

# A Higher Education Experiment to Motivate the Use of Gamification Technique in Agile Development Methodology

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**Abstract**—Student’s motivation and engagement difficulties are present in higher education. Between many technologies to increase student motivation and engagement, we found that Gamification technique is the most suitable case. This paper presents our experiment of using Gamification in learning process and based on the use of the Agile methodology in-order to obtain the best results and engagements from the students. Applying Gamification in software engineering is not as straight to move as it may appear. Current research in the area has already recognized the possible use of Gamification in the context of software development. It is still an open area of research about how to design and use Gamification in this context. Higher education universities, especially in the Middle East are sometimes facing problems to get students engagement and motivation as a group structure. This paper supports the proposed idea; we presented a preliminary experiment that shows the effect of gamification on the performance of students involvement in a funded project from TRC (The Research Council) in Sultanate of Oman.

**Keywords**—Gamification; Agile methodology; mobile application

## I. INTRODUCTION

Nowadays, motivation and engagement is a very common problem in lecturers, especially when they don’t find the purpose of learning activities [1]. Therefore, as an academic lecturer, we faced a daily problem to motivate and develop student’s skills. Actually, learning strategies related to the use of game components look like an appropriate contribution to the development of these skills. Thus, “gamification”, understood as the use of game design and game elements in non-game contexts [2] becomes a relevant technique for increasing student motivation and engagement. By applying gamification into the classroom, students could be motivated to learn in new ways or become engaged in otherwise tedious tasks [3]. According to these principles, different experiences are being carried out [4], [5].

In this paper, we introduced the concept of gamification to show how it may be successfully applied to the process of Agile development methodology. Our final purpose is to improve software education/training and to improve the quality of project development for team. The aim of using gamification in Agile was to increase the engagement, motivation and to add fun to their work in the project. The gamification includes setting the comfort level of members in the workplace.

Agile methodology is commonly used in terms of software development by making the building process easy and efficient, thanks to iterative and incremental tasks including permanent testing and corrections. The attention to the human motivation and engagement issues gives Agile projects a particular relevance.

Through our course-work experiment, the method of Gamification was applied as Final Year Projects (FYPs). The method was deployed after the funding approval of project proposals by The Research Council of Oman (TRC). Agile methodology has been assigned in the project proposal as a research methodology. We integrated gamification technology as a part of our check-points by counting the students engagement and motivation in all Agile iteration process.

This paper is structured as follows: Section two presents the best practice for higher education. Agile methodology and Gamification in education are sub-sections. Section three introduces our framework to integrate gamification technology in Agile methodology. Section four aims at explaining the findings and observations of the study. Section five shows the results related to our experiment. Finally, section six presents conclusion and suggestion for further studies.

## II. BEST PRACTICES RECOMMEND FOR HIGHER EDUCATION FROM THE LITERATURE

In this section, we highlight various ways in higher education to enhance the production of software and furthermore how to increase engagement and motivation of the students.

In this experiment, the students should create a mobile application with the title “Scientific and Numerical Miracles in the Holy Qur’an” using Android studio.

The following subsections are covering first, the main methodology used in mobile application (Agile Methodology) and secondly, the new trend in higher education learning strategy to increase student’s motivation (Gamification).

### A. Agile Methodology

In mobile software engineering, we have found that Agile methodology is an appropriate for mobile application development [6]. Agility means having the capacity to move

rapidly and effectively. Utilizing Agile methodologies in software development process improvement makes the procedure sufficiently adaptable to adjust rapidly and effectively to the changing patterns and innovations. In mobile software engineering, methodology is of extraordinary significance, since software applications are perpetually changing and developing in view of quick client prerequisites. For the team concentrated on customer satisfaction by means of advancement of a very much composed application by methods of generation procedure. Agile methodology was adopted. Projects were produced through arrangement of emphases called "sprints" Projects are developed through series of iterations called "sprints". Each sprint was in a perfect world a pack of low level SDLC forms where a little sub highlight is driven from thought origination, arranging till testing stage, which took around two to four weeks to finish. Short meeting were hung once a day to talk about announcements of the group's sprint undertakings. In our case we proposed weekly meetings. Post sprint review meetings led to reporting the shortcomings and improvements. It has been found that agile-scrum process is most appropriate for project development scenarios with highly emerging or quickly changing requirements as in the case of mobile software development.

Agile methodologies aim to improve the efficiency and quality of the final developments, having the ability to respond to changes and new definitions and by providing the greatest possible satisfaction to the final user and continuous feedback. Therefore, in contrast to traditional methodologies, Agile relies on incremental developments with very short iterations, giving greater value to the individual issues with high effectiveness in unclear and changeable environments. Agile development encompasses a broad set of principles and methodologies [5].

### B. Gamification in Education

In this section, we have Gamification analysis as an educational technique. Gamification appears as a good match for education [7].

Gamification is defined as the use of game design elements in non-game contexts [8]. The most elementary gamification element consists of a rewarding mechanism that awards people in response of the accomplishment of certain activities (also known as challenges) that need to be encouraged.

We see gamification as using social gaming elements such as team-work, game thinking, and game mechanics, in non-game environments (e.g. higher education). The main promise of gamification is that it gives the educator a number of powerful and predictable tools for influencing human motivation and behavior and, when done right, to activate various types of students in pursuing learning activities. The main concern is to make technically and conceptually challenging courses interesting for classroom of students with various personalities and skill-levels [9].

There are many reasons for this 1) Games are built on sound learning principles. Play is an important element to provide concept of learn through play, as digital games can provide an opportunity for play through simulated environments. 2) Games provide an environment where failure can happen without consequence, allowing learning to happen. 3) Games provide personalized learning opportunities. As games

support the use of levels, games can provide students with the ability to learn at their own pace and at a level that suits where they are. 4) Games provide more engagement for the learner. Games contain the pieces necessary to engage students and help them enter a state of flow [10], where they are fully immersed in their learning environment and energized and focused on the activity they are involved in. 5) Games teach 21st century skills. Teaching and assessing 21st century skills frequently require exposing learners to well-designed complex tasks, affording them the ability to interact with other learners and trained professionals, as well as providing them with appropriate diagnostic feedback that is seamlessly integrated into the learning experience [11].

Gamification can be divided into two main categories: internal and external [12]. Internal gamification focuses on motivation of internal employees in some company. It has several types of use in internal environment such as company development, Human resource improvement and work efficiency; while external Gamification is customer-oriented and it focuses on building strong connections between customers and a company. Propagation is a part of external gamification when it is implemented into web pages to motivate visitor to be more interested in a board. Education is another part of external Gamification. It is mainly used in e-learning courses or as a part of the software user guides.

### III. FRAMEWORK FOR AGILE GAMIFICATION

This section focuses on the use of game elements in Agile methodology. We have a previous experience of using Gamification in higher education classes [13]. Our previous experiment results show a very positive feedback from students and the pass rate was increased, as well.

In this experiment, we have created a framework to include gamification technique in Agile methodology life-cycle. Many gamification frameworks exist in the literature and most of them were developed with business, as shown in the bibliographic review [14]. Gamification in learning focuses on specific experiences [15], [13]. The approach to a conceptual framework in education context based upon Agile methodology also presented in the literature [5], [7], [16], [12].

In Agile, gamification is often used as part of release planning [17]. The release planning requires a high level estimation to give the business an indication of what stories to include in a release and how to prioritize them. However, when faced with the need to produce an estimation, the team were spend a significant amount of time, discussing the low level detail, and how the story would be implemented, rather than giving an estimate. These discussions were often only of interest to the development team, or sometimes specific members of the development team, with others in the meeting quickly losing interest. The release planning session was used to estimate and prioritize many stories [7].

From the previous definition, we have noticed that gamification is a great tool to increase peoples interests. That is why game became very common to use in Software Engineering as well as our experiment used same concepts of Agile methodology and we added the gamification technique in the proper phase or iteration in Agile. For the followings, we explained

some of the game concepts and how we have integrated in the Agile methodology life-cycle.

1) **Team profile**

It is important to the team to understand that team success can always be a good motivation element for all team members. Each team member can publish their profile status, results and evaluation, gain experience point, team velocity, gain budget, etc.

2) **User profile**

Since we are dealing with mobile application, it is important to know some of the main data such as contact information and relevant information expertise, skills and user feedback.

3) **Experience points**

With the end goal of users' motivation, exertion spent by utilizing Agile structure must be compensated. Picking up experience points is an exceptionally valuable method for user's evaluation with the end goal of reward framework. Experience points should be received during whole development process for teams' achievements. As an inspiration apparatus, experience point ought to be increased just for significant exercises. Framework gamification is intended to contain these point-gaining possibilities:

a) **Points for work time**

Teams and their members get experience points for every week for work in the environment using Agile framework. Prototype is designed to give every person 2 points for every week spent in the team assigned to some projects.

b) **Points for finished user stories**

Every user story should be evaluated ,with its completion being rewarded. Main parameter of this evaluation type is sum of really finished (state Done) user stories compared to sum of user stories planned to be finished during current sprint. Both team and its members get 0 to 5 points according to ratio mentioned above for every week spent in previous sprint, after it ends.

c) **Points for efficient work**

If sprint ends and all finished user stories from sprint backlog are approved by product owner, the team gets 1 point multiplied by average product owner evaluation of customer satisfaction for every week of such sprint.

d) **Points for integrated work**

Each team member is responsible to integrate his/her work with other team member in a Drop-Box file. For each correct integration activity they get 1 point.

4) **Progress bar**

People always like to see their progress in visual forms and not just as a number, so the framework should also contain a progress bars which display how much experience points user/team currently has and how much points are left.

5) **Badges**

Team evaluation by experience points is a good

approach, more can be done more for their motivation increase, such as system of gaining badges for some achievements. There exist lots of opportunities, for which users and teams can gain some badges. Badges are evaluated regularly as mentioned at every badge description. Gamified Agile framework should contain at least these team badges:

a) **Hard workers**

All sprints of given team in last semester have been completely finished (with no undone user stories), evaluated once at the end of each semester.

b) **Stable workers**

Velocity of sprints in the last semester, evaluated once at the end of each semester.

c) **Completion masters**

All user stories of one project has been finished before end of the project, evaluated after end of the project.

d) **Customer importance**

Product owner is satisfied with the team work, evaluated after end of the project.

6) **Attendance holder**

Team average attendance. Evaluated once at the end of each semester.

7) **Team leader board**

Agile is based on the rule of team as an individual. People are typically motivated by comparison with others, so the prototype should contain leader board which compares results of all teams.

8) **Rewards**

It is really great to have a system, which can show differences in efficiency and work effort between people and teams, but all of that is only in virtual world. For better motivation of all members of development teams, there is also a need of some tangible thing they can get.

The main purpose of this experiment is to integrate gamification into Agile framework in a way that it increased the motivation and engagement of all the team member. We have selected Agile because it is defined as a way to increase motivation among the whole team as a unit and gamification to motivate individual team member. In our experiment, each student should submit two products. First, as his/her individual work to be evaluated as a final year project. Second, an integrated project with other team member as a FURAP (Faculty Mentored Undergraduate Research Award Program) scholarships are granted by The Research Council of Oman (TRC) through higher education institutes, colleges and universities in Oman project. The challenge was how to evaluate both products in a separate measurement procedure. A team member should communicate with other members and at the same time, must be careful about submitting similar projects.

For motivation increase, we have used the following modification and its gamification improvement:

- **Unit tests**

Unit tests are good for fast and efficient software development. It can improve team effort to maintain framework rules and it can be based on their importance.

- Test-driven development uses a very simple process for test creation and product implementation. This process can be very easily adapted on creation of unit tests and helps to maintain the order and clear work-flow.
- Pair programming Pair programming belongs to often used development methods in Agile approach. It has several advantages such as increase in the team members' substitutability, more educated employees with wider knowledge and more efficient development with less mistakes.

#### IV. OBSERVATION AND FINDING

This section tends to discuss our observation in applying Agile Gamification in this mobile project and the practical experience faced in developing our Android application. Today's smart phones support many different programming options. We focused on the Android platform, since it is one of the most prominent platforms so far [18], with the largest number of available devices [6].

The present study aimed at finding suitable answer for the following questions:

1) **Can gamification used with Agile project and improve the tracking of Agile?**

2) **Can gamification improve the efficiency of the team and what are the impact on the team motivation?**

There was a positive result of our experiment. Our observation has focus on four main areas:

- 1) **Engage**  
Adapting gamification in the different phase of Agile methodology life-cycle increases team engagement. Students notice that their individual work will be integrated with other team members work and this issue increase their challenge to submit high quality work. We have noticed that engagement has been increased in the integration activities. For those activities, we propose target environments such as dealing with same Android studio version and using Drop-Box to store the latest integrated version of their practical work.
- 2) **Train**  
The final objective of the study was to improve both software education and training. In addition we aimed at improving developments activities frameworks. Actually, using pair programming increases training among the team members. They have created also Whats-up group to share their knowledge, information and to support team member to solve any technical issues.
- 3) **Monitor**  
It was a confusing task to be a student supervisor and at the same time, a team leader for group project. This was the main reason to search for a technique to be assisted in that complicated task. The gamification technique facilitate the monitor tasks and gave us an easy indicator to monitor the students' behavior and performance both individually and as a team work.
- 4) **Motivate**

Points system and rewards with points increase the student's motivation. Furthermore, level access and power increase their achievements. For example, students may get access to additional materials. As the project was funded, budget was also a reason to increase student's motivation, since this was the first time for students to avail funds for their work.

#### V. RESULTS

Finding of the experiment revealed several benefits of using Gamification integrated with Agile methodology through Android Studio. Some examples may include 1) project risk minimization; 2) better productivity; 3) High range of quality assurance; and 4) on-time project release.

Our basic idea was to develop a light weight mobile application as shown in Fig. 1. We have achieved the requirements to be easy to use and understandable in two languages Arabic and English. The software is still under the evaluation phase with different customers. The Alpha version will be published soon on the Google Store and with feedback from actual customer to generate the second version if required. The team

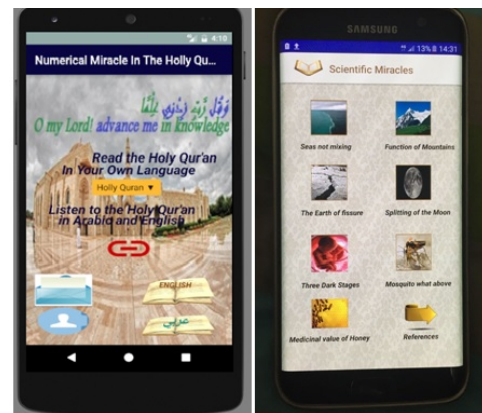


Fig. 1. Mobile application environment.

members in this experiment got the highest marks in their final year project grade in comparison with normal students.

#### VI. CONCLUSION AND FUTURE WORK

Several research about gamification success in driving desired behavior already exist [19], [20], [21]. Gamification does not necessarily mean success [22]. It also depends on the form of gamification integration, used elements and target domain.

By using Gamification Agile in our experiment, we have been able to increase students engagements and motivation and increase the project quality. Finally, it gave us a good benchmark to evaluate team individually and as a team work. The application was developed using important features from (Agile), technique from (gamification), software application by using (Android studio).

The Mobile industries need to adopt software development methodologies that provide a balance between market-oriented and technical activities in order to sustain in today's market.

It is conceivable to enhance the current experiment by augmenting the project and running it over a more extended period. Through this approach, the information could be analyzed crosswise. This would in turn diminish the probability that the outcome was identified distinctively. A further augmentation to this would run the gamification in more than one group.

Another area of research would be searching for a way to acquaint observing with a group in a convincing way. As talked about in the evaluation, the group profited from exact estimation of the venture, yet at the same time opposed observing to help them to accomplish exactness. In summary, education and gamification turned out to be good fits. Gamification helps to increase the engagement in a fun way.

The aim of this paper was not only to report on the outcomes of the research project, but also to describe our experience with an approach for a teaching and a learning method.

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