An Experience of Using a Board Serious Virtual Game for Teaching the SCRUM Framework

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Adler Diniz de Souza, Rodrigo Duarte Seabra, Juliano Marinho Ribeiro, and Lucas Eduardo da Silva Rodrigues

Abstract

The use of serious games has emerged as a differentiated strategy to promote the teaching of essential concepts and techniques in several areas of knowledge. To contribute to the student's formation process of the Software Project Management, this research presents the development and validation of an electronic board serious game, named SCRUMI, to the teaching of concepts inherent to the SCRUM framework. The evaluation of the proposed game was carried out according to some criteria such as usability, quality of the question and presentation of the activities, applicability and motivation. The main results showed that the game is presented as a good alternative to be explored in the classroom.

Keywords

Serious games · Project management · SCRUM framework · SCRUMI

31.1 Introduction

The gaming market has grown significantly in Brazil. According to the Vice-President of the Brazilian Association of Game Developers, Fred Vasconcelos, in recent years, there has been an increase between 9 and 15% in the Brazilian video game industry. One of the most influential factors for this index is the popularization of tablets and smartphones, which allow interactivity anywhere [1].

Due to the accelerated expansion of the games industry, many researches have been developed aiming to generate knowledge about the engagement produced by this way of entertainment. In this context, the concept of gamification emerged, which concerns the use of games for various entertainment purposes [2]. In practice, the gamification is based on the use of mechanics observed in games in contexts that are not games [3]. The use of gamification in the educational field represents a valuable tool kindle the interest of students facing traditional methodologies, making learning more interesting [4, 5].

Among the various areas in which the use of gamification may provide interesting results, from the point of view of the teaching-learning process, is Software Project Management. Back in 2004, Dantas, Barros and Werner [6] argued that the use of games represented a different strategy to promote the teaching of the essential concepts and techniques of an area that, in some cases, is eventually forgotten because project management is an activity based on the knowledge acquired from the experience of the professionals having worked on several projects. In addition, games emerged as an innovative way, once they provided the feeling of a real environment, differently from traditional simulations. According to Werbach and Hunter [7], in the corporate environment, the use of gamification has presented good results regarding customer satisfaction and motivation of employees.

Because of the constant changes in the professional market, project managers often need to fit this scenario, having to reschedule their strategic decisions, reducing operational costs and adapting their processes and services in order to meet customers' demands. Based on this need, the importance of a more responsive way of project management and flexible to changes arises. In this case, the use of the SCRUM framework can represent a differential, because it prioritizes the iterative and incremental development and the flexibility required by the frequent changes in the labor market, in addition to maximizing the competitive advantage [8].

From the scenario above, this research aims to introduce the development of an electronic serious game, using some mechanics observed in board games, which can possibly

A. D. de Souza (✉) · R. D. Seabra · J. M. Ribeiro
L. E. da Silva Rodrigues
Institute of Mathematics and Computing, Federal University of Itajubá, Itajubá, Minas Gerais, Brazil
e-mail: rodrigo@unifei.edu.br

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support the teaching of concepts inherent to the SCRUM framework. The proposed educational game is expected to help students understand related contents for learning the discipline of Software Project Management. Moreover, the study investigates, from the students' perspective, the potential benefits provided due to the experienced use of the proposed game in that discipline lessons. The main contributions of the study are: (1) to help spread the idea of using educational serious games, so as to increase their use in education; (2) to qualitatively evaluate the students opinion involved in the study, verifying if the game developed met the expectations, as well as its degree of acceptance and contribution to the teaching process.

31.2 Theoretical Foundation

Project management comprises an area targeted in organizations, representing a differential factor in the success of a project. Brewer [9] considers that organizations are becoming increasingly geared to projects, and these are growing rapidly, which requires best managers. Given the increase in the degree of importance of good management, recruiting individuals with the required skills for the success of the project is made necessary. To exercise this function efficiently, besides the theoretical knowledge that is typically acquired in undergraduate courses, the project manager must be experienced in the area, which will influence the decision-making process required for the projects [6].

Despite the practical works, traditional education lacks effectively practical experiences, as observed in the universities or in specific training courses, in which classes are usually teacher-centered and the content is presented through lectures [10]. The lessons do not provide the practicality needed to the area and, consequently, fail to contribute to students' motivation. The lack of practical resources for classes is reflected in the corporate scenario. According to Brewer [9], in corporations, a large number of projects failed due to reasons related to mismanagement, caused by the absence of trained project managers.

This reality makes it essential to improve the educational process. To make the traditional teaching more enjoyable and fill in the blanks as to the practical experience required, according to Von Wangenheim and Prikladnicki [11], there is an emerging demand for new ways of teaching to improve project management classes.

Specifically regarding project management, the SCRUM framework has been intensively applied, to introduce best management practices. SCRUM is defined by its creators [12] as a structural framework used to manage complex products, which allows integrating multiple processes or techniques. SCRUM prescribes five events, also known as ceremonies, all of which have minimum and maximum lengths defined, and may be reduced or increased. One of the SCRUM events is the Sprint, considered the key point of the framework [12]. It is a cycle of 2–4 weeks, in which an incremental and potentially usable version of the product is created. Each Sprint has a list of specific features to be developed, called the Sprint backlog. Sprint is also composed of four other events in the SCRUM: Sprint Planning, Daily SCRUM, Sprint Review and Sprint Retrospective.

31.2.1 Related Researches

Developed to complement the teaching project management concepts, the Planager game focuses on the group of processes that involve the planning [13]. Focusing on the definition and simulation of Sprints, the Scrumming game aims to meet the needs related to teaching agile methods. The player assumes the role of Scrum Master in the simulator module, and his/her role is to set the Sprint and monitor his/her progress in the taskboard, visualize the burndown chart and manage the product backlog activities [13]. Paludo, Raabe and Benitti [10] developed RSKManager, an educational serious game focused on teaching risk management in software projects. The objective of the game is to exercise and to simulate situations involving software project risk and decision-making. The research by Campos et al. [14] offers a game based on simulations, named Kallango, which aims to give students the opportunity to analyze the impact of their choices in a controlled environment using the practices proposed in SCRUM. Several other studies consistently reported in the literature feature games developed exclusively for the teaching practices of the SCRUM framework: PlayScrum [15], The Scrum Game [16], Scrum from Hell [17], Ballpoint game [18], Scrum Game [19], Scrum Simulation with LEGO Bricks [20] and SCRUMIA [11]. Another approach can be found in the recent research by [21]. Still with regard to the use of games, other researches can be highlighted [22–25].

From the research presented, it is a fact that studies involving the use of games for teaching concepts linked to project management, especially in SCRUM, have raised the interest of researchers in the development of different projects that facilitate teaching and learning the theme. Similarly to the studies presented, the motivating factor involved in this opportunity is also to provide support to students who often demonstrate or report any kind of difficulty in learning the SCRUM framework. Thus, we here present another alternative in face of this challenge, offering a new opportunity for training concepts linked to the theme.

31.3 Method

31.3.1 The Game SCRUMI

SCRUMI is a board electronic game consisting of questions and answers, whose goal is to introduce key concepts of the SCRUM framework. The game was developed by the authors of this work. In its development, we used the activities that are part of the Sprint life cycle in a software project. The platform used for the game design was Unity. The game consists of two kinds of questions: (1) multiple choice or (2) drag and drop. The questions were distributed into five phases, namely: Preparation, Analysis, Execution, Monitoring and Control and Closing.

Figure 31.1 illustrates the activities of two phases of the life cycle and the game control panel. The player's progress occurs when he hits the question related to the activity in which he is on the board. The player who moves all the spaces within the stipulated time wins the game. Each question presents an estimated response period of 1 min, and the game total time consists of 44 min. The player who misses more than ten questions or spends more than 30% of the estimated time accumulated during the match loses the game. The player who spends less time on questions will have less time spent accumulated and, consequently, will have more time available to answer the next questions.

To facilitate monitoring the player status, there is a control panel (Fig. 31.2) that allows the activation and/or monitoring of the following actions: (1) to enable/disable the sound by the button indicated in 1; (2) to show the number of the player errors indicated in 2; (3) to control of the total time spent in the game indicated in 3; (4) time spent in current activity indicated in 4; (5) the clock (indicated in 5) display will flash in yellow when the player hits 50 s on the question, and will flash in red when the time exceeds the estimated duration of 60 s for the question.

Figure 31.3 shows a question example about a specific activity of the board. After the player answers it, the game provides a feedback stating whether he/she hit or missed the question, and if he/she spent more or less time than the estimated. Whenever a player misses a question, the player wasted the time spent on the question because he/she does not advance any board space. If the player sets the question, he/she may: (1) save time for the next questions, if answered in less than 60 s; (2) waste time, otherwise.

Since every project has a risk element involved, the spaces represented by an interrogation were added to the board. These spaces bring random events, positive or negative, to the time and cost of the project and are always related to phase activities of the life cycle in which the player is at the moment. The game can be accessed via the Internet at address: http://scrumigp.com.

31.3.2 Participants and Description of Method

An evaluation questionnaire, based on ISO/IEC 25010 standard, was developed to assess some attributes. This question-

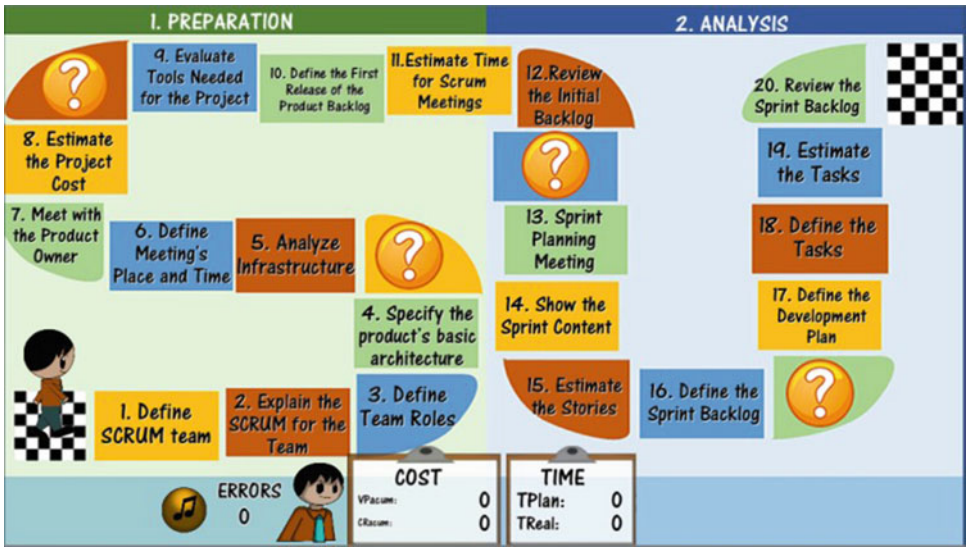

Fig. 31.1 Game interface

Fig. 31.2 SCRUMI control panel

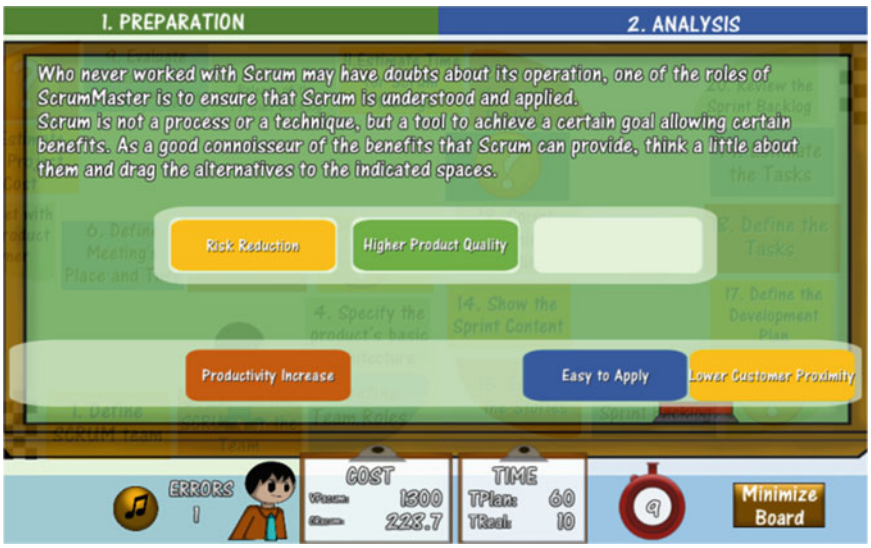

Fig. 31.3 Example of drag and drop question

naire was reviewed by an expert researcher in ISO/IEC 25010 standard, who suggested improvements to be incorporated in the questionnaire. Thereafter, game was released for a four professionals' team who have been working with SCRUM framework for 3 years. This team also suggested some improvements, especially for the interface and for the score panel. All the suggestions were fully incorporated into three new versions of the game.

Students selected to participate in the study were at a stage corresponding to the sixth period of the Information Systems course of the Federal University of Itajubá—UNIFEI. The lecturer responsible for the Software Management discipline gave a theoretical lecture about the SCRUM framework and, as a result, presented the SCRUMI game for students, highlighting its functioning and its mechanics of progress. Finally, the game was made available for use for 2 h. The class was composed of 34 students who, after playing the SCRUMI, answered a questionnaire composed of 27 questions (Table 31.1) based on the following attributes: (1) **usability**, questions 1–8; (2) **questions quality and activities presentation**, questions 9–15; (3) **applicability**, questions 16–21; (4) **motivation**, questions 22–27. All the questions presented answers based on Likert scale, whose possibilities of response varied from 1 to 5, namely: 1—strongly disagree, 2—partially disagree, 3—indifferent, 4—partially agree and 5—totally agree.

31.4 Data Analysis

For discussing the results, the following feedbacks will be considered: (1) positive—evaluated questions with answers 4 or 5; (2) indifferent—to the responses evaluated as 3; (3) negative—in the case of answers 1 or 2. Conversely, the incorrect classifications are represented as false positive and false negative rates. Intuitively, false positives represent incorrect class membership classification and false negatives represent incorrect class non-membership.

Considering the positive assessments of the **usability** attribute, 77% of the students positively evaluated the attribute; 11% rated as indifferent and 12% disagreed with some question. Through the boxplot chart depicted in Fig. 31.4, it is possible to affirm that the students positively evaluated questions Q1, Q2, Q3, Q5, Q6 and Q7. Regarding the game design (Q5), despite having been positively evaluated, this question showed the highest discrepancy as compared to the previous result, with some indifferent reviews and only a negative one. As to the game music (Q8), the student's opinion majorly concentrated on the range 1–3, showing certain rejection of this item. Because the SCRUMI is a game that requires concentration, some students complained of the sounds from the 34 computers performing the same song in the classroom. Note that the player can turn off the game sound during the match.

As to the **questions quality and activities presentation** attribute, 89% of the participants positively validated this attribute; only 8% assessed any questions as indifferent. Only 3% of the students negatively evaluated this attribute. A certain discrepancy in the evaluation of the questions writing quality (Q9) has been verified. This can be explained by the fact that two questions of the kind "drag and drop" presented a defect each. However, most of the values assigned to this attribute were distributed between 3 and 5, assuming a satisfactory result. The other questions (Q10–Q15) were positively evaluated, with fewer students expressing to be indifferent.

The evaluation of the **applicability** attribute showed an increase in positive feedbacks, adding up to a total of 91%. As for the negative results, only a few cases were observed in which some student partially disagreed with some question. For this attribute, no student completely disagreed of the

Table 31.1 Questions of qualitative assessment

Questions
Q1. Are the arrangement and distribution of items on the game screens clear and objective?
Q2. Is the navigation in the game menus easy to understand and intuitive?
Q3. Do the characters and animations of the game contribute to playful activity?
Q4. Do the arrangement and the distribution of the colors not hinder reading the items contained in the board?
Q5. Is the game design attractive?
Q6. Are the game rules clear and objective?
Q7. Was the understanding of the game and its use as study material easy?
Q8. Is the game music pleasant?
Q9. Are the questions well written?
Q10. Are the questions well reputable?
Q11. Are the questions appropriately challenging?
Q12. Based on the proposed activities, is the present contextualization at the beginning of the questions well placed?
Q13. Do the activities within each phase of the game match the phase to which they were assigned?
Q14. Are the unforeseen events of the doubtful spaces adapted to the environment in which they are placed?
Q15. Are the life cycle displayed in the game board and the activities contained therein easy to understand?
Q16. Was the game content relevant to their interests?
Q17. Does the SCRUMI allow a better understanding of the SCRUM concepts?
Q18. Does the SCRUMI assist in studies for proof?
Q19. Is it easier to study after playing the SCRUMI?
Q20. Were the game mechanics suitable to your way of learning?
Q21. Did you feel confident you were learning while going through the game stages?
Q22. Did the game catch your attention while you were playing?
Q23. Did you have a good time playing SCRUMI?
Q24. Did you have positive feelings while you were playing the SCRUMI?
Q25. Would you like to play this game again?
Q26. Would you recommend this game to your friends?
Q27. Based on the lectures, was the use of the game a different and enjoyable experience?

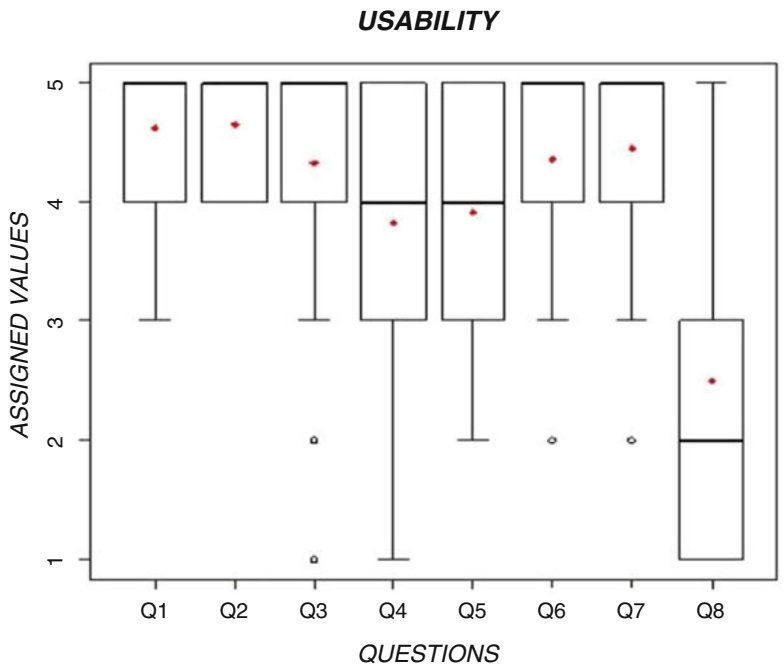

Fig. 31.4 Usability boxplot chart

questions presented. In relation to this attribute, only a few students were indifferent and, on average, a single student partially disagreed with some question. The attribute applicability still showed positive comments by some students about the game, including: "*A great game to master the content in a different way*"; "*Very cool! With the game, I learned more about certain concepts of the SCRUM*"; "*Very well prepared, although with some rare bugs, but its interface is intuitive and easy gameplay*".

Considering the **motivation** attribute, the percentage of positive ratings focused in the range of 88%. The percentage of indifferent opinions in this attribute was 8% and the negative answers amounted to 4%, and in 1% of the questions there was total disagreement and 3% partial disagreement. In relation to the overall average, the students felt satisfied and had fun playing the SCRUMI. We can conclude that the SCRUMI was well evaluated in all questions, because most students positively assessed them and few were indifferent.

31.5 Final Considerations

Unlike the old conception that people had on the use of games, currently they are being increasingly used as learning tools, for marketing, for behavioral change and for entertainment purposes. In everyday life, most people play or have utilized some mechanics related to games for fun.

Based on the evaluation carried out from experienced usage of the SCRUMI game, we can notice that most of the students felt motivated to face the game questions, seeking to supplement the proposed challenges. The idea of being the first to complete a challenge shows the human essence, because humans are perennial competitors. This, among other features, adds credibility to the study presented herein. Another point noted in testing the game developed was the students' motivation after experiencing it. Most of the students proved keen to try again when not completing the game with the expected success. Considering these, among other results, the use of games and their mechanics could be more exploited in teaching Software Project Management and other disciplines. This statement can be proven by the positive results observed in the study, and it can be concluded that the games add a differentiated and enjoyable experience, in addition to allowing better understanding of the content of the subjects worked in the classroom.

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