of the respondents.

Table 6 Statements about When to use Gamification

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S4.1	Theoretically, gamification can address any task, any user and enterprise. This does not mean it is easy to implement correctly, but the idea itself has no restrictions	8	15	3	46	28	0.20	3.86
S4.2	Gamification should be used to achieve another goal, e.g., behavior change. Gamification by itself is not an objective	0	15	8	46	31	0.18	3.82
S4.3	Gamification requires that the users' characteristics, enterprise, and context of the use are known very well, Gamification is not "one size fits all"	0	0	5	29	66	0.29	4.62
S4.4	Gamification is not a cheap solution from both technical and organizational perspectives. It should be used to support long-term goals and also when users/employee's loyalty is a key	0	10	13	46	31	0.19	3.97
S4.5	Gamification requires that we have clear business objectives and metrics to measure success and failure. This is preliminary to decide the suitability and feasibility of gamification.	0	8	18	38	36	0.17	3.99

Concerns and considerations in the gamification development process

The next statements cover the concerns developers and business owners should take into account while developing gamification so that they can avoid the negative impact it may have in both the short and long term. Knowing these concerns and issues beforehand can prevent organizations from applying gamification in a way which is not cost-efficient, and sometimes is detrimental for them. The cost here does not only refer to monetary development expenses, but to those related to the side-effects of applying it.

While some of the statements (S5.3 to S5.9) had a high rate of agreement, the others had a considerable amount of neutral responses or disagreeing responses. This could mean that we still lack enough knowledge to confirm or reject such statements and further research is still needed. For example, one of the experts strongly disagreed with the statement that removing the rewards will eliminate the intrinsic motivation with it. This was advocated based on an empirical study that the expert conducted. Some others stated that "knowing your players is a key" and believed that each type of user or environment needs their own design of gamification. This should not discourage developing engineering approaches which take that variety of users into account and perhaps provide patterns and adaptation mechanisms for gamification.

Systematic approaches for developing gamification

The next question in the interviewing phase was related to whether there exist practical systematic approaches for the development of gamification. Our reason to ask this question was that the clear majority of papers apply gamification techniques as ready off-the-shelf solutions in a business context without explaining how decisions are made. We still lack a clear picture whether we should build gamification in conjunction with the business task and software supporting it or apply it in a plug-in

style with some configuration steps. By analyzing the interviews, we identified 12 insights, which were subsequently confirmed by the questionnaire. The statements are presented in Table 8 with the respective results.

Table 7 Statements for Concerns and Considerations in the Gamification Development Process

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S5.1	Gamification should not be used when there is doubt about users' perception of gamification, e.g., certain users see gamification as trivialization of their job	0	23	44	28	5	0.19	3.02
S5.2	It should not be used when it could change management style against the company norms. e.g., transparency about who has the highest performance would affect the way promotions are given by managers	15	31	23	26	5	0.12	2.69
S5.3	Users should not feel they are forced to use gamification as this will lead to negative impact on the enterprise and the well-being at work	0	0	21	38	41	0.19	4.14
S5.4	Gamification should not lead to undermining the task. Users should not forget that gamification is for making the task more interesting, but it is still their job to do the task	3	15	8	51	23	0.18	3.64
S5.5	It is hard to guarantee that every user will see gamification positively regardless of how testing and validation were conducted. It is highly personal	0	10	13	49	28	0.20	3.81
S5.6	Not all game mechanics are applicable for any kind of task, e.g., leader-boards might not be suitable for the task of a collaborative editing of a shared document	3	0	3	34	61	0.25	4.42
S5.7	The desire to win the reward may affect the quality of the work negatively, e.g., users may do tasks in a cursory manner to collect points and win	0	5	13	24	58	0.18	4.14
S5.8	A game mechanic has a lifetime. That is users might get disinterested with it and reject it after a while	0	5	18	58	18	0.23	3.79
S5.9	Gamification may lead to clustering users and changing the original structure of the organization, e.g., good students could group together to win all the t-shirts given as a reward in gamified learning	3	16	18	50	13	0.17	3.51
S5.10	Not all game elements can be applied together, e.g., using competitive and collaborative elements together might not be a good idea	11	18	18	32	21	0.07	3.16
S5.11	Rewards are not good for intrinsically and already motivated users. If you remove the reward after a while, the intrinsic motivation goes with it	8	32	21	16	24	0.12	3.03
S5.12	Rewards are good for tasks which are not creative or intellectual. Rewards could distract users from applying their mind on the task.	8	24	26	29	13	0.12	3.2

Table 8 Statements relating to Systematic Approaches for Developing Gamification

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S6.1	There is not any established systematic/rigorous approach available in the literature	5	5	23	41	26	0.16	3.84
S6.2	There are guidelines on certain facets of gamification. Guidelines are a looser form of systematic approaches	0	13	15	62	10	0.25	3.82
S6.3	There is not necessarily a systematic approach to build gamification, it is a highly creative activity and systematic approaches could hinder success	3	23	21	44	10	0.14	3.34
S6.4	The engineering of gamification could be seen as a variation of user cantered design	0	13	28	44	15	0.15	3.61
S6.5	User cantered design is supportive but not enough for the engineering of gamification	0	18	15	59	8	0.25	3.71
S6.6	The engineering of gamification is not simply an assembly of other approaches, e.g., motivation theory, gaming, business analysis, etc. It has its own challenges and requires novel engineering approaches	0	8	15	51	26	0.21	3.9
S6.7	Business objectives should be considered from the start, i.e., gamification alignment with business objectives is core	0	5	8	51	36	0.23	4.02
S6.8	There is a lack of standard metrics and criteria for analyzing the feasibility of gamification	3	4	23	47	23	0.18	3.83
S6.10	There is no guarantee of the success of gamification	0	3	11	47	39	0.22	4.2
S6.11	There are tools to aid the design of gamification, e.g., tools offering templates and patterns and check-lists, but not rigorous approaches	5	5	28	51	10	0.23	3.58
S6.12	It is a mistake to think of gamification as a piece of software to engineer. It is a technique to customize and apply in the first place	0	0	13	42	45	0.21	4.52

The results show that there exists a high percentage of agreement on the lack of practical systematic approaches, e.g., "there is a lack of standard metrics and criteria for assessing the efficacy/feasibility of gamification". However, some thought that "there are some good guidelines" and "approaches but they have many key failings". This would mean that even guidelines are still not validated. Interestingly, there is a debate whether we ever need such systematic approaches. Some thought that "gamification development is not software engineering, [but] it is a game design". Others still think that there should be engineering approaches that "combine conceptual theories and technical practicalities". Engineering gamification could borrow certain techniques from user-cantered design, although it has its own unique challenges and we would still need "to standardize the instantiation of gamification" to fit its own peculiarities.

Gamification and ethics

The use of gamification is a new trend in business, motivated mainly by increased productivity, though we argue that it may not always be cost-free. Gamification could raise ethical issues and affect

the mental and social well-being of employees, and might be detrimental to the team. For example, leader-boards could demotivate those who never appear in them, and giving points upon completing a task could be overly stressful for some and lead employees to complete tasks hastily and without care. In the interview phase, we discussed the ethical issues and professional practice that may need to be considered when applying gamification in a business environment. These statements and their respective results are presented in Table 9.

A high rate of agreement on the statements in this section was observed. Participants unanimously agreed that introducing gamification to a business environment can have potential ethical issues. If contextual elements such as culture, norms, and personality of users are not considered in the design process, gamification may lead to problems such as adding stress and pressure on people, drive them to sacrifice privacy, or create clusters of users and isolate some others.

Notable recommendations

In the last question, we asked the interviewees about best-practice recommendations for developing and applying gamification. By doing this, we aimed to produce a body of knowledge coming from previous experiences. We gathered 11 recommendations which are presented with their respective results in Table 10.

A high rate of agreement on the statements in this section was observed. There was a consensus on considering the business environment and the end-users in the design process of gamification. Users can differ from various aspects, namely their personality, age, gender, and cultural and social background, which seem to have high impact on how gamification should be designed. In addition, the environment that gamification is being applied to has various aspects, such as management style, culture, work style, and nature of the job that have to be considered in the design process of gamification. Neglecting these aspects may lead to a gamification design that does not satisfy some users' requirements, or is against norms, nature, or goals of the business which in both cases, can be detrimental to the ultimate goal of adding gamification to a business environment.

5 Discussion

In this section, we discuss our findings in two sub-sections. First we discuss aspects of gamification that gained a collective agreement and provide a body of knowledge that can aid gamification designers in increasing the quality of a gamification design. Then, we discuss the implications of our findings, in particular noting those areas where there was disagreement, or ongoing debate, which need further investigations.

Table 9 Questions for Gamification and Ethics

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S7.1	Gamification can lead to tension in the individuals/groups relations, e.g., when applying a leader-board	3	5	13	51	28	0.17	3.9
S7.2	Gamification can lead to exposure of information users are not necessarily willing to expose, e.g., saying who are the top per- formers	0	10	15	44	31	0.18	3.83
S7.3	Gamification can create tension in the person, i.e., it can be looked as a monitoring system on how well a person is performing	0	13	5	51	31	0.20	3.9
S7.4	It could lead to rating people and creating classes, i.e., additional pressure on some people and change in the equity principles	0	13	15	49	23	0.17	3.67
S7.5	Gamification ethics are highly dependent on the norms and culture of the organization	0	5	10	51	33	0.22	4.21
S7.6	Gamification captures a lot of personal data, e.g., about performance. Privacy policies and data protection need to be augmented by ethical awareness	3	5	26	38	28	0.16	3.7
S7.7	The desire for winning could drive some users to overlook how data is gathered and to whom it is exposed. This makes some users, at times, vulnerable	0	18	15	44	23	0.17	3.67
S7.8	Ethics in gamification could be seen analogous to those in marketing, i.e., gamification could make some tasks attractive to users who would not ethically like to perform without gamification	0	8	33	46	13	0.20	3.56
S7.9	Gamification, in certain cases, could mean trying to get from people more than what their job requires, i.e., using gamification as an “exploitation-ware”	0	23	13	38	26	0.15	3.6
S7.10	Ethics should be seen case by case and even at the individual user level, e.g., the same game mechanic for the same task may be seen differently from ethical perspective according to the user	0	5	26	50	18	0.24	3.84
S7.11	Freedom of Information. Users’ ability to see what is stored about them is an ethical issue	0	8	10	44	38	0.19	4.16

Table 10 Statements of Best-practice Recommendations for Gamification

Statements		Results in Percentages					Stn. Dev.	Mean
		SD	D	N	A	SA		
S8.1	Gamification should focus on end-users. Adopting gamification without a rich knowledge of users could turn to be harmful on users' experience and consequently the business	0	8	3	41	49	0.23	4.3
S8.2	Age is a distinguished user attribute, e.g., elders might not like virtual rewards	5	28	18	36	13	0.13	3.12
S8.3	Gender is a distinguished user attribute, e.g., males may like competition, females may like cooperation	10	26	13	46	5	0.16	2.97
S8.4	Social background is a distinguished characteristic of users to consider, e.g., some cultures are reputation-oriented while some others are not	3	10	23	54	10	0.19	3.54
S8.5	Gamification should be informative, people like feedback on how they are doing	0	5	3	49	44	0.26	4.41
S8.6	Users should not feel they have to rely on gamification, i.e., they should be still able to do the task perfectly without gamification	0	3	21	44	33	0.19	4.04
S8.7	We cannot decide the applicability and efficiency of a game mechanic per se; amongst other aspects, an analysis of the task and users should be made	0	5	13	54	28	0.21	4.04
S8.8	Gamification should be configurable by managers, e.g., the tasks, the user groups, and the periods to activate and deactivate	5	3	46	31	15	0.19	3.55
S8.9	Management and work style, hierarchical vs. non-hierarchical, need to be considered, e.g., leader-boards may seem odd in highly collaborative teams	3	5	21	38	33	0.15	3.84
S8.10	The word gamification might lead to a negative reaction by some managers, e.g., trivializing the work. Words like behavior change, employee engagement could be used interchangeably	5	28	28	33	5	0.15	2.96
S8.11	It is desirable that gamification is designed as an adaptive mechanism, e.g., depending on the type of users, the culture of the group, the business status, etc.	0	0	8	58	34	0.25	4.21

A Body of Knowledge on Gamification

In this section, we discuss the agreed aspects of gamification from the perspective of practitioners and researchers, see Figure 1.

Definition

In this sub-section, we elaborate on the findings in section 4.1 and discuss what defines gamification and how it is differentiated from serious games and games with purpose.

There seems to be a tendency towards accepting the definition provided in (Deterding et al., 2011). Despite what the name suggests, gamification is not a game. It merely uses a number of elements that

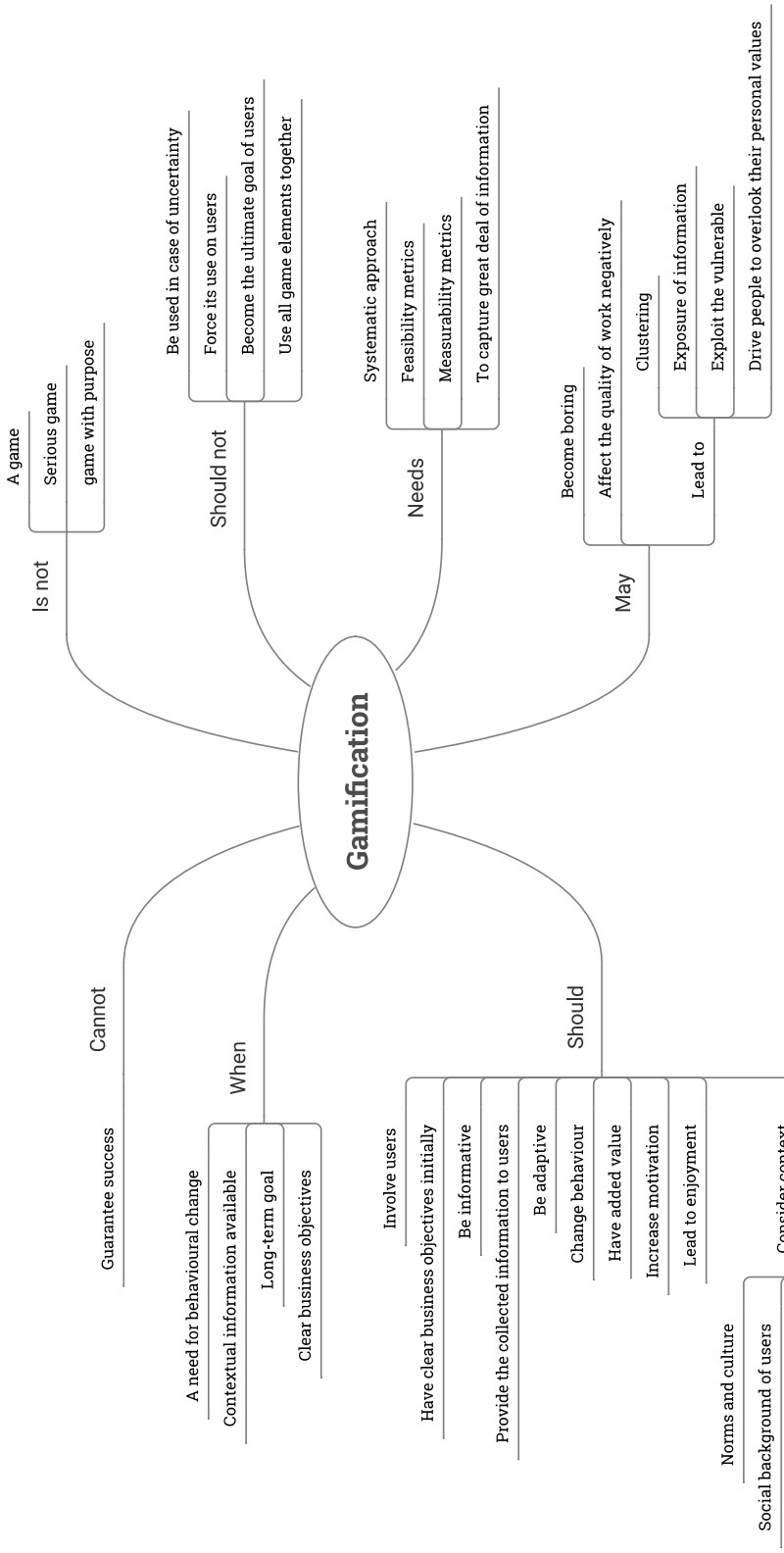

Figure 1. A reference Model for Engineering Gamification

are used to shape a game to achieve non-game objectives. This is where gamification is different from serious games and games with purpose. Serious games and games with purpose are games in essence, however, they pursue non-game goals, e.g., education.

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There are a number of properties that a gamification design should possess. As such, aiming at increasing motivation and engagement in its users is one of these properties. Gamification per se does not increase performance or quality of work. It should be designed in a way that increases motivation and engagement in its users, which may lead to an increase in the performance and quality of the work of employees subsequently. In addition, gamification should be meaningful for its users, create added value for them, and create joy for the users in participating. Failure to create this added value and provide the meaning in the design of gamification for its target users, will lead to gamification's failure in motivating its users and increasing their engagement (Deterding, 2012). These aspects are substantial in how gamification is defined and what properties it should contain.

Relevant fields of study

In this sub-section, we elaborate on the findings in section 4.2 and discuss the list of relevant fields of study that their involvement in the design of gamification can be beneficial to the final artefact. Based on our findings, in addition to the fields mentioned in (Herzig, Ameling, Wolf, & Schill, 2015b), the relevant fields of study that should be involved in the development of gamification are as follows:

- User Experience (UX)
- Human Computer Interaction (HCI)
- Psychology
- Game Design
- Management
- Behavioral Economics
- Software Engineering

Gamification targets the end-users and has direct interactions with them. Therefore, involving the knowledge from user experience (UX), human computer interaction (HCI), psychology, and behavioral economics seems reasonable. These fields of study can provide the information about which strategies gamification should follow in order to be successful in changing the behavior of its users and observe considerable increase in their motivation and engagement.

Gamification borrows its main elements from the games. Therefore, game design is relevant to gamification as it provides information about how game elements can be embedded in the business environment in an interesting and enjoyable manner. Management is relevant as well since they should advise on what goals gamification should achieve and how to resolve possible conflicts that adding gamification to the business environment may introduce.

Finally, software engineering is needed to model and engineer the design of gamification. This involves features such as feasibility analysis, cost efficiency analysis, and measurability of the success for a design of gamification before it is implemented in the business environment.

Stakeholders

In this sub-section, we elaborate on the findings in section 4.3 and add to the list of stakeholders proposed by (Herzig et al., 2015b). We list the stakeholders that their involvement will benefit the design of gamification as follows:

- Management

- End-users
- Behavioral Economics
- IT Developers
- Researchers
- Domain Experts

These stakeholders should provide rich information that can guide the design of gamification in the correct path.

Management can inform the design with what the business objectives are and how they should be followed and achieved. End users will enrich the design of gamification with valuable information of what aspects of gamification will motivate or demotivate them. Behavioral economics and domain experts will enrich the design with what behaviors are beneficial and how they can be achieved. IT developers will inform the design with the possibility and feasibility of requirements from a technical point of view. Finally, researchers will try to enhance gamification and resolve problems that gamification may introduce and have.

When to use gamification

As our findings in section 4.4 suggest, when there is a need for behavioral change, gamification can be used as one solution to achieve this goal. Gamification per se will not add to the performance of the employees or increase the quality of their work. It is useful when there is a lack of motivation and engagement in the environment, or bad habits that the organization wants to eliminate by rewarding the desired behaviors.

Another important aspect to consider is the availability of contextual information, that is, clear information about the environment, business objectives, and the users' characteristics that will be involved in gamification. Designing gamification without considering aforementioned contextual information can fail in meeting its ultimate goal and have detrimental effects.

Concerns and considerations

According to our findings in section 4.5, the engineering process of gamification would need to cater and provide countermeasures for a variety of concerns which may hinder its success and introduce risks

One of the recommendations is that in case of uncertainty of the outcome of gamification; it should not be introduced to the business environment. These uncertainties can be related to the impact gamification may have on the business environment or the perception of it amongst the users. In any of these uncertainties, introducing gamification may not only fail in achieving its goal of motivating its users, but also may be detrimental, such as demotivating users which are already intrinsically motivated. Although there is no guarantee to the success of introducing gamification to a business environment, reducing the uncertainties can decrease the risk of failure.

In addition, it is noteworthy that gamification should not be forced upon the users who must be able to opt-out from using gamification. Although, it is arguable that the peer pressure of using gamification by others may prevent employees from opting out. Moreover, gamification should not become the goal of the employees and they should remember that their actual goal is to achieve their business

objectives successfully and gamification is introduced to the business environment in order to help them to do so.

Game elements used in gamification have their own nature and characteristics. For instance, some game elements promote competition and some others, in contrast to competition, focus on increasing collaboration amongst their users. Therefore, a successful design of gamification should take all the characteristics of these elements and choose those that comply with each other and do not cause conflict. In addition, the alignment of game element characteristics with contextual situations is important. Contextual situations refer to the tasks, users, and business environment that gamification is being introduced to.

For various reasons, users may lose their interest in a gamification design. Therefore, a dynamic and adaptive design of gamification is advised where users are constantly monitored in order to detect the need for a change in the design and trigger the need for a new solution, such as introducing a new game element.

It should be taken into account since gamification can assess users according to their strengths and skills, shaping clusters of users is not an unexpected occurring. Although, it was mentioned that this is not necessarily defective for the business objectives, there is potential danger in having clusters of users, especially when it leads to isolation of some others who cannot maintain their performance with the top performers.

Finally, a gamification design may drive employees to decrease the quality of their work, especially when gamification is rewarding the speed of production and does not consider the quality of work while rewarding. It is a very important concern for businesses planning to facilitate gamification, where increasing the quality of work is a major goal.

Systematic approach

Gamification is different from commercial video games as it aims at fulfilment of business goals through game elements and *play* is a secondary goal for businesses. Therefore, we advocate a systematic approach towards the design and implementation of gamification which can reduce risks and side-effects related to relying on the creativity of its designers and prevent possible losses in the business.

Despite the presence of templates and guidelines for how gamification should be designed and implemented e.g., (Herzig et al., 2015b, 2013), our findings in section 4.6 suggest that there still seems to be a lack of systematic approach, and feasibility and measurability metrics for designing gamification. This is crucial to any system design as lack of them will cause uncertainty in its success or its introduction to the business may cost more than expected since the feasibility of adding it to the business was not analyzed properly beforehand. In addition, the lack of a systematic approach in designing gamification will make it hard to evaluate and analyze its success before implementation.

Moreover, a gamification design should involve its users and employ user centered design techniques in order to identify user requirements in the design process and also have clear business objectives beforehand. This should help achieving a design which is closer to what is expected from a successful gamification.

Ethics

The findings in section 4.7 suggest that, as with any persuasive technology, gamification deals with psychological aspects of its users. Therefore, the engineering process of it should be performed with due consideration of any ethical aspects and impacts it may have.

Gamification relies on collecting personal and work related information from the users and the business environment. However, how this collected information is used can impact whether gamification will lead to ethical issues. Since gamification often collects very detailed work information, it can be used as a very accurate and detailed monitoring mechanism by managers. This can create a great deal of tension among employees as managers can retrieve work habits of employees and put pressure on them to work constantly.

Also, competitive elements of gamification can shape clusters of users with the same skill-sets or similar performance level. As mentioned earlier, this is not necessarily problematic on its own. However, there are potential risks such as users with the same abilities and performance level cooperate with each other to stay in the top performers by helping each other and isolating others.

Moreover, the design of gamification may exploit the vulnerable users, driving them to work more than their contract, without extra payment from the organization, or be less concerned about their privacy just to achieve virtual goods. This, in the long run, can be defective for the social and mental well-being of the users involved.

Furthermore, a gamification design should consider the norms and culture of the society or organization it is being applied to. Promoting competition in a society that competition is defamed in, is going to be ignored by the users or force them to perform in a way that they are reluctant to do.

Finally, gamification should allow the users to have access to what has been collected about them by the use of gamification. This should be available to the users in addition to the feedback that gamification provides. Feedback is one of the main drivers for employees as they will know how they are performing and allows them to decide in which part of their job they need to put more effort.

Recommendations

In this section, we elaborate on the findings in section 4.8 and discuss the best practice recommendations of experts regarding the design of gamification. There are several recommendations about how gamification should be designed and implemented. However, here we discuss the ones that have collective agreement.

One important aspect that is recommended to be considered while designing gamification is the context gamification is being applied to and choose game elements that are compatible with those contextual elements. These contextual elements could be the end-users, the business objectives, or culture of the organization gamification is being introduced to.

Another important aspect is the managerial style in the business environment. There are various reasons that this becomes of concern as how managers will use gamification and the data captured by means of it can change its impact and perception amongst users. If the managerial style tries to value collaboration and hard work through positive reinforcement, this is usually acceptable from the users'

point of view, however, having a negative reinforcement and punishing users for being in the bottom of the list in performance monitoring, could be very detrimental.

In addition, it is recommended that gamification should be configurable by either managers or end-users. This is a very important feature that gamification could have which can allow resolving many conflicts that gamification may introduce or even change the design when necessary to avoid boredom and sustain motivation in its users. It is important for the design of gamification to be adaptive. This can be achieved by the use of social adaptation (Ali, Solis, Omoronyia, Salehie, & Nuseibeh, 2012) and social sensing (Ali, Solis, Salehie, & Omoronyia, 2011) to detect when the setting and design of gamification is not working or users have lost interest in it. Then, it can trigger the need for a change in the design to avoid its harmful side effects.

Finally, it is important for the design of gamification to be supplementary to the environment, and it should not become the goal. Users should be reminded all the time that gamification is there to help them, and not to be the goal of the business.

Debates on gamification

In this subsection, we provide the debatable statements on gamification reported in Section 4. We considered statements debatable where the rate of agreement and disagreement were close and a definite decision could not be made from the results.

Debates on the definition

The first debate is whether gamification should be applied to a task after the users have already become familiar with it. The first view advocates that this should be the case as gamification should not be seen as an intrinsic part of the task and could be removed eventually, but the task would remain and the user should still be able to perform it. The second view expresses that this is not necessarily the case. This view argues whether we can consider gamification as a general paradigm that includes serious games and games with purposes.

The first view believed that there is a possibility of designing gamification as a game, similar to serious games and games with purposes. The second view on the other hand, preferred a neat definition of gamification and excluded the possibility of gamification to be designed as a game.

Stakeholders

There was a debate whether legal departments and security and privacy engineers should be considered as stakeholders. The first view advocated this opinion as gamification means changing the work contract in certain cases, e.g., monitoring of performance. The other view preferred to detach that aspect from gamification and advocated that it has to do with the strategy of the company and the way gamification is used is not a concern for gamification engineers.

Concerns

There are three debates here. The first debate relates to users' reaction and opinion about gamification. That is whether we need to avoid violating users' experience, or gamification is meant to lead to behavior change and uncertainty about its usage should be expected. The second debate is whether we should apply gamification if it is going to change the management style. Disagreeing views were analogous to the first debate. The third debate is whether the use of rewards, mainly tangible rewards,

is not good for tasks which require intellectual contribution as they would be distracting. One view advocated it, with preference to use intangible rewards, e.g., social recognition, while the other view still sees rewards of all kinds the core of gamification regardless of the task types.

Recommendations

The first debate related to whether age and gender are main factors in the success of certain game mechanics. Different experts had different experiences regarding this aspect, which would call for further studies to investigate this. The other debate related to whether managers should be able to configure gamification or a pre-planned gamification should be applied. The debate mainly emerged because of the fear that this configuration could lead to subjective decisions, e.g., trying to exploit users. However, this seems to be an issue of management style rather than gamification. The third debate relates the perception of gamification itself. Some experts had experiences where managers viewed it as trivializing the work and therefore preferred to avoid using the term, while some other experts believed that this is not applicable and the term is now widely known and accepted.

Threats to validity

Our expert study involved 46 experts (six in the interview phase and 40 in the survey phase) and was proceeded by a secondary research on the literature and distinguished projects on gamification and followed by another study to gather users and managers' perspective so that we enrich our analysis and reflections. The survey questions were appended by text boxes so that experts could add further insights, which explained their choices in many cases. The questions were developed based on an initial qualitative phase and literature review, so we ensured their relevance to our study. The experts were selected based on their contribution to the field of gamification, demonstrated via published works so that the credibility of their opinions is maximized. We also ensured that the experts were from different institutes and countries to avoid bias towards specific views of gamification. In spite of these careful arrangements, our study still has some threats to validity, as outlined below:

1. Most experts had only academic expertise, which means that the opinions presented in this paper have an academic flavor. However, the majority of experts still applied gamification in practice, e.g., via case studies to test their contribution and research questions. This would mean that their opinions are not purely theoretical, but also substantiated by some practical experience.
2. We recognize that some of our statements were about problems which still need to be investigated. Experts' opinions about these statements were to some extent speculative. However, their responses and comments enabled us to identify those issues which are still a focus of debate or need further research, and we presented them in subsection 0.
3. The study was, to some extent, biased towards gamification in a business environment. Some experts observed such business emphasis in the questions. That observation itself would mean the domain in which gamification is used could affect their answers. We suggest that our results are feasible for a business context and the generalizability of these results to other domains is still to be explored.

6 Conclusions

In this paper, we conducted an empirical research to provide a holistic picture of gamification and foundations for its engineering process. This included the meaning of the term, recommendations on

the use, concerns to take into account, stakeholders and fields of study to involve, ethical issues that it may create, and best-practice recommendations. Our goal was to provide a body of knowledge, which informs researchers and practitioners in their future work. This research also identified issues which were debatable and required further investigation.

Findings of this research suggest that there is a need for the alignment of gamification and its characteristics with the environmental contexts it is being applied to. Nevertheless, the constituents that give characteristic to gamification and the environmental context are not yet clear. Hence, as future work, we will try to identify these constructs and properties of gamification and the business environment it is being introduced to. This should help in creating a domain specific modelling language for gamification, with the ability to analyze the compliance of the business environment and the gamification being introduced to it and point out any risk that the design of gamification may introduce to the business environment. This can pave the way for software support and automated analysis of the gamification design. Moreover, this modelling language should be able to provide the evolution of gamification according to the changes in the requirements of the stakeholders. These changes can occur for various reasons; users may lose interest in motives over time or even as a result of contextual changes in the business environment. The detection of the changes in the requirements of the stakeholders for the purpose of gamification evolution remains a challenge which needs to be tackled.

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