

SPRINT TOWARD A SUSTAINABLE FUTURE

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ABSTRACT

Students of today should learn and see a need for change and recognize the importance of a shift towards a more sustainable business world, design and engineering is an important piece of this equation. The phenomenon of design and engineering is claimed to be in the complex domain. In the complex domain long-term plans are not predictable and the methods used to lead this process should be agile and cope with the emergent nature of the phenomenon. Short sprints pulled from a backlog is one of these methods and could therefore be argued to be relevant for teaching design and engineering students. In an attempt to learn and practice this method, the teaching of a design and engineering course at the master level is using this method directly in the teaching. Combined with the principle of “one piece flow” the students must every week prepare homework for their class, then followed by relevant classroom teaching and ending the day with a 3-hour graded sprint. The sprints are done either as an individual task or as a group task, depending on the learning objective. The students report less waste and higher learning effects, an impression also shared by the teachers. Let us sprint toward a sustainable future.

Keywords: Short sprints, “one piece flow”

1 INTRODUCTION

To solve a problem, it is an advantage to know what type of problem you are solving. A “wicked” problem is more complex than a “tame” problem [1]. Solving the climate change problem can be defined as a wicked problem [2]. Some of the core characteristics of a wicked problem is that there is no definite formulation for it, it has no stopping rule, the solution cannot be true or false, but good or bad, and every wicked problem can be a symptom of another problem [1]. An attitude taken at The University of Agder is that the students that we educate will have a very important role in becoming change leaders. It is of paramount importance for the future that they both see the need and learn of ways to work with it. A former employee of the author had a large campaign stating, “Standing still is not an option”, this paper claims this metaphor applies to all businesses, all companies, and all persons, and can be directly aligned with the UN’s 17 global goals. In terms of this paper, it might be climate goal thirteen, “Climate action” that becomes most relevant. We have to do something, but how do we take decisions and act to solve a complex problem in a complex context? According to Dave Snowden [3], you cannot analyse but only probe in the complex domain and have to decompose and then rebuild/construct when acting in a complex environment. This means that the agile [4] system Scrum [5] introduced first to the IT business should not be used in a complex system directly, it and other systems like Scrum should be decomposed and then rebuilt to probe for its usefulness in the complex domain [6]. One of the smaller components in a Scrum is a sprint, but its original 2-4 weeks duration has been challenged. It has been argued for an advantage to reduce it to 5 days, but not to make it shorter [7]. In this paper we argue for a further “decomposing” and test the effect of a 2-3 hour duration of “sprints” in education, we call them “Student sprints” in this paper.

2 METHOD & LIMITATIONS

2.1 Method

This paper is based on reasoning done in the conceptualization of theory and specific methods and testing of it in practice. The reflections and learning are done both as a teacher, but also based on formal and informal feedback. The formal feedback from the students has been done both by standardized mid-

term evaluation reports, evaluation of the progress in an oral exam and an evaluation done by a specific questionnaire to increase the detailing of the student feedback.

2.2 Limitations

Using students' surveys and feedback as an indication of the success factors of using sprints, have some biases. An important limitation is that we cannot tell if they salute the sprints because it has become easier for them to prepare for a course. The same bias goes for me as a researcher because I am both the writer of this paper and the teacher of the course. A classical Rosenthal or Pygmalion effect, where I can unconsciously affect both the students and my grading according to my wish for this attempt to be successful.

3 THEORY AND CASE

The definition of a Student sprint is taken from the method of Scrum [8], but also inspired by a former Tesla employee, Joe Justice's statements on how work is organized into small tasks and teams within Tesla. We, therefore, want to present a reflection on the theory in original sprints, but also the theory behind the student "sprints" this paper wants to share reflections on.

3.1 Agile, Scrum, and Backlog

Jeff Sutherland and Ken Schwaber are the creators of the Scrum system [8], and were also part of the team coining the Agile Manifesto with its 12 agile principles in 2001 that has later been announced to be the original principles representing an agile mindset that started a lean inspired agile movement in IT and software development. In several agile methods, a backlog represents what is currently identified to be left to do in the project. In an ideal world the backlog could be a comprehensive list of items that should be solved, but agile is often used in contexts where maturity, learning, and problems might emerge and develop. In these settings, often related to complex problems, the accuracy of the backlog will differ. In some projects the team might try to make a comprehensive list, in others, it is considered wasteful to make such a list, where at best only milestones are made and or the backlog are only detailed in a short perspective, and the nearest timeframe. Normally there is at least made ready and prioritized list of items that are presumed to be the content of the sprint before it starts.

3.2 Original sprints

Jeff Sutherland acknowledges the Media Labs team's mandatory presentation every three weeks in the 1990s as an inspiration for the later sprints. The name sprints were according to Jeff Sutherland chosen to show a sense of urgency and high pace before feedback is given [5]. When entering a sprint, the team must commit to a clear outcome of the sprint. One of the original 12 agile principles [4] states "Working software is the primary measure of progress", the need to create something "working" is enhanced with Lean Startup [9] and its focus on Minimal Viable Products (MVP) [10]. So, the clear goal in a sprint is often challenged into making something that the customer or representative of the customer can test and give feedback to. Here is a list of some of the other theoretical arguments for conducting an original sprint:

- A sprint should have a clear and defined goal and be limited within a predefined time frame (A timebox).
- A sprint team is normally also predefined in the sprint and should ideally consist of 7 people plus or minus 2 with cross-functional competence. A small team is preferred due to the exponential growth in direct communication lines in larger teams.
- A working team within a sprint should not be presented with new elements to solve during a sprint. They should only be supported with any request they have that emerges within the sprint that has to do with solving the original goal of the sprint.
- The teams should be autonomous in how they reach the goal. There should be 0% excuses for not reaching the intended goal.

Dealing with a complex problem or project, a sprint takes a part of the problem or project and puts it into a manageable size. This simplification together with a clear predefined goal gives the teamwork peace and enables concentration.

3.3 Design sprints

It is claimed that the Design Sprints [7,11] have been inspired by design thinking to reduce its timebox from 2-4 weeks to 5 days duration [7,11]. A sprint of fewer than 5 days duration is not recommended, due to practical concerns with facilitation [7,11]

3.4 Student sprints

The development of the Student sprints has taken inspiration both from the method of Scrum [12], but also inspired by a former Tesla employee, Joe Justice's statements on how work is organized into small tasks and teams within Tesla. The main inspiration came from a YouTube interview with Joe Justice [13] where he stated that Tesla has learning cycles every 3 hours. The sprints started the same day that the course started, and the students that answered the questionnaire reported that 86% did not attend the first sprint, the next week 97% attended and for all the following weeks they all attended. This is the opposite trend that many teachers report from their classes, where fewer and fewer students attend class as the subject progresses.

The Student sprints are graded, and thorough feedback is given to let the student reflect on where and what they have the potential to be better at and what they have understood. All the sprints make up the whole delivery of a mandatory project report that counts for 60% of the grading in the subject. This means that if they pass all the sprints and are happy with the level they have achieved they can get a weighted grade and do not need to do any extra work for when delivering the final report. If they want to improve their grade they get a similar task they have to answer as a compensation for the sprints they want to improve. In a way, this means they can "cherry-pick" their weak points. That is correct, but isn't that what we want the students to do? Improve where they have knowledge gaps. When they redo a sprint with a new task, the grading expects a higher level of understanding and perfection. Because the maturity level is expected to rise, and also the time they can spend on answering this is not limited to being within a timebox.

Here are some examples of the sprint content with their logic/dependencies:

1. Students are divided into groups of 4 people that have to prepare to read an academic paper within the curriculum as preparation before the lecture and sprint. They have to write their own personal takeaway of the content as a "pass" to enter the group before the sprint. The papers have either been referenced or part of a previous lecture or are the content of the lecture they are entering. When the sprint starts they are given 2,5 hours to prepare a video presentation of the content that should be delivered in a format that their fellow students understand.
2. In the following sprint they had to read another paper. But not knowing how the sprint was they might have expected another presentation, but this time they had to see the students' video made of the paper the week before and make peer review feedback to the student group that had created the video.
3. In another sprint they were divided into groups of 4 and had to prepare some readings on an overall understanding of the subject, but when the sprint started they got to know that it had been a pre-booked podcast appointment with a number of designers/developers and engineers from the business they study to become a part of.

In many aspects, you can say that it is a 3-hour test every week, but there is a difference in how we think about it; First, the sprints are mainly organized as a team effort. The reasoning behind this is that we believe learning among students is much greater as a team rather than doing individual work. We are not doing it because we want to grade the students, we do it because we want them to learn. The grading is only done as a part of feedback, but also to let the students feel that they lose something if they are not attending. We could have made the sprints mandatory, but that would have made the system less flexible. The sprints are not mandatory, and they can as mentioned choose to write a similar task as a part of the project report. If a normal mandatory task would be presented as a group work for the students, procrastination might kick in on all levels. Not preparing before lecture, not paying attention to the lecture that much, since they think they can read the notes later. A sprint can also be built on a previous sprint that often enables more learning and becomes a representation of "continuous improvement". In a test the accessibility of tools is often limited, in a sprint all available tools are welcomed. Even the advantages and limitations of AI (Ex. Chat GPT) have been tested in some of the sprints. A sprint also differs from a test where a test often have to prepare the students on what is going to be asked, in a sprint we give them preparation material but do not need to prepare them on anything about the content of the test. We do this to not let the students be selective on what they are reading and

learning. Live streaming of the lectures was shut off after the first year of testing sprints. The reason is both argued in organizational challenges, but also the power of meeting people physically at Campus. An attitude is taken that “It is better to get a student from home to socialize in class, than to help a student that is not attending to learn from home”. The stand is taken because one of the most important skill sets that a physical Campus can teach students is teamwork and interaction between people. To have sprints both physical and digital in parallel have hence been tested and it is definitely manageable, but the attendance in class and at Campus suffer if streaming is made available.

3.5 The difference from a task

The novelty of using a sprint might not be too obvious from dividing the course into tasks, but the advantage of rather using a sprint lies in the details. We have a tendency to measure students' performance in how well their results become in that task. Because their grades become so important for their future careers their goal is more about getting the grades and not getting knowledge. Even teachers believe that a student that has been drilled to solve specific national tests is a better student just because the test result is better, even though they are comparing themselves with students that have not been given any specific training for the test form of the national tests. The main reason for using sprints is to focus on the effort and process and not only the result. Therefore, a big point in the sprints is not to reveal their content until both homework and lectures are done.

3.6 The difference from a test

Since the sprints are mostly being graded the similarities to weekly tests are notable. They are both based on pushing homework and attention in class in order to achieve a good grade and having a timebox for delivery, the content is not revealed until they start, and they both are being graded. So, a weekly test and a sprint can in many ways be the same, but it is the practical difference in use that makes the difference. A test is a measurement for control and its purpose is closely linked to being a tool for measurement, while in nature a sprint is a practical way of making something that can be tested. In other words, the sprint can and should be a practical task and it is even better if the tasks can build on each other to become a project. Many of the sprints have an effort-based evaluation and not a result-based evaluation as most tests have. The sprints can and should be organized as group work where this can enhance learning and if the groups are internally motivated grading is not needed, but a thorough feedback and improvement suggestions should be prioritized. So even though the difference between a sprint and a test is subtle, their original purpose is different. A sprint is being used as an agile work session tool in business, while in business a test is used in order to measure performance already done. Learning and development through working together is the essence of a sprint, while a test is often a measurement of the progress within a topic so far.

3.7 The principle of “one piece flow”

The thinking behind the use of sprints is linked to the theory, effects, and experience of practical use of the principle of “one piece flow”. This can again be linked to the effects of the problems related to multitasking ([14,15]) and how good habits often happen in a short time span, with incremental changes [16]. “One piece flow” does not only apply to the short sprints but also how the subject encourages the students to not think about the subject in between other subjects. Students are encouraged to practice “one piece flow” with the following routine; 1. Do homework in the time period directly before the lecture starts, for most students this means the evening before the course starts. 2. Be present in the lecture and link it to the homework and practical examples. 3. Attend the sprint and deliver a result before the timebox is over.

4 RESULT & DISCUSSION

4.1 Advantages

The questionnaire that was sent out among the students about using sprint as a part of the topic, when this paper was written it only had a feedback rate of 34% with around 30 respondents. 67% reported that they have increased their preparation before lectures, 71% say it increases their attendance to the lectures and 76% says it has increased their attention level in the lectures as a direct consequence of using sprints as part of the lectures.

The group sizes are different from many sprints. Mixing the groups from sprint to sprint makes the social networking among students higher. Still, they are organized into core groups of 4 people in order to give them some stability in about half of the sprints. Types 1 and 3 of the sprints are mentioned under point 3.3. were the sprints that the students reported they had learned the most from. The principle of having a timebox in order to set an artificial deadline for a task to push forward a result was the principle 63% of the students felt was the primary effect shown within a sprint. The effect of a backlog (12%) and an enclosed container (16%) was not that easily recognized. Only 8% reported they had not learned any of the mentioned effects of a sprint. A positive effect of a sprint is reported to be that it is much easier for the students to organize the meeting and start working together. They also report that the pressure of delivering helps them to do exactly that and not procrastinate a task. Some of the students report that having parts of the grading done every week also motivates them because it becomes a measurement of progress and how much of the grading has been done. An important part of using the sprints is that Scrum and the use of sprints is part of the curriculum, and their hands-on knowledge about being organized within sprints creates a practical learning experience.

4.2 Disadvantages

By grading the sprints, the first sprints are being graded on a low maturity level in the subject. That is being taken into account when the sprints are graded, but to avoid “inflation” of good grades, the first sprints are in a much smaller percentage, than the latest sprints.

A negative side of a sprint is that it can be stressful when the sprint is conducted. Some students would like to study more, and work more than the sprint allows after the sprint has started. In a way, we align the students' effort with a sprint, but their preparations for homework before the sprint still differ. The procrastination of homework, preparation, group work and even paying attention in class is only possible within the deadlines if you want to join the sprint if you want to prepare for a good execution of the sprint.

If someone is sick or not able to attend that day they will suffer for not being given any feedback on their progress. One of the sprints conducted was too ambitious in their goal and none of the students did manage to fulfil the rule of always delivering the goal. This sprint taught some of the students the importance of specifying the goal and the need for thorough preparations before a sprint, but it was not a good way of conducting a sprint in general. This was the only time a sprint was made with too high ambitions to actually make a delivery, and this is also the sprint the students reported to have the lowest degree of learning in. A too short timeframe might hinder the quality of the delivery and some students find that the sprint should be a bit longer in order to deliver better quality. But no one reports the actual sprints to be too short, 8% even want it to be shorter. With a response that 92% find a 2,5-3 hour sprint to be accurate in time the duration of the sprints will not be changed in the nearest future. Some of the students report that they understand that the sprints are under continuous improvement, and they find some of the attempts to be less accurate. As a teacher, I can confirm that some of the sprints are run almost as tests of the limitations of the content in a sprint. The sprint that failed to meet its ambitions was organized using the programming/coding functions from ChatGPT and the groups should within the sprint organize themselves both in teams of 4 but should also deliver results to a more skilled team that could evaluate the code being generated. The scope of the sprint was not clear enough and the preparation for the skilled time was not good enough, so it ended with not delivering a workable solution. But many of the students reported learning from failure and saw the importance of well-defined sprint goals.

4.3 Improvements

The students want to be prepared with all practical and technical tools before the sprint starts. If the sprint contains video editing, they should be able to know this in advance so that the technical part of the presentation does not become a bottleneck for showing their subject skills. This is a very just demand and should be fixed.

The preparations for the sprints can be announced as soon as possible and could even be announced on a longer time span. Since the groups are changing

One of the early sprints almost failed because it had the ambition to create self-organized teams around a common task. It was about using programming skills in combination with ChatGPT as a tool to solve a design process. This became too complicated and even though some reported a new insight into the complexity of organizing a design task, it should have been prepared more thoroughly.

For the teacher, the time spent on feedback increases, and with over 90 students per semester the time spent every week is a bit higher than stipulated. Some of this work burden can be reduced with peer review, somewhat larger groups reversed classrooms, etc.

5 CONCLUSIONS

With the number of students attending class after the sprint was introduced as a method there is a claim that the negative effects of missing out if you do not attend overgoes the positive effects of a social learning environment that happens when all students that are capable of attending do so physically. There is an assumption rising that the sprint method would give value to many forms of teaching and especially in this course where teaching the sprint method is part of the mandatory syllabus. This gives the students a direct knowledge of the method, so even the bad sides of the method give them insights. Sprints in a short timespan are especially relevant for problems in the complex domain, where you can only probe and then sense what your next response should be. Based on the feedback from the students, the knowledge level they gain through the course, and the attendance in class I will continue using sprints and testing agile methods as part of the education method and have a firm belief that it makes the students learning higher and that less waste is used on organizing and non-value-adding activities related to knowledge gain.

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