

Be Ahead of the Game: Gamification for Inclusive RE

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Abstract. Requirement Engineering (RE) research has evolved in the last decades, addressing new challenges emerging from advanced software development methodologies, and from extending the user population to special groups of users. Although more and more products are developed for special needs user groups, only few research works address the unique challenges of eliciting requirements for users with whom such collaboration requires overcoming substantial barriers. In parallel, the use of gamification techniques has been investigated for the purpose of enhancing RE task performance, typically not addressing special user groups. In this paper, we focus on using gamification for RE tasks, intended for three special user groups: young children, individuals on the spectrum of autism, and elderly adults. We propose a model representing cognitive barriers hindering the RE process with the aforementioned groups of users, and set the ground for a research agenda which addresses these barriers of communication and engagement, by exploring gamification as a facilitator of inclusive RE.

Keywords: Inclusive requirement engineering, gamification, children, autism, elderly adults.

1 Introduction

Requirements engineering (RE) is an important part of software development, and has a considerable effect on the quality of the deployed software and on customer satisfaction. Several challenges were found in RE, many of which are related to stakeholder involvement in, and contribution to, the various RE tasks – requirements elicitation, specification and validation ([6][11]). The RE process requires ongoing communication involving customers, managers and developers. In the software domain, RE is typically even more complex than in other product domains, as often the stakeholders come from different backgrounds, with many of the end users having little or no technical understanding of the software product developed. This makes the tasks of eliciting requirements and specifying them in a way that will be coherent to all stakeholders highly complex. RE, starting with the task of requirements elicitation becomes even more challenging when the end users have further barriers, affecting their motivation, communication capabilities, or both.

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This position paper aims to explore the use of gamification for facilitating inclusive RE. It briefly reviews existing literature in order to understand what has been achieved so far in inclusive RE, and to what extent gamification has been included in these research efforts (section 2). Next, we propose a model of communication and engagement barriers hindering RE with special populations and discuss the potential contribution of gamification for overcoming these barriers (section 3). We summarize the paper by presenting guiding research questions for future research (section 4).

2 Scientific Background

2.1 Gamification in RE

Gamification is defined as the use of game design elements in non-game contexts in order to encourage individuals to participate in certain tasks and contribute to their success [3]. In recent years, various gamification elements have been embedded in different information systems and applications in general and, more recently, in applications intended for the use of RE in particular.

Research works concerning gamification in RE have thus far been mostly examined empirically with student participants (e.g., [1][11]), with several recent studies conducted with practitioners (e.g., [8][9][10]). For example, gamification used in virtual teams during requirements elicitation was found to assist the teams to locate experts and share their knowledge [9]. Another work [4] identified three types of activities needed to be performed when engaging gamification into RE: analysis, integration, and evaluation, and found that students performing these activities had better results in RE. These research works mostly focused on measuring the outcomes of embedding gamification techniques in RE processes. Still, a systematic research revealing specific factors leading to motivation and productive behavior, thus guiding gamification design, is yet to be conducted. Little attention has been paid to the individual influence of each gamification technique, or of the combination thereof, on the results [8] [17].

In the following subsection, we bring several examples of special groups for whom gamification has been used for eliciting requirements.

2.2 Gamification in inclusive RE

2.2.1 RE for young children as users

RE for young children, who are still unable to express their needs of a software product, is usually done by educational experts, whereas the intended users are involved in the process only as testers [16]. This method, called child-centered design, is common when designing games for children. However, it does not involve the children in early stages of the product development, and, in particular, in RE. Several attempts have recently been made to involve children in RE. For example, Heikkinen et al. [7] created a tool for requirements elicitation for mobile applications for children. They found a technical gap between the children's requirements and the developers' capabilities, and concluded that with the lack of proper requirements management, many of the desired

requirements collected from the children could not be mapped to technical capabilities. Marti and Giusty [14] asked children with disabilities to use a robot for assisting them in social interactions; this facilitated the enhancement of the robot's visual interface.

The involvement of children in the RE process of products designed for them is still relatively scarce. The few attempts made highlight the need for a systematic method guiding the elicitation of requirements from young or disabled children, in a way that would lend these requirements to be "translatable" to the developers.

2.2.2 RE for end users on the spectrum of autism.

Some effort has been invested during the last decade in researching RE for autistic spectrum disorder (ASD) users. The main progress in this area is the acknowledgment that AURE (Autistic Users RE) requires special attention, such as visual over verbal communication, that rationalization plays an important role in this process, as does prepping a detailed report of the process conclusion [15].

Documented challenges of requirements elicitation for ASD users (typically focusing on children) stem mostly from the fact that verbal communication is very difficult, and while some advantages were found in the work of ASD children interacting with a robot as an agent, many challenges remained [12]. Additional empirical efforts were made, such as using picture completion tasks instead of user stories, bearing promising results [2]. In recent years, as research concerning gamification for ASD children has evolved, gamification has been used for collaboration among young ASD children as a way to assist them in understanding social contexts and encouraging motivation to participate in these games [9]. The game serves as a therapeutic tool, as well as a source of enjoyment. Such game could possibly be designed for the specific use of eliciting requirements for software products to be used by ASD children. These attempts are still in preliminary steps of their operationalization in RE for ASD users. As communication is difficult and the engagement of these users is usually low, additional strategies are needed in order to understand what their needs are.

2.2.3 RE for elderly end users

As the use of computers and mobile applications becomes a necessity today, and with the rise of digital healthcare for all, including elderly patients, elderly users often struggle with the use of these applications. One major challenge in assisting elderly users to overcome the technology gap is their lack of motivation and engagement in performing tasks related to the use of these applications [5][13].

Several examples of gamification exist in the literature, where gamification was employed to engage elderly users to use technology and to be aware of its risks. For example, a game was designed to increase elderly users' motivation in user authentication when using online applications. The results showed that although gamification was helpful in promoting authentication awareness among elderly users, the task was highly time consuming and was thus recommended to be restricted to scenarios where a higher level of security is required [5]. While limited, this example shows some promise as to the potential of gamification to engage elderly users in technology-related processes.

3 Inclusive RE Barriers - Proposed Model

Literature review reveals very few examples of using gamification as an inclusive mechanism in RE. In other words, the question of whether gamification may enhance requirements elicitation from special groups, with whom traditional RE methods do not produce the desired results, is yet to be addressed. As a starting point for directing this research, we propose a model that captures and maps the different communication and engagement levels, with regards to the example populations (see Fig. 1).

Unlike traditional RE, in which users are capable to communicate their needs, and are often keen to express their opinions and thoughts, in the case of inclusive RE, at least one of the characteristics – communication or engagement – is compromised. In the case of young children, for example, we can expect them to demonstrate high engagement in the process (and even more so, when they are asked to play a game), but the younger the children the more difficult it is to communicate with them and capture a clear and realistic specification of their requirements. In the case of elderly adults, we may assume high communication skills (as long as their cognitive condition is not impaired), but often low engagement, due to the reluctance to use technology, as discussed above. RE for users on the spectrum of autism presents challenges on both dimensions: communication and engagement.

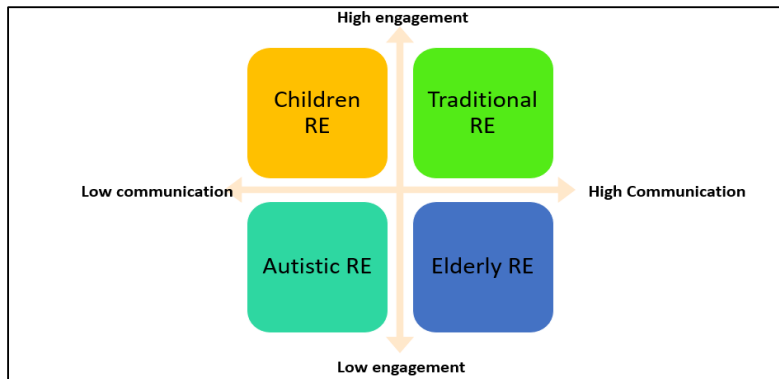


Fig. 1. Communication and engagement model for inclusive RE

We propose a research agenda that can guide research works aiming to investigate and improve requirements elicitation for special populations. Specifically, we propose to address the following research questions: How can gamification be used for improving requirements elicitation from populations with (1) communication barriers? (2) engagement barriers? (3) with both, communication and engagement, barriers?

In order to address these questions, we propose to construct a framework of models, where each model refers to various gamification techniques, with regard to different special user groups. Several combinations of gamification techniques should be evaluated for each group, trying to determine which gamification techniques can enhance the RE process, facilitating and promoting user communication, engagement, or both.

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