Agile in 3D: Agility in the Animation Studio

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Abstract. Agile Software Development has been gaining importance because of its adaptability, focus on people, continuous improvement, and short construction and delivery cycles. Companies outside the software engineering context also desire such qualities. This paper presents a case study where a 3D animation production company adapted Scrum and Lean Kanban methods to achieve better results by reducing the effort required to create their products and make them available. The results demonstrate that the adaptation led to a shorter animation development time, helped the team track product evolution, increased automation, made the development process transparent and improved team engagement. This paper provides evidence that the animation industry can benefit from adapting and adopting Agile.

Keywords: Agile · Scrum · Lean · Kanban · Animation · 3D Studio

1 Introduction

Animation studios are companies that deliver solutions ranging from the creation of illustrations and small special effects to the development of feature films. They operate in creative environments, characterized by the non-linearity of their actions and by their complexity and even chaos. However, they also face the restrictions of corporate environments, such as costs, deadlines, scopes, client relationships, contracts, etc. [12].

The challenge of conciliating these characteristics, and the difficulty of making the professionals respect these restrictions and stop missing deadlines, led the 3D animation studio described in this paper to search for a solution to the following problem: How to do creative work while respecting the deadlines and the production pace agreed upon with the clients?

This work presents the result of the action research carried out and describes how Scrum and Lean Kanban practices were used to shed light on the problem

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and help find a solution. The objective was to explore how Agile software development methods can be adapted to the production of 3D animation, engaging people not only in the development, but also in the self-management of their products, reducing delays and consequently improving client satisfaction. Here we describe how the work process was built collaboratively and iteratively by collecting efficiency metrics, feedback and views from those involved in the process.

The paper is divided as follows: Sect. 2 presents related work used as support for this study. Section 3 describes the action research method used. Section 4 presents the experiments carried out to build the management model used in the animation studio. Section 5 presents the results obtained in the study. Section 6 concludes this work and indicates next steps in the research.

2 Related Work

Agile Methods have crossed the boundaries of software development. They are currently used for teaching [6], scientific research [9] and hardware product building [4]. Animation and visual effect creation has also experienced the benefits of these methodologies. Yothino et al. [13] described the experience of adopting Scrum for visual effect production. The authors identify the framework's ability to increase control over the creation process and improve project quality as the main reason to adopt it.

In another application, the same group of researchers applied Scrum again, this time as a knowledge equalizer, so that professionals from different backgrounds could create visual effects collaboratively. The framework was used to speed up the creation process, in the short space of just three weeks [14].

These contributions show that Agile Methods can assist in the management of animation creation through iteration cycles. However, they were applied to new projects and controlled environments. The present research was applied to a real company, with the corporate pressures of costs and deadlines, and to an ongoing project. The goal was to reduce delays, identify bottlenecks in the process, and adapt not only Scrum [11], but Lean Kanban as well [1].

3 Research Method

The action research method was considered the most appropriate because of the need for researchers and study participants to collaborate, the qualitative nature of the results, the complexity of the system assessed, and the need to perform multiple experiment cycles to reach the best possible result [8].

This scientific method has similarities with Scrum [11] and Lean Startup [10] Agile development cycle. The researchers start by identifying solution hypotheses, plan the validation and execute the experiment. At the end, after result collection and analysis, the researchers can assess and propose new solutions to the problem, thus achieving continuous improvement [7].

However, there are challenges to action research, because data capture and analysis depends on qualitative information perceived by the researchers and

obtained through feedback and interviews with the team under study. To reduce this challenge, we used the Cognitive Task Analysis (CTA) method. This method is recommended when the tasks to be analyzed require intense cognitive activity by the user, such as decision making, problem solving, memory, etc. [5].

3.1 Method

The activities carried out in this study began with an interview with the animator responsible for the team and the researchers. The purpose of the interview was only to identify the challenges faced by the production company.

Following the CTA process, based on the interviewee's information, a timeline with the most significant events the team had gone through was drawn. We then determined the most relevant points in the discussion. This way, we were able to classify the attention points into four types: Management, Development Process, Deadline, and Client. Figure 1 presents the result of this initial analysis.

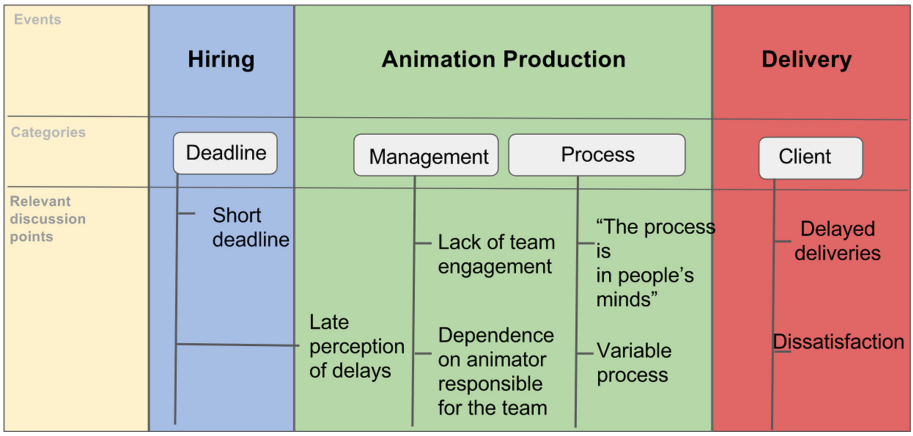

Fig. 1. CTA of information captured during the interview with the professional in charge of the animation.

Once classified, the issues were prioritized by the interviewee as follows: 1. "The process is in people's minds"; 2. The team lacks engagement with management; 3. Dependence on animator responsible for the team; and 4. Late perception of delays. According to the interviewee, variable process and client dissatisfaction are consequences of the prioritized problems. The short, one-week deadline is a given that cannot be negotiated.

This way we were able to understand the issues the company was facing, develop the research question (Sect. 1), and create assumptions and experiments to solve the problem (Sect. 4).

After applying the CTA, we carried out bibliographic research to assess how other organizations operating in a similar context have dealt with the issues identified.

Table 1. Experiment summary table

Experiment cycle	Problem	Objective	Duration
1st	Chaotic and unstructured process and high dependence on the responsible animator	To structure the work process	15 days
2nd	Delays and Process Variability	Define and give transparency to the process stages, highlight bottlenecks, increase team engagement	15 days
3rd	Delays and Process Variability	Deliver an episode of the animation in 7 days	15 days

We used the IEEE, Springer, ACM DL and Google Scholar databases to locate academic contributions. The most relevant results are mentioned in Sect. 2. Because the number of academic contributions was small, the researchers searched Google for industry solutions to this type of challenge.

Based on the obtained results, the researchers proposed a process-monitoring model based on Scrum [11] and Lean Kanban [1]. The method was applied and improved in three research cycles, each one lasting two weeks. At the end, a new interview was carried out with the head animator to record his feedback and assess the results achieved by the model in relation to the issues identified through the CTA. Table 1 shows the experiment cycles, the problem that each experiment tried to solve, goals and duration.

3.2 Limitations

The proposed model was created to accommodate the production specificities described in Subsect. 4.1. Some characteristics of the professionals involved in this experiment made the model implementation easier. The most important of these are the company culture of innovation and experimentation and the adaptation capacity of the team members.

Moreover, the results obtained are qualitative, so they depend on the subjective analysis by those involved both in the team under study and the research team.

Another limitation is the small number of academic contributions available on the theme. This limitation makes it difficult to compare the proposed model's results with others. The expectation is that this model can be adapted and applied to other producers, so we can assess its potential generalization.

4 Experimentation Cycles

4.1 Context

The company that participated in the action research is a 3D and 2D animation producer. It has several production contracts and provides services from

scriptwriting to post-production. The team that participated in this research is composed of five people: two animators and a production assistant who work exclusively in the production under study, as well as a scriptwriter who is responsible for each episode's narrative, and a voice talent who does the character voices. The two latter team members divide their time among various animation teams.

The company's need to improve the way it manages its creative process arose from a new contract, whereby they would produce and publicize a series of two-minute videos published on YouTube every week. Production started in a poorly organized and hurried manner. The production stages started to get behind schedule, and team members missed what had to be done. It was important for them to visualize what was happening and how they could make up for lost time [3].

The challenge was how to efficiently manage the creation process for this animation series so that there were no delays, ensuring client satisfaction and a lasting contract. The initial delay was of more than seven days.

4.2 First Cycle: Scrum Adaptation

The first experiment cycle had the goal of making the creation process management easier. Because Scrum [11] is a simple framework with clearly defined development stages, roles and ceremonies, it was the method of choice for this goal.

During the cycle, items were defined that could make activity monitoring easier. The stories that represent the client's needs (User Story) were adapted to represent the series episodes. Each episode is defined by the producer's manager, who played the role of Product Owner (PO). His main responsibility is to define and prioritize the themes each episode should cover. He actively participates in each episode's planning and review when these are presented by the creation team. The professional in charge of the animation team played the role of Scrum Master (SM), facilitating the team's work. The remaining team members played the role of the Creation Team.

One of the assumptions for the animation series was that it would include recent topics in the media and promotions, so the PO must keep a clean Product Backlog. He has stories for one or two iterations (Sprints), which last two and a half weeks.

Iteration Planning (Sprint Planning) is done between the PO, the SM and the Creation Team. In this planning, the PO presents the episode topics and the team chooses what will be done in that iteration. For each iteration, three episodes are chosen to be part of the Sprint Backlog.

The team also adopted as Definition of Ready that the topic must have been chosen by the PO and debated with the team during planning. The execution is monitored through Daily Meetings. The episode is ready (Definition of Done) when it is created, rendered, edited and has the promotional material prepared.

At the end of the iteration, the revision meeting is held to show the animation to the PO and collect his feedback. The PO, the SM and the Creation Team are present in the meeting.

After the review, in the Retrospective Meeting, the team's feedback is collected about the method and how it could be improved. According to the team, Scrum was useful to define roles and significantly reduce the team's dependence on the head animator. That was important to "take people's minds off the process". However, the project started behind schedule, with stories that had not been delivered at the end of the iteration. The team also showed little engagement with project monitoring, and the process continued to be non-predictive, with tasks arising during the Sprint. Moreover, although they had realized that they were going to be delayed, they thought this was not very clear. In fact, the delay observed before the beginning of the experiment was not shortened.

4.3 Second Cycle: Life Cycle with Kanban

The objective of the second cycle was to make the process stages more transparent and the delays easier to visualize. Kanban was chosen because it is a method that can represent the entire value chain of the work process and reveal handoffs and bottlenecks [1].

The concepts adapted from Scrum were maintained: the roles of PO, SM and Team; the Planning, Daily, Review and Retrospective meetings; the definitions of Prepared and Ready; the Sprint Backlog; and the episodes as User Stories. After analyzing the activities carried out by the Team, it was observed that the creation of episodes could have been better described through the following value chain:

1. **Script:** Creation of the story to be told in the episode;
2. **Narration:** The voice talent reads the script;
3. **Modeling:** Creation of the animation items: characters, vehicles, objects, background, etc.;
4. **Blocking:** Animation of key sketches of characters and objects in the scene;
5. **Cleaning:** First refinement after blocking;
6. **Lip Sync:** Synchronizing the characters' movements and the narration;
7. **Refining:** Refinement of the animation to check for problems;
8. **Rendering:** Animation rendering, which results in the first version of the video, still without the background;
9. **Correction:** After putting the video together and rendering it for the first time, motions and element synchrony must be corrected;
10. **Composition:** Addition of background scenery to characters and objects;
11. **Editing:** The whole video is watched and, if needed, edited to fix any remaining problems.

Moreover, the need for the team to also focus on the promotion process of the episodes was identified. This process begins after the Blocking stage and involves composing the promotional material and creating the opening sequence that will be used to promote the animation.

Based on this feedback, the board was redesigned, as shown in Fig. 2.

Not all process stages are sequential. As can be seen in Figs. 2 and 3, after the Script is defined, the Narration and Modeling stages can be done in parallel.

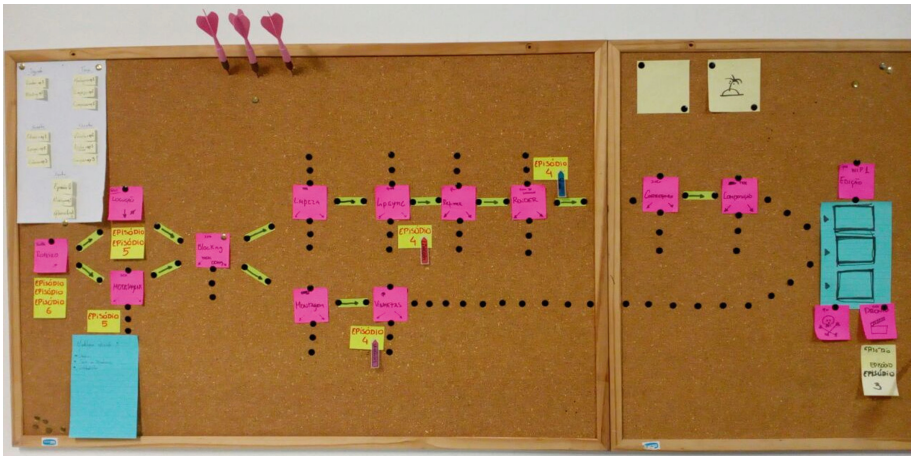

Fig. 2. Kanban Board to monitor animation production.

However, both must be ready for the Blocking stage. After that, the process is divided into two well-defined sub-processes: episode Creation (upper line) and Promotion (lower line).

Besides the board, the team adopted important Lean Kanban features: the first is a limited quantity of items in execution (Work in Progress). Each stage can have one execution item at most. However, because there are two animators on the team and each episode is two minutes long, they decided to divide the episode into Minute 1 and Minute 2, working on Cleaning, Lip Sync, Refining and Rendering in parallel. Minute 1 is placed above the name of the stage, and Minute 2 is placed below.

The action and waiting steps in each stage are also represented. When the episode is to the left of the division (three tacks), it means that the item is stopped, awaiting execution (To Do). When it is to the right of the tacks, it means that the item is being executed (Doing). When the animator concludes that stage, he moves it to the To Do column of the next stage.

Observing Fig. 4, the board should be read as follows. For the current iteration, Episode 4 was selected. Minute 1 of the episode is being rendered. Minute 2 is in the Lip Sync stage. Meanwhile, in the Promotion process, the composition was done and the episode is awaiting the opening sequence.

The Definition of Ready adopted by the team was maintained, but it started to be visually represented on the board by the three editing boxes (blue paper in Fig. 5). The first box is occupied by Minute 1, the second by Minute 2, and the third by the promotional material. When all three are completed, it means that the episode is ready.

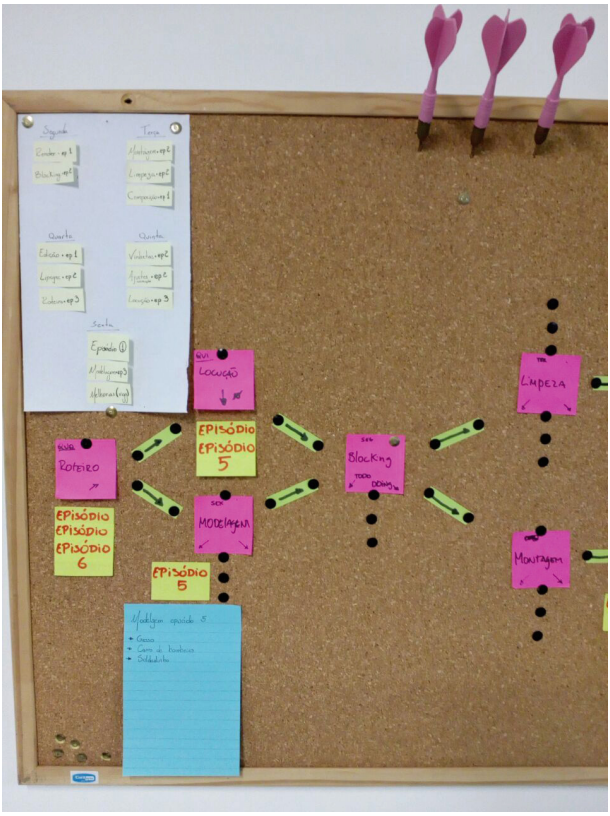

Fig. 3. Approximate view of the first part of the Kanban Board.

With this new format, another experimentation cycle was planned and executed, and the first three episodes were delivered. Once again, comparing the relevant points brought up during the CTA, the team displayed better engagement with self-management, dependence on the head animator was virtually nonexistent, the creation process became clear with the board illustrated in Fig. 2, and it was no longer subject to variability. The animations were delivered, although four days behind schedule.

4.4 Third Cycle: Lean Kanban

The last experiment cycle had the objective of eliminating delivery delays. To achieve that, we chose to explore Lean Kanban techniques [1] more deeply.

The team started to work on a continuous flow of episodes. Instead of doing Sprint Planning and defining what the next three episodes would cover, they decided that at each delivery they would present the episode to the PO and

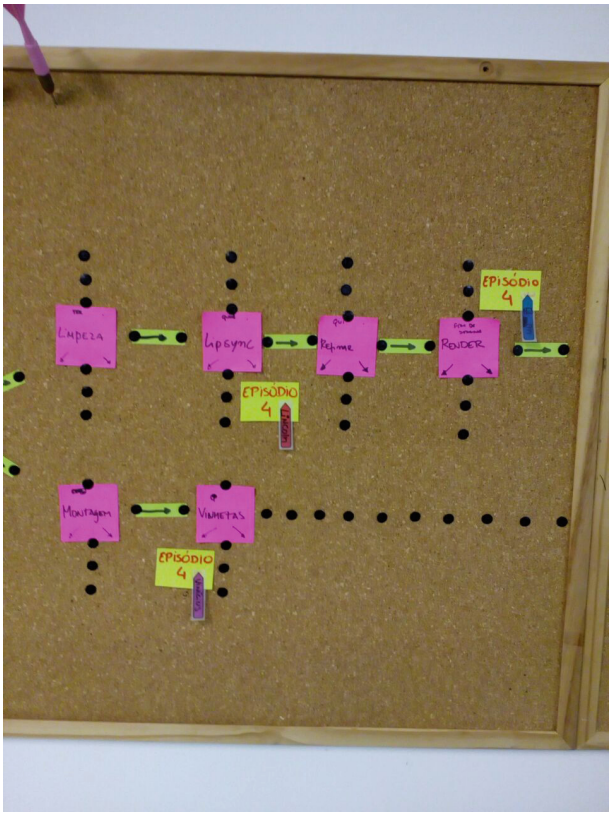

Fig. 4. Approximate view of the second part of the Kanban Board.

then define the following one to be created. The goal was to keep three episodes in production, thus generating a minimum reserve of episodes.

With the Work in Progress restriction, the team started to notice downtimes in the productive chain. Since the work they develop is highly specialized, they chose not to do swarming [1]. Instead, they decided to use the downtimes to automate animation items, thus reducing the effort needed to draw them and, consequently, the production time.

Automation is the creation of compositions that can be reused in different episodes in the series. For instance, the team had a few days off, so they used them to do Character Irrigation, which improves connecting joints such as arms, legs, neck and hands, making the motions more natural and without cuts. They also automated facial expressions and created some plugins to save time in future animations.

The team also agreed that each stage should last at most one work day. The script was written on a Wednesday, and from then each stage had to be

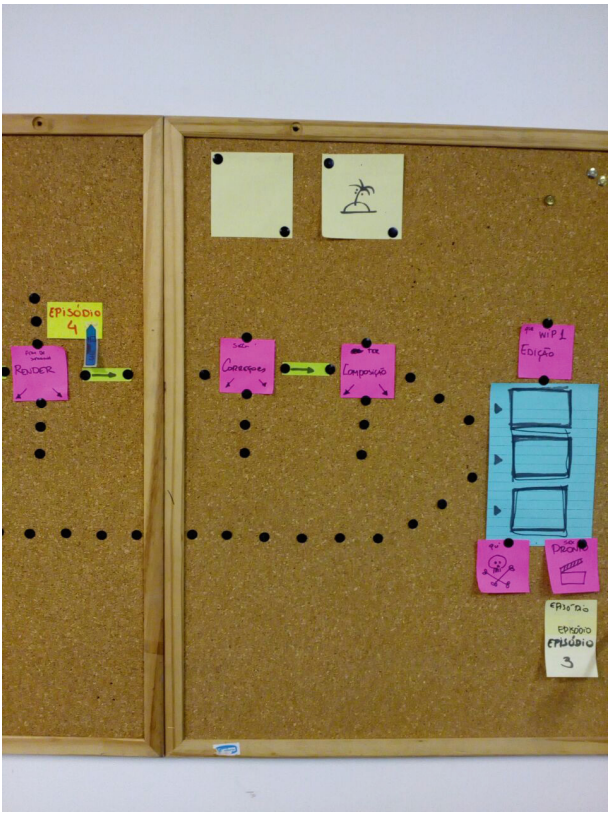

Fig. 5. Approximate view of the third part of the Kanban Board. (Color figure online)

executed in up to one business day. The only exception was Rendering, which was executed automatically and could take one weekend.

As an example of delay visualization, going back to Fig. 4 and assuming that it is Thursday on the first week, we could infer that Minute 1 of Episode 4 is one day ahead of schedule. Minute 2 of the same episode is one day behind schedule, because Refinement was supposed to take place on Thursday.

These changes allowed them to notice the delays and identify production bottlenecks. The episodes started to be delivered with a delay of two days.

5 Results

To collect the results obtained with the method described, at the end of the third Experiment Cycle a second interview was carried out with the animator in charge of the series [2]. The goal of this interview was to assess whether the proposed model was able to solve or mitigate the problems identified during the CTA (Fig. 1).

5.1 Management

Regarding the adoption of the method by the team, the interviewee said that there was some initial resistance. However, with time, the team started to feel represented on the board, which led them to start adopting self-management. The head animator no longer had to tell team members what to do, as they begun to select the tasks they had to work on. The daily meetings continued to happen, and the board was updated by the team.

The fact that the board represented the creation process saved significant time that was previously used for team management. There used to be a good deal of discussion about what each one should do. The head animator spent a lot of time organizing the process, but because he was also one of the animators, this caused delays in the animation development. After the process was detailed on the board, there was no more discussion. "I still act as responsible for the team, but now all I have to do is monitor", said the interviewee.

The board also brought two positive side effects. The first is that the area manager, who was not directly involved in the team's activities, realized the value of process transparency. "At a glance, he knows what is happening, if anything is delayed, what people are doing." [2] Another effect which emerged was the interest of other teams in using the model to start managing their creative processes.

5.2 Process

The board also resulted in a standardized creation process. Without variations in the stages, the team could now predict when an episode would be ready, when there was room for improvement and where there would be delays.

5.3 Deadlines

Regarding delay reduction, the interviewee said that the model adopted was crucial to identify delays and to find out which stages of the process had bottlenecks. Although the delays were reduced, they still happened during the experiment. However, assisted by the board, the animator responsible for the team was able to justify the need to hire one more employee for the team.

A few weeks after the interview, the head animator told us that a new member had joined the Creation Team and that the team started to deliver the episodes within one week. Figure 6 shows the reduction of the production time obtained in each experiment cycle.

5.4 Client

Finally, even with small delays in some episodes, the client's relationship with the producer became stable. The client is satisfied with the product being delivered.

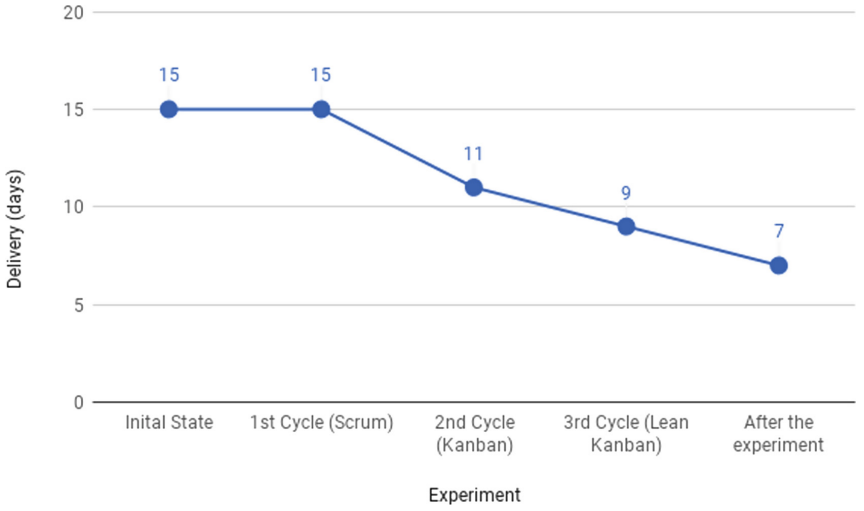

Fig. 6. Reduction of time of episode production per experiment cycle.

6 Conclusions and Future Work

The objective of this work was to build, collaboratively and iteratively, an Agile management model for the creation of 3D animations. We used Cognitive Task Analysis to understand the problem faced by the company and verify the results achieved when the model was implemented. As has been demonstrated, the action research method implemented through the experimentation cycle can assist in the continuous improvement of the solution proposed.

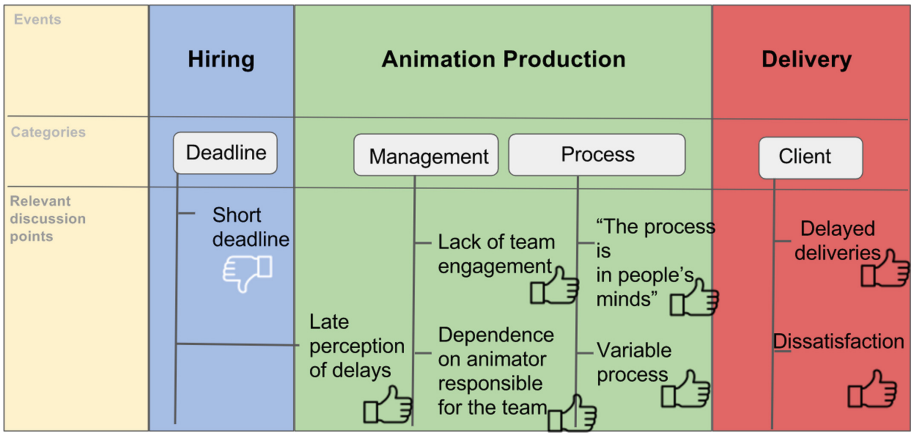

Fig. 7. Team response after the Agile adoption

Based on the perceived results, it is possible to claim that the method was able to solve problems related to the team's lack of engagement in managing the creation process, encouraged self-management, improved process visibility, reduced process variability, uncovered bottlenecks and reduced delays. Moreover, it was able to demonstrate the need to increase the number of professionals on the team so that the goals could be met in the turnaround time agreed upon with the client.

In the end, we sent the CTA analysis to the production team (Fig. 1). We asked them to indicate with a positive signal if they believed that the problem had been solved and with the negative signal if the problem had not been solved. The result is in Fig. 7. According to the them, with the exception of the Short deadline defined at the time of hiring, all major problems were solved.

In the future, this method will be applied to other teams in the same company to assess how it can be expanded to other contexts. The researchers are also searching for other video production companies to verify whether the method can be broadened and its results extrapolated beyond the company under study.

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