LEARNING AGILE METHODOLOGIES THROUGH GAMES

**ABSTRACT**

Game is an excellent tool for learning. Agile methodologies can be taught by using games. This paper throws light ongames that can be used to explain agile methodologies and the learning outcomes of it. Learning agile through games has proved to be an effective method in the real world. Also, this idea can be related to the concept of ‘learning made fun’ which not only encourages people to learn about agile but also makes it an enjoyable experience for them**.** Observations suggest that many companies have followed this approach for team building and employee development. So, by implementing this approach in the undergraduate level and graduate level, it will be very beneficial for the students who are learning agile.

Keywords: Agile games, Scrum, Kanban, Lean, team building, active leaning

**1. INTRODUCTION**

A Software Engineer needs skills and knowledge to analyze and understand the requirements of a customer. If the current educational institutions emphasize on teaching these skills using games, apparently students acquire more theoretical knowledge through their course work than practical knowledge [2]. As far as a real time project is concerned, the goal of the Software Engineer is to identify which software process model suits best, based on the many criteria such as valid requirements, time constraints and budget. To achieve this goal, software engineers should be well-versed withthe software process models and the corresponding tools that manage the process. So, for students to become good software engineers they must be able to practically apply whatever they learn.

Collaborating games with software process models creates enthusiasm to learn and help the students easily understand the concepts. This can be carried out as an in-class activity. It is intriguing to hear that agile process model has turned out to be one of the most effective models ever known [16]. So, this paper focuses on collaborating games with agile methodologies. This paper also explains the games using which students can easily learn Scrum, Kanban, and lean.

This paper is organized as follows. Section 2 explains different games used to teach agile methodologies. Section 3 is on learning outcomes of the students. Section 4 has the future work and in the Section 5 paper will conclude.

**2. METHODOLOGY**

The idea of learning a concept through games has been considered as most efficient way of learning since many years [3]. People of all ages love to play games that are fun and engaging [4]. There are enough reasons to prove that games allow students to focus well enough to learn better [5]. The following are the games used to teach Agile methodologies to the students.

**2.1 AGILE COIN GAME**

Agile Coin game is a basic game where students will be introduced with the concept of Agile. The goal of the game is to teach the students the difference between Agile methodology and Traditional methodology. For this game, students would require stack of coins, an end user, and two teams, where one team takes the side of Agile model and the other team takes the side of traditional model. We would also need two observers with the timing devices. A team should have at least three students in it.

The rules of the game are simple, the team which has taken traditional model (Waterfall model) side will follow sequential approach, so they should turn the coins each one over and stack them. Once all the coins are done, students pass the stack to the next sequence and the process should continue until the last sequence. The team with Agile side will follow incremental and iterative approach, so they will break down the stack into individual coins and as soon as they flip one coin, they can pass it to the next person and so on [6]. The first observer will note the time it took for the first coin to reach the end user. And the second observer will note the time it took for the last coin to reach the end user. The end user will note the complete time taken to process all the coins. The observation is that the time taken for the coins to process in Waterfall model is longer than the Agile model [7].

**2.2 KANBAN PIZZA GAME**

Kanban Pizza game is a good way to learn Kanban if one wants to practice some Kanban concepts in a safe environment outside daily work. It was originally developed by an Agile coaching company called Agile42, which mainly focused on visualizing Kanban flow [8]. The game has 4 rounds; at the end, students can understand the workflow of Kanban.

In the first round, we divide the students into teams, and each team is given a ready-made slice of Hawaiian Pizza and is taught about what goes into the pizza: a slice of pizza base (paper triangle), tomato sauce (red marker), three slices of ham (pink Post-Its) and three slices of pineapple (yellow Post-Its). There is also an oven in the game which can hold a maximum of three pizzas. Cooking time is at least thirty seconds. Now, the teams will be asked to produce as many pizzas as they can while trying to avoid waste i.e. raw materials prepared but not used. Once the first round is done, the scoring system will be explained to the teams. The teams will be asked to analyze their work. Now, second round will begin with newly established Kanban system. One minute will be given to the team to reflect upon how well their plan worked and what didn't work out, and another minute for rebuilding the workflow. The team will have to play around with the workflow. In the third round, the game becomes slightly more complex by introducing customer orders and a new Pizza Rucola recipe. The team gets points only when the order is fulfilled. Pizza Rucola contains no toppings except seven pieces of rocket salad (green Post-Its). Counting of points and reflection of performance is same as previous rounds.

The final step in the game is to visualize the process by creating something that is closer to a real Kanban board. The teams will be asked to reflect on the flow of the game; they will draw the flow on a whiteboard (including WIP limits) and make it look nice using paper materials and pizzas produced during the game. Over the course of the game, each team created a workflow that made sense in their own context of people, resources and bottlenecks. Every team has a different way of working and it doesn't mean that any one of the boards is necessarily "more right" than the others. During the game the teams learn to introduce limits on the work in progress (WIP) so that they produce the right things and avoid losing points for unused materials. As the teams keep going into later rounds, they learn to keep inventory down and maintain flow by tightening the WIP limits [9] [10]. Thus, the pizza game allows students to experience the Kanban workflow just by being part of a simple yet enjoyable game.

**2.3 LEAN AIRPLANE PAPER FOLDING GAME**

Lean methodology is used in manufacturing industries in order to eliminate waste. Lean was first implemented in the Toyota industry. Students can understand the concepts of lean by using Airplane Paper Folding Game [11]. This game will cover the lean concepts whether it is in software development or in manufacturing industry.

Lean methodology can be explained by using push v/s pull approach. This game distinguishes push v/s pull approach along with idle WIP and throughput time in the pull approach [12]. In this game, students will be divided into teams and each team can have 4 members in it and also an observer who will act as a Quality Analyst (QA). QA will analyse the quality of the product. The game has two rounds; push and pull rounds. In the first round, i.e. push system, students will make the inventory as soon as they can and will push the work to the next work centre. There will be no limit in WIP and students will be provided with the inventory i.e. papers to make the airplanes. The observer will insert a coloured paper in the inventory. But, students have to follow FIFO (First In First Out) approach, so they can’t use the coloured paper in the middle by jumping ahead of plain papers. The QA will also track the time taken for the entire process to complete. The process is completed after the last airplane is made and put in the finished goods. Now, the discussion is done among all the students about identification of bottleneck, throughput time, and line balance.

In the pull method, customer pulls the product from the supplier when needed. A space between each student is created in the form of Kanban box. So, in the team of four members there will be three Kanban areas and limit the WIP to one [12]. So, the student shouldn’t start the work unless the next student leaves the Kanban area empty. When the Kanban area is empty, then it means it needs more production. So, as a result of this process, each student will have a smooth traffic, control over inventory, an organized work place, and a shorter lead time.

**2.4 SCRUM SIMULATION WITH LEGO**

Scrum methodology is one of the Agile principles in software industry. Students can understand the important principles of Scrum by using this game. It was developed by Alexey Krivitsky in the year 2009. It was followed by some trainers to teach Scrum methodology in the software companies. The developer has received good feedback and appreciation from the trainers [13]. This game can be taught by using LEGO bricks [20]. Students will be divided into teams with 4-5 members in it. Apart from the team members, the game should have one member as a product owner and one scrum master. At the end of this game, students will understand about product backlog, sprints, and sprint reviews.

After organizing the team, students will be briefed with the process. Students have to build the city by using the Lego bricks. They need to build the backlog of the product and then plan the sprints accordingly. A city will have houses, hospitals, church, school etc. So, students have to develop the city according to the backlog. This game will have three sprints, with fifteen minutes given for each sprint. Students will work on backlog for an hour and three minutes on planning, seven minutes on sprinting, and five minutes in reviewing the sprint. At the end of each sprint, students will have retrospective in which they can discuss how the sprint was. The product owner will help the team in designing the product and the scrum master will manage the entire process on how the information being exchanged.

Once the game is done, the city will be presented to the product owner and he will review the product. So, the students will learn to prioritize the backlog and can measure their team’s velocity. The team can also understand on planning and organizing the tasks in the sprint. They will learn to measure the performance and improvements in the sprints. Scrum master can learn to mediate between the teams and the product owner. Some trainers found this game to be useful in training the employees and they wish to continue this game for training in the near future [14][15].

**3**. **RESULTS AND** **LEARNING OUTCOMES**

Agile methodologies are mostly used now in software industries [16]. They can be taught to students in many ways, but teaching Agile through games is a fun and interactive approach that allows students to grasp the key points and concepts of Agile. By implementing this technique, students will get the feeling of working in the real world [17]. Instead of using these games to train the employees in the software industries, we can use them to teach the students at graduate level so that they will have more time to work on these methodologies.

The feedback from the students will be very positive. After the game, the instructor will compare the game with Agile methodologies concepts. So, students can easily correlate the game with the concepts. There will be active participation from every student and they can understand the concepts easily. So, instead of teaching them in a traditional way by a simple lecture, it is always good if they experience the principles on how it really works [17]. As a result of being taught with Agile games, they will gain the real world experience without being engrossed in technical world [18].

**4. FUTURE WORK**

Teaching Agile concepts to employees through games has been a great success in IT industry [19]. Looking at the positive influence and growth which Agile has brought to IT industry, the organizations and companies are coming forward to build the foundation of Agile concepts at an early stage for students through the means of games. Companies like Agile42 and Tastycupcakes.org are developing new games which students can play easily in the classrooms as a fun exercise [21] [8].

Many workshops are being conducted to promote this teaching technique. As learning a concept through games is a fun exercise, students can actively participate in the exercise and learn the Agile concepts [18]. Agile trainers have been using the games as a source to teach Agile, and have found it to be useful over a decade, and will continue to use them in the near future [22]. In the future, we can see many workshops that promote teaching Agile concepts using games.

**5. CONCLUSION**

Therefore, with the revolution in technology and IT industry outgrowing every possible boundary, it is essential for employees who form the building blocks of a company to be familiar with Agile, which is surely one of the most used workflows in companies [16]. The best time to get familiar with these concepts would be college so that as fresh employees they are well-aware about the way an organisation functions and hence contribute their best. By the means of games this whole process is made fun and it also reveals the advantages of Agile methodologies over other existing workflows. It promotes adaptive learning, quick implementation, and rapid development.

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