

Gamification and Gaming Elements for Software Requirements Elicitation: A Systematic Literature Review

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Abstract: Requirements elicitation holds a significant place in developing successful software, thus stands crucial for the success of any software project. There are numerous elicitation techniques present for eliciting requirements from the stakeholders, but these techniques are more textual in nature which give rise not only to problems like ambiguity, inconsistency, incompleteness but also lack of stakeholder's involvement and interest in the system. If stakeholders are not properly engaged in the process, this could lead to disastrous outcomes. Researchers have worked on new ways of eliciting requirements from the user; one of them is using gamification. Gamification is a 'young' yet exciting way of engaging stakeholders to the system. It uses game mechanism and elements in non-gaming context. Several studies have referred its use as '*the use of non-serious context in a serious context*'. In this article, SLR is presented on gamification in elicitation of requirements. Although, there are multiple studies on gamification in requirements elicitation, yet none of them targeted the suitable game elements for elicitation, and undesirable features of gamification during elicitation. For this purpose, we have surveyed 525 initial and 48 primary studies. A set of 18 game elements suitable for requirements elicitation except points, badges, leaderboards (PBL) were determined. Also, undesirable features of gamification and the solution to overcome these challenges have also been identified. Furthermore, effect of gamification on verbal communication during elicitation has also been determined. This study effectively contributes to highlighting the role of gamification in eliciting requirements from the users. This study also provides answers to the research questions which will be helpful for practitioners and software development teams while performing elicitation.

Keywords: Requirements elicitation, gamification, requirement engineering, gamification elements, elicitation technique, requirements gathering.

1. Introduction

One of the major reasons of the failure of software project are incorrect requirements, that is why requirements engineering (RE) is considered as the success-critical activity during software development. RE helps to define user needs into requirements in an accurate way. Furthermore, RE recognizes the problem that arises from the user needs and change it into understandable requirements [1]. One of the major parts of RE is elicitation of requirements, which is generally observed as a key to the excellence of the developed system. Gathering requirements is the method of following, finding, attaining and elaborating desires or wants of stakeholders. It involves variety of techniques, methods, and tools for elicitation of requirements from the user. It is the process of gathering requirements for better understanding about the system. It is the beginning step in requirements engineering process [2]. Completeness or improvement of require project or system depends upon eliciting requirements from users. The fulfilment of requirements elicitation activity has good impact on the achievement of objectives set for requirements elicitation, which gives rise to rectify application or system [3][4].

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Elicitation involves variety of techniques, methods, and tools for elicitation of requirements from the user. It is the process of gathering requirements for better understanding about the system. Completeness or improvement of require project or system depends upon eliciting requirements from users. The fulfilment of requirements elicitation activity has good impact on the achievement of objectives set for requirements elicitation, which gives rise to rectify application or system [3][4] Requirements Gathering or Elicitation is most important and vital step among all the Requirements Engineering processes. Several elicitation techniques are used such as interviews, brainstorming, questionnaire, focus group, prototyping etc. Whereas all these techniques have advantages they also have some problems as well, such as interview is time consuming and requires commitment as small number of interviewees may involve in this technique [5]. Problem with brainstorming technique is that there may be duplication of data and may take too much time if the group is not properly controlled [6]. In Prototyping, problem arises as it may be time consuming process if the system is complex also after seeing prototype of any system customer expects same kind of system which is too difficult [7]. Similarly, questionnaire technique requires more time and effort. Follow-ups required in this technique, and it is longtime process sometimes stakeholders might not participate [7][8][9]. In Focus group technique, it is difficult to gather all group members at same time and place also participants hesitant to express their thoughts, especially when their thoughts were against the view of other participant [9][10]. The requirements must be gathered through requirements elicitation activity before requirements can be investigated, displayed, or specified [11]. Therefore, elicitation must be conducted properly to develop system correctly and according to users need [12]. But actual problem is that requirement elicitation process can never be assured completely that all the requirements can be gathered from the user by simply asking about system working and functionality. Also, it is time consuming process when developing system is large and complex as user requirements change again and again for better understanding make this process less accurate and problematic. Hence, to reduce this problem, the solution is using gamification method for elicitation [12][13]. Current Research in the field of gamification determines why gamification is used as most preferable solution for this problem. As with the development of technology, growth of computer industry and ability of an organization to influence user behavior, this is evident that gamification has become a progressive strategy to involve human factors for the success of a project [14]. Gamification encourages team members' collaboration and increases team competence [15]. It helps to increase the motivation and commitment levels of a work team. It is the use of game thinking and mechanics in non-gaming contexts to engage the users and solve the problems. Gamification is getting an admiration and reputation in the last few years, it is assumed that gamification has been developing eye-catching features to increase the engagement of user in non-gaming context such as the place of working, educational institution, software houses or user-friendly websites [16].

Gamification prefers those features of gaming context that motivate or enhance certain behavior of users and customer to get their better engagement in requirements gathering task as compared to elicitation techniques. By using gamification, elicitation process become less complex as it uses gaming context to get requirements from users. In this way users also show interest in giving requirements through playing or using different games and developers get more time to understand requirements clearly [17]. This recommends the context of gamification in elicitation by using gaming elements into non-gaming contexts, as it may help to elicit requirements more suitably. As gamification has been young emerging technology, but it gains much importance in the field of engaging customers or stakeholders. In developing system main concern is engaging stakeholders and communicate with them because problem rises with the changing requirements and demands of stakeholders, they change their requirements anytime throughout the developing process which lead to many problems and difficulties for system developer. Gamification technique is used for this purpose for better engagement of customers or users by motivating them encourage and enhancing their interest in the giving complete and proper requirements once during developing process. If stakeholder or users participate in development process actively there has been less chances of requirements changing [18].

In this study, SLR – systematic literature review has been presented to identify the gap between requirements elicitation and gamification, based on past studies. For this purpose, different game mechanisms and game elements have been studied. We have presented undesirable features of using gamification during elicitation, along with the ways to manage their effect during software development.

The review process is classified into six sections. In section 1 introduction of topic is presented. In section 2, a detailed review on literature is given. The section 3 elaborates research methodology. In section 4, detailed review process is presented. In section 5, results are determined and discussed in detail. The section 6 highlights threats to validity, and in last section 7, outcomes are concluded, and future directions are presented.

2. Literature Review

Requirement elicitation is an extremely significant process in development of software. If this process leaves ambiguities, then there is a high chance that system wouldn't be developed properly [19][20]. Because of wrong elicitation choice, mainly system falls flat. It is not possible to discover out the needs and wants of customers, users without the involvement of requirements elicitation techniques. The foremost challenge for developers amid requirements elicitation process is to guarantee successful communication between client and the developer [21]. Maximum faults occur in the system because of bad communication or miss-communication between customer and developer [22]. During requirements gathering, there come many problems which include unclear requirements, ambiguous requirements, not define requirements, repetition, unrelated requirements, complete requirements and many more. To overcome these problems different elicitation techniques are used [23][24]. These techniques include traditional techniques such as interviews, questionnaire, observation, ethnography, prototyping, joint application development (JAD), brainstorming, scenarios, and focus groups [24][25][26] etc. Table 1 presents the problems that occur in elicitation techniques.

Table 1. Requirements Elicitation techniques and their problems

Sr. no	Elicitation Techniques	Problems	Ref.
1	Interview	Lesser number of individuals includes in this yet it is time consuming at the same time. Training is needed for interviewer. Likewise, it requires follow-up and considerably much more consideration of stakeholders and developers.	[20],[22],[23], [25]
2	Questionnaire	In this there is a chance that questions may not clear to all participants. Sometimes all members might not participate in this session. In this valuable input is not gotten.	[22],[23],[25]
3	Brainstorming	It is quite expensive elicitation technique to organize or conduct also it requires presence of maximum stakeholders at one place. Data duplication chances high in this technique.	[21],[22],[24]
4	Prototyping	After seeing prototype, customer expects same performance of the system and because of changing requirements it is difficult. It is expensive and time-consuming technique for complex system.	[21],[22],[25], [26]
5	Ethnography	In this technique stakeholders include from different environment having different perspective for these highly experienced and trained developers are needed to use this technique.	[20],[21],[22], [23]
6	JAD (Joint Application Development)	It required trained facilitator and bunches of planning and time management. Different opinions of different people within the team make it hard to adjust goals and maintain focus.	[22],[23],[26]
7	Introspection	This technique depends upon assumptions about how system works after development in future. No direct contribution of customers or stakeholders in developing system framework.	[20],[22],[25], [26]

Sr. no	Elicitation Techniques	Problems	Ref.
8	Scenarios	It is used to determine the relation between components of system. This technique is not helpful for complex systems because it is not suitable to cover complete view of system.	[22],[23],[25]
9	Focus Group	This technique requires detailed discussion in form of group about system. For this skilled or talented moderators are required for good time management.	[20],[21],[22]
10	Observation	In this, multiple sessions may be required for gathering all requirements. It is time consuming and sometimes stakeholder behaves different when interrupted for asking questions.	[22],[23],[24], [25]

Except the techniques mentioned in figure 1, there is another method which is quite young yet productive, known as ‘gamification’. It is considered as combination of mix emotions like joy, excitement, curiosity, and thrills, all these have been used to get requirements from stakeholders [27]. It is an effective technique for motivating and engaging users to get clear and ambiguous requirements. Using a pleasurable context, the users are encouraged to perform tiresome but important tasks. Gamification involves different game elements to engage and attract user in the form of points, badges, awards etc. [28].

Gamification strategies help users to methodically define their needs and requirements. Gamification has become more popular and pervasive in various contexts as a means of embracing the benefits of positive human emotions invoked by games [29]. Specifically, gamification has been used and found to enhance motivation and improved user experience. Recently, the researchers are keenly interested to know the effect of gamification in increasing the motivation and commitment of users [30] as it taps into the world of “fun”, affect emotions, and can involve users more deeply. Software development teams used gamification technology for collaborative experiences, learning, and knowledge sharing and engagement of customer [31]. One of the purposes of gamification technique is to provide such an environment that attracts user’s interest, and to maintain user involvement in different domains including education, marketing, health etc. Gamification has been implemented in several different sectors for supporting user involvement and providing benefits, such fun-based user activities, social interaction among the users, quality, and productivity of user actions [32]. In health perspective, gamification technology can be implemented to facilitate people to maintain their health. It is an important factor to motivate users for adopting healthcare apps. It has noticed that different gamification methods or techniques have been utilized in few mobile health wellness apps, and this gamification application instigate clients to use healthcare apps [33]. Moreover, it is assumed that today an average student spends 50,000 hours in gaming, which is immensely huge amount of time [34]. Gamification features in the internet banking website motivate users to adopt internet banking and other mobile banking applications. It also attracts more users and helps in maintain privacy of users [36]. Gamification also promotes intrinsic motivation by satisfying player’s psychological and emotional needs.

Gamification always proven all the work that have been done on it correct by clarifying that gamified system give better result or outcomes than non-gamified systems. It figures out that how to motivate a creative mind and enhance excitement level for growth of literature [37]. In addition, gamification also addresses motivation and engagement of user in the system [38]. The game elements that are frequently used and are popular are PBL or points, badges, and leaderboard. These are external rewards which are used to increase user involvement and attraction. Other than these elements, there are many other elements of gamification which are used to elicit requirements. In determining which gamification elements is used for elicitation, it is also important to consider the interest of user or stakeholder that in which type of games user show more interest to give their requirements are the video games, rewarding games etc. other than PBL, there are many other gamification elements like feedback, mission, levels, time limit, ranking, blocked contents, virtual goods etc. which are good to use for elicitation of requirements [38, 39].

In past research, developers used elicitation techniques to fulfill the requirements of developing system, but those elicitation techniques have not been enough for successful system development. For this purpose, topic of our research which is gamification plays an important role to develop system completely and according to the needs of stakeholders and also become better choice for gathering requirements from stakeholders as compared to elicitation techniques. Many elicitation techniques demand for participation of user through face-to-face conversation. As gamification is becoming source of attraction in our society it reduces the trend of physical communication and replace this with gamified system. Many developers seeing the value in gamification and trying to use its motivation potential to get users to choose their application over others [40][41][42]. As the technology established and grew very fast, games have been played by everyone and it is most effective way to involve user and grasp their interest. Gamification in elicitation helps in designing system features, motivation, provides joyous experiences, and enhances user engagement in all related activities [43]. As gamification become source of relief for most of the organizations, especially for the developers of the systems, there is also a dark side of it. It always needed a proper management system as far as to create fun activities for upgrading client commitment to improve their involvement and interest and in this way system performance become satisfactory. If a gamification technique has been used to get more engagement, then, there must be a complete setup for this which is costly as well as time consuming. Moreover, to engage customers, training must be provided to the customers on how to use different game elements, which is also a long-term process [44]. Similarly, in any project development, people work in form of team or groups, coming from different backgrounds and having different choices, can grow conflict among them for selection of gamification element [45]. The gamification rationale may also help system architects and designers to perceive user's activities in a broader way, to recognize the significance of viewpoints coming after strong social interaction including user participation and communication [46, 47].

Our contribution for this study is that we have provided systematic review on gamification in requirement elicitation. Also highlight the effect of gamification, game elements except mostly used game elements (PBL) in gathering requirements. As this technique has been related to technology, so it has some undesirable features also which has been elaborated through our study and their solutions have been also provided here

3. Research Methodology

In this section, research methodology is elaborated. The methodology of our study is divided into five sections.

- i. Formulation of research questions
- ii. Selection of data source
- iii. Selection of former study
- iv. Evaluation and examination
- v. Results and discussion

In Step 1, research questions were formulated. Three research questions were formulated related to our study in order to keep our research in one direction.

In Step 2, search strategies which includes keywords, synonym and search queries were defined for stated database.

Step 3 is one of the primary steps. It helped in choosing article and related information from previous findings. We applied multiple filtrations on our study to get final material. As in filter one, total 525 relevant materials have been short listed. First, our main focused was to study abstract and downloaded it if any related article to our study was found.

Step 4 has been related to examination and assessment. It has been applied on requirement elicitation techniques. This step determined the quality assurance principles and based on these principles our research questions 1.2 and 3 were detailed.

Step 5 is the last step in our study. In this step results of all the three research questions have been discussed.

In this study, goal is to illuminate the usage of gamification in requirements elicitation. For this purpose, we also get guidance from past studies which are related to our research area and then describe the role of gamification in elicitation process through systematic literature review and by answer few related research questions. Our study also offered requirements engineer, reviewers,

innovators, and future investigators to get knowledge about the importance of gamification in requirements elicitation process more easily and in better way. The following figure elaborates the steps of our research methodology.

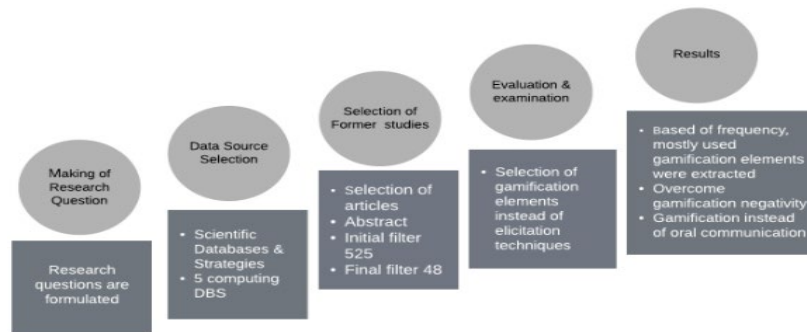


Figure 1. Steps of research process

4. Review Process

In this heading, we composed three research questions that relates to exploring the process of requirement elicitation through gamification were discussed in detail. These questions determine that the elicitation process can be conducted properly with the help of technology.

A Formulation of Research Question

There are many studies that uses elicitation techniques for requirement elicitation process but faraway there is no study available yet that cover the role of gamification in requirement elicitation process [48].

Our study is focused on answering following questions: -

RQ1: What is the effect of gamification on face-to-face communication during requirements elicitation?

RQ2: Which gamification elements are suitable in requirements elicitation other than PBL?

RQ3: What are undesirable features of gamification in requirements elicitation and how to overcome them?

The search string designed for these research questions are given as follows: -

(Influence OR outcome OR consequence) AND (requirements extraction OR requirements gathering OR requirements collection)

(Components OR features OR basics) AND (requirements gathering method OR gamified elements OR requirements discovering practice OR gamified properties)

(Control OR conquer OR overwhelm) AND (unwanted features OR objectionable attribute OR unacceptable qualities)

B Data Source and Search Strategies

To implement search queries, scientific databases and search engines related to relevant publisher were used. Scientific databases used to choose and search relevant material including google scholar, IEEE, ACM, Springer libraries, and science direct

Despite of these, some other scientific databases are also used for gathering material. To search relevant material for our research and select them, following synonym was also used with the search queries: -

For RQ1: Gamification outcome, Requirements Extraction, Requirements Collection, gamification influence on head on contact, influence of Gamification, gamification.

For RQ2: Requirements elicitation practices, gamification components, proper elicitation methods, suitable gamification basics, gamified elements.

For RQ3: Control unwanted features, unacceptable qualities of gamification, undesirable features, requirements extraction, unacceptable features of gamification, gamification.

Search string was composed by using logical expressions between them. With having limitation on tracking specific databases for our study, each search string must be carefully framed.

The criterion that was used to extract studies from the databases has been mentioned below:

1. We preferred data in our study which belongs to the areas of software engineering, gamification and RE In-depth of software Engineering field, covering one in all its parts which was requirements elicitation.
2. Research articles related to our study and chapters of book which were published in journal format provide validation and evaluation to our study.
3. For better understanding and maintain strategic distance from complexity, chosen data were in English dialect.
4. For covering recent improvement and trends in our chosen range of study, we selected distribution from year 2015 and onward.
5. Articles provided in HEC (Higher Education Commission) repository, which were free of cost and openly accessible, were selected to perform this study.

C. Process of choosing Articles

First step for this process is that to study the title and abstract of the selected papers carefully whereas, full article has been examined just for its validity and to induce important data sometimes, in selecting relevant or related articles, duplication may occur as Articles recovered from more than one database. This duplication must be expelled at initial stage. The result of certain articles has been affirmed to be portion of our proof-based study.

D. Principles of included and excluded process

This step represents the standards to guarantee that the chosen articles have been related to our review study

- a. Papers which are not in English dialect are not included.
- b. Letters, paper posters and blurbs are excluded.
- c. Paper whose full content is not accessible and only abstract is accessible are not considered.
- d. The distribution related to the main area of RE and gamification is included.

E. Procedures of Quality Assessment

In this step, quality affirmation (QA) guidelines have been applied on research questions of our study. Quality assurance benchmarks for driving three research question of our study was distinctive. Moreover, for enhancing the worth of our paper and to reduce the risk of duplication in our selected material, few QA checks have been given below (appendix).

F. Outline for Data Extraction

As in this step, all the information that is relevant to research study has been gathered from primary data. It covers the useful information which was extracted from each study. Publication and other details were covered. Data extraction criteria have been shown in appendix.

G. Strategy for combining data

The outcomes have been concluded from collected information amid the procedure of selection. The selected articles have been obtained from different sources, and our final concluded data at the end has been displayed in tabular form.

5. Results and Discussion

The process of designing search strategy and information gathering from distinctive databases took eight months to complete from September 2020 to April 2021. The research structure has been already defined which highlights each and every step of review process. In answer to research question 1, 150 related articles; for research question 2, 200 relevant articles; and for research question 3, 175 articles were selected. The following Figure 2 represents data collection method in detail.

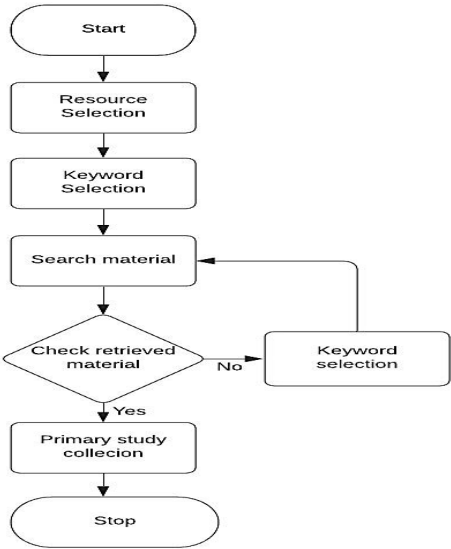


Figure 2. Data search strategy

Figure 2 displays all the required steps included in research methodology of this study. Starting from the resource selection, keywords were selected, and related material was searched. The retrieved material was checked for relevance and then primary studies were collected. Similarly, table 2 provides the list of retrieved articles according to the data sources and filtration process. In the final filter, relevant studies of each research question were finalized.

Table 2. List of filtration and selection of articles

No.	Different Sources of Data	Initial filter			1 st filter			2 nd filter			Final filter		
		RQ 1	RQ 2	RQ 3	RQ 1	RQ 2	RQ 3	RQ 1	RQ 2	RQ 3	RQ 1	RQ 2	RQ 3
1	IEEE library	39	50	44	20	19	10	12	12	10	4	8	8
2	Google Scholar	47	45	45	16	15	18	10	7	12	8	6	3
3	Springer Link	24	38	31	15	8	10	4	6	3	2	3	0
4	ACM digital library	30	37	35	15	5	9	2	2	5	0	0	1
5	Science direct	10	30	20	5	4	7	3	2	2	2	1	2
Total		150	200	175	56	51	54	31	29	32	16	18	14

There were 525 research articles chosen from recorded databases. The data related to our study has been chosen and irrelevant data has been removed. In figure 4, articles after numerous filtrations were shown. Initially scanned material for RQ1 was 150, RQ2 was 200 and RQ3 was 175. After 2 filtrations the number of selected articles was reduced to 16 for RQ1, 18 for RQ2 and 14 for RQ3. As in segment E, quality measures were characterized among which sixteen research articles were found relevant to research question 1; eighteen relevant materials have been selected for research question 2; and fourteen research articles have been chosen which were relevant to research question 3.

Table 3 shows list of selected research articles in conjunction with their references.

Table 3. List of selected articles against each research question

ID	Ref.	Articles linked to RQ1	ID	Ref.	Articles linked to RQ2	ID	Ref.	Articles linked to RQ3
1	6	(Meyer, Christian. 2016)	1	10	(Garcia-Iruela. 2020)	1	11	(Aon Rapp,2018)
2	15	(Pedreira, Oscar. 2014)	2	30	(Act Klock 2018)	2	12	(Hee Yoon Kwon,2020)
3	16	(Alsawaeir, Raed. 2017)	3	31	(Gafni, Ruti 2018)	3	13	(Hammedi,2020)
4	18	(Agnessa, Shpakova. 2019)	4	32	(Shih, Li-Hsing 2017)	4	14	(Dhawale,2019)
5	20	(Alharthi, 2017)	5	33	(Brull, Stacey 2016)	5	43	(Sanmugam,2014)
6	21	(Tebib, Mohammad. 2019)	6	34	(Hishamuddin 2018)	6	44	(Scheiner,2016)
7	22	(Hamari, Juho. 2015)	7	35	(Nasirzadeh 2020)	7	45	(Mavroeidi,2019)
8	23	(Aguir Castillo. 2020)	8	36	(Sailer. 2017)	8	46	(Dhawale,2019)
9	24	(Alsawaeir, Raed. 2019)	9	37	(Ali Darejeh 2016)	9	47	(Nacke. 2017)
10	25	(Eisingerich 2019)	10	38	(Toda, Armando 2020)	10	51	(Seaborn, Katie. 2015)
11	26	(Patrick Buckley 2016)	11	39	(Wee, Siaw-Chui 2019)	11	65	(González. 2020)
12	27	(Nana Wu2019)	12	40	(Lombriser 2016)	12	66	(Porto. 2021)
13	28	(Hosseini 2015)	13	41	(Robson 2015)	13	67	(Hyrynsalmi. 2017)
14	29	(Tracy Harwood 2015)	14	60	(Ghaban, 2019)	14	68	(Aboo Bakar. 2020)
15	48	(Sgueo, Gianluca. 2020)	15	61	(Ferrer Conill. 2016)			
16	51	(Seaborn, Katie. 2015)	16	62	(Oliveira. 2018)			
			17	63	(Sofia Marlena. 2020)			
			18	64	(Meşe. 2019)			

All the information extracted from our primary studies has also been stored (appendix).

A. Data Composition

Gamification strategies are implementable with gamification elements. As gamification elements usability depends upon its rate of occurrence, Gamification elements are chosen based on some criteria. As criteria was extracted from [49, 50, 51] to select gamification elements such as usability, level of engagement, fun level, attractive, cost effective, well communicated, understandable etc. shown in Figure 6.

Similarly, obstacles of gamification also presented here and their solutions have been also given in our study. Furthermore, use of gamification technology instead of facial communication discussed in our study by analyzing past studies [50, 51, 52, 53].

B. RQ1: What is the effect of gamification on face-to-face communication during requirement elicitation?

Mostly 60% of projects fail due to weak gathering of requirements. There are many causes of weak requirements gathering due to communication problem, lack of user engagement, poor understanding of requirements [54]. Whereas research studies on the factor that motivate stakeholder to share their knowledge is still lacking [55]. RE is renowned as a serious factor for the success of software and systems enlargement projects, RE related issues are still in the top ten core causes of half-done or complete project failures. We need more eye-catching and motivational ways to make stakeholders skilled and accurately involved for efficiently completing all RE activities [56]. There are many requirements gathering techniques which are used to elicit requirements from users. Mostly developers prefer to get requirements from user through physical interaction in form of meetings, interviews email etc. but as with the development of technology these physical interaction sources are becoming less important due to high risk of project failure technology has been increasingly attached for motivating people and providing support. Perhaps the most widespread expansion in this area has been gamification. Gamification is better and most appropriate method of getting requirements from user and involving stakeholders as compared to face- to-face communication [56, 57, 58]. Gamification uses game-based elements, due to which user prefer it more because they show much attention in giving requirements by playing games in contrast to physical interaction. It makes elicitation process more effective by using fun and attractive ways. It has positive effect rather than face-to-face communication because by using gamification technology, there are fewer chances of incomplete requirements and system failure [59].

Gamification provides full of fun experiences to users and extends their interaction with the developer and system [60]. By guiding and motivating the user to give the needs and requirements related to system clearly, gamification actually helps to boost the whole development process [61].

For better communication it is always preferred face-to-face communication with individuals. This type of communication gets importance day by day because through it we noticed facial expressions and gesture of client [62]. But today is the world of technology so this process of communication began to low. According to this system requirements gather through face-to-face interaction cost are much higher than gathering through technically [63]. Games inflame powerful emotional reactions, such as curiosity, frustration, and joy [64]. Games can engage individuals in them for a long time, and during this process, their attention is highly concentrated which is the basic need for eliciting requirements from stakeholder. It is up to developer to engage customer in such a way that he gave requirements properly without any negligence [65, 66]. Software products, which were created and grown under the extent of control of requirements, must carefully balance. Hence, to avoid this, gamification is preferable than other methods [67].

C. RQ2: Which gamification elements are suitable to use in requirement elicitation process other than PBL?

Gamification is a technique that relates game components in non-gaming system. Gaming elements are very helpful to engage and motivate the users [68]. Gamification elements make it easy to gather requirements form user by engaging them with fun and joy. Using gamification elements, in requirements elicitation, brings out higher satisfaction, motivation, inspiration, and efficiency of the stakeholders. The job of these components is to profile user friendly interface to clients so that user can play and give requirements at the same time while doing gaming tasks. There has been high demanding in the use of game-based elements in non-game applications, to build clients commitments and increase motivation [68]. Game design elements play an important role in designing games and articulating the game's individualities [69]. With the information or knowledge of game elements, it is expected that responsiveness of gamification elements is huge. As gamification is utilized for gathering requirements from stakeholder and stakeholder must have knowledge about gamification and gamification elements [70]. The accomplishment of gamification highly depends on the decision of game methodology and elements of gamification [71].

Gamification elements play vital role in gamification concepts. It can be considered as key for using and implementing concept of gamification for gathering requirements from different stakeholders having different environment [72]. Many gamification elements are shown in studies, but most used gamification elements are known as PBL which are points, badges, leaderboard. PBL are the classic game elements used in gamification because of their efficiency and implementation. Points are concrete and measurable signal of achievement. It attempts to reward a long-term engagement of stakeholders also it is one of feedback tool. Badges are visual representation of achievements. It tends to have an influence on motivating the stakeholders, as they indicate achievement level. They are virtual rewards obtained through achievement and certain effort [73]. Leaderboards allows player to relate themselves against each other also it based on several different metrics, such as number of contributions, fans or reads. It shows the stakeholders their position in gamified environments [74]. Beside these three, there are many other gamification elements which can also be used in requirement elicitation. In the Table 4, some gamification elements other than PBL (Points, Badges, and Leaderboards) are given.

Table 4. Identified Gamification elements other than PBL used in requirements elicitation

Gamification Elements	Studies	N=18	Percentage
Trophies	[71],[73]	2	11%
Leveling Up	[71],[73],[74],[75]	4	22%
Medals and scoreboards	[70],[71],[72],[73],[74],[75],[76]	7	38%
Virtual Goods and Levels	76	2	11%
User Profile and Storytelling	[71],[75]	6	33%
Activity Feed and Story	[72],[73],[74],[75],[76],[77]	2	11%
Voting/Voice	[72],[73]	4	22%
Feedback and Missions	[70],[71],[73],[75]	4	22%
Levels and Time limit	[70],[73],[74],[75]	2	11%
Blocked content	[70],[73]	5	27%
Teammates	[70],[72],[73],[74],[75]	6	33%
Achievement and Gifting	[70],[72],[73],[74],[75],[76]	3	16%
Quest and Guilds or team	[75],[76],[77]	4	22%
Voting mechanism and Status	[71],[72],[73],[74]	4	22%
Penalty and count down	[70],[71],[72],[73]	5	27%
Count down and performance graph	[71],[72],[73],[74],[75]	3	16%
Novelty	[75],[76],[77]	3	16%
Progression	[74],[75],[76]	3	13%
	[75],[76],[77]		

Gamification elements play important role in implementing gamification technique for gathering requirements from users or stakeholder. The engagement of stakeholders in elicitation process impacts the quality of the requirements. To increase stakeholder's engagement in the system, gamification is helpful [75]. We have identified 18 gamification elements from 10 studies. According to figure 6, medals and scoreboards hold highest percentage than other elements. User profile and storytelling holds second highest percentage.

D. RQ3: How to overcome undesirable features of gamification in requirement elicitation?

The presence of gamification different domains has been thought to be based on the suspicion that it is motivational and helps to extend user involvement [75]. As gamification gain much importance and popularity with the passage of time not only in requirement gathering process but also in software developing projects [76].

In software engineering, gamification is viewed as an encouraging way that can theoretically improve the interest of developers and motivation in carrying out software development activities [76, 77].

While gamification has been mainly used on improving users' benefits on worthy issues and tasks, there are also clearly dark issues where it has been applied. No doubt gamification is new technique for gathering requirements and has benefits, but it also has some challenges [77]. Most of the previous studies and research only described its benefits and mainly focused on its advantages but not bother about its negative side. Gamification can open only if its benefits as well as its obstacles has been addressed equally and properly [78]. The applications of gamification have been determined with both of its advantages and disadvantages. Past justifications or studies and scientific research have primarily dismissed or neglected this side and only focused on its potential benefits and values. It can clarify its potential only as it was beneath such situation where complications as well as challenges have been addressed decently [79].

One of undesirable characteristic of Gamification is "interaction". When we use this technology for engaging customer, they don't have any knowledge about how to use gamification elements for this they must have knowledge about those gamification elements which we are using. For this purpose, customer must give knowledge about gamification elements first, by giving them some small tasks in which gamification elements are used. Moreover, also trained them by arranging workshops in which experts from the field of gamification participate and guide them how to use gamification in giving requirement [80]. While using gamification, some game demands user profile in which personal information are given so there are chances of "privacy risk". This work alarms the inspection of the relationship

between gamification and privacy. The researchers are also working on how to relate gamification with privacy concerns so that the protection of privacy in gamified systems is handled.

Despite of some of gamification challenges, it is most likely to use it for gathering requirements. More and more developers recognize the prioritization & benefits and have started to apply gamification as requirements gathering method [81]. Different gamification tools exist to support requirements gathering. However, with gamification, it is possible to involve users in solving real-world problems. Gamification can be used in environment where it is hard to influence people's behavior and improve their inspiration and engagement [80][81].

6. Threats to Validity

Following threats may exist to our study: -

1. Data collection and selection was done single handedly.
2. The results concluded at the end are based on the articles accessed from different databases.
3. They may produce different result as those of other relevant studies.
4. We have not included any model or framework in this study to justify our research questions; hence, at this stage our review is suggestive.

7. Conclusion

In this paper we have discussed the role of gamification in requirements elicitation. Traditional techniques also help to elicit requirements from the stakeholders, but gamification is an emerging technology which is effective in getting requirements from the user. In this article, effects of gamification on facial communication are presented, 60% chances of project crash are more in facial communication due to irresponsible behavior of stakeholders than technical communication. Gamification solves this problem by its developed technology. Also, game elements other than PBL are discussed and 18 gamification elements except PBL are derived from 10 studies in which two elements (medals, scoreboards) hold high percentage than others. Moreover, the negative effects of gamification in eliciting requirements are also discussed. From our studies we discover some obstacles of gamification such as privacy risk, interaction, and game development. We found the solution of these obstacles in our study which include complete knowledge guidance about game elements, trustable privacy services, settings and creating gamification environment. From the findings of our study, we have concluded that gamification is useful technique to be applied for elicitation as the adoption of gamification in requirements elicitation method is advancing more and more. Furthermore, we found that it has been developed for motivating and encouraging developers to work with developing software by studying users' behavior and understanding their perspectives about the system. Our work can help, and guide requirements engineer, practitioners, and researchers to work on gamified requirements elicitation. Beside this, our work may also lead in characterizing general outline to accommodate gamification in requirements elicitation process.

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Appendix

Quality Assurance for RQ1																	
S/s	Quality assessment questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Research Problems																
	Does the study state its problems?	1		1	1	1	1	1	1	1	1		1	1	1	1	1
	Does the study present a proposal that can be used in future?	1		1	1	1	1	1	1	1	1	1					1
2	Literature Reference																
	Does the study signify suitable LR?	1	1	1			1	1	1	1	1	1	1	1	1	1	1
3	Research Methodology																
	Is the research study covering the specific methodology?	1	1		1	1	1	1	1		1	1	1	1	1		1
	Does the study follow a systematic method for gamification and applied in another setting?		1		1	1	1	1	1	1	1	1	1	1	1	1	1
	Is assessment procedure specified?			1	1	1		1				1	1	1		1	
4	Outcomes																
	Does resulted material justify the concluded work?	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1
	Has some proof given after examination?		1	1	1	1	1	1	1	1	1	1				1	1
5	Total Score	5	5	6	7	7	7	8	7	6	7	7	6	6	5	5	7

Quality Assurance for RQ2																			
S/s	Quality assessment questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Research Problems																		
	Does the study state its problems?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Does the study present a proposal that can be used in future?		1			1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Literature Reference																		
	Does the study signify suitable LR?	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Method of Research																		
	Is the research study following specific methodology?	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	
	Does the study follow a systematic method for gamification and applied in another setting?	1	1	1	1	1	1		1		1	1			1	1	1	1	1
	Is evaluation method defined?	1	1				1		1			1	1			1	1	1	1
4	Outcomes																		
	Does the provided conclusion result from final results?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Has some evidence been given after investigation?					1	1		1	1	1	1	1	1		1		1	
5	Total Score	6	6	5	5	7	8	5	8	6	7	8	7	5	6	8	7	8	6

Quality Assurance for RQ3															
S/s	Examination of quality queries	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Research issues														
	Does the study state its problems?	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Does the study present a proposal that can be used in future?	1	1	1		1	1	1	1		1	1	1	1	1
2	Literature Reference														
	Does the study signify suitable LR?	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Research Methodology														
	Is the research covers the specific area ?	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Does the study follow a systematic method for gamification and applied in another setting?	1	1	1	1	1			1	1	1	1	1	1	1
	Is evaluation technique stated?		1	1										1	1
4	Outcomes														
	Does the end result provide specification for concluded data?	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Has some verification provided after examination?	1	1	1				1							
5	Total Score	7	8	8	5	6	5	6	6	5	6	6	6	7	7



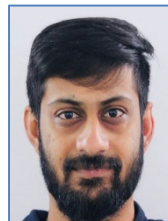
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