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Adding Scrum-style project management to an advanced Design Thinking class

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Abstract (300-500 words)

Design Thinking has become popular as a methodology that produces innovative and creative solutions in different industries, e.g. in the software industry or in product development. As such the methodology is taught in institutions around the world, e.g. D.Schools in Stanford, Potsdam, Paris. While Design Thinking already provides a process along with various techniques to use at each step of the process, it lacks project management techniques. In project-based classes this can become a problem, when student teams feel overwhelmed by open tasks with deadlines.

We aim to solve this problem by adding project management techniques from Scrum to the Design Thinking toolbox, because we believe the planning and reflection techniques used in Scrum projects are easy to understand and implement and fit in with the general Design Thinking mindset. Scrum is the most popular agile software development methodology and has recently found its way into other industries as well. It provides a framework that allows a team to plan and implement their work in smaller cycles, called sprints, that last between 1 and 4 weeks.

In this paper we explore the addition of Scrum techniques to a project-based Design Thinking class. We provide a description of how we added Scrum techniques to the existing curriculum of the Advanced Track at the School of Design Thinking at the Hasso Plattner Institute at the University of Potsdam. We will present which methods were introduced and how we taught them to the seven teams enrolled in the class. We will analyze and discuss our findings from observations with the seven teams, two group discussions with the coaches involved in the program and questionnaires with the students and the coaches. Based on these findings we will discuss benefits and problems we discovered along the way, as well as the usefulness of the specific techniques from Scrum for DT our class.

Our paper contributes to Design Thinking education by providing a list of useful techniques for students and coaches in existing Design Thinking classes and describing ways to introduce them into the class.

Keywords: Design Thinking, Scrum, Higher Education, Agile Project Management

1 Introduction

Design Thinking has become popular as a methodology that produces innovative and creative solutions in different industries, e.g. in the software industry or in product development. As such the methodology is taught in institutions around the world, e.g. D.Schools in Stanford, Potsdam, and Paris. While Design Thinking already provides a process along with various techniques to use at each step of the process, it lacks project management techniques. In project-based classes this can become a problem, when student teams feel overwhelmed by open tasks towards deadlines.

On the other hand, Scrum is an agile project management framework specifically designed to support projects in fast changing contexts. It has become one of the most used agile techniques in software development and is being used in other areas as well. Scrum has been used with design teams or in design projects. Both methods already share some important ideas, e.g. having self-organized teams, empowering the teams, and working in small iterations. Furthermore, Scrum teams already make use of some the techniques that can be commonly found in the Design Thinking toolbox, e.g. brainstorming or visualisation techniques.

Thus, the Scrum tools and techniques could be a valuable addition to the design toolbox and could help solving the problem of flexible project management for Design Thinking classes. To prove this assumption, we integrated Scrum in a Design Thinking class at the HPI School of Design Thinking and will share our experiences in this paper.

To that end our paper is structured as follows. First, we will give some background information on Scrum and Design Thinking in Chapter 2. Chapter 3 will provide an overview of related work. Our case study will be described in chapter 4 followed by a description of our evaluation methods in chapter 5. Chapters 6 and 7 will present our findings and discuss them. And Chapter8 will close the paper with a short summary.

2 Background

Scrum was developed as an agile software development framework by Ken Schwaber and Jeff Sutherland (Schwaber & Sutherland, 2013) and has become one of the most used agile techniques to date(Komus, 2017; Scrum Alliance, 2016; Version One, 2017). As other agile methodologies it was designed to be a more flexible development approach than the traditional software development approaches like the Waterfall model and its successors. As one of the earliest documented development techniques the Waterfall model (Royce, 1987) defined the basic steps of software development as a linear sequence of phases, including steps like requirements engineering, design, development, deployment and so on. Later models such as the Spiral Model (Boehm, 1988) tried to incorporate more flexibility and risk assessment into the process by breaking the process down into several iterations of the linear process with risk assessment and controls after each iteration. In contrast to these approaches Scrum assumes that these steps of the development are unpredictable and incorporates an empirical process and controls to create a flexible and reliable methodology. The idea of an empirical process to ensure quality control and foster continuous improvement dates back to the 1950s. Denning developed the Plan-Do-Check-Act or PDCA approach that could be applied to production companies and later evolved into the Plan-Do-Study-Act or PDSA approach (Moen, 2009).

At its core the Scrum process uses so-called sprints, 1-4-week development cycles. At the end of each sprint the development team delivers an increment of the software under development, thus providing the possibility to switch priorities or incorporate changing requirements when planning for the next sprint. Each sprint starts with a planning meeting, in which the team chooses which requirements to implement during the upcoming sprint. During the sprint, daily Scrum meetings ensure everybody knows what is going on. At the end of each sprint a review

meeting is held to inspect and review the developed software. Furthermore, a retrospective meeting is held to reflect on the process and team work and discuss required changes for the next sprint. Figure 1 illustrates the Scrum process with its main meetings and deliverables.
A Scrum team consist of the Product Owner, the Scrum Master and the Development Team. The Product Owner collects and prioritizes requirements for the software under development. Such requirements are kept in the so-called Product Backlog. When requirements are chosen for a sprint they are moved into the Sprint Backlog. The Scrum Master is responsible for organising and facilitating the meetings and helps the team to overcome any issues that may arise. The development team plans and implements the sprints and thus incrementally develops the software.

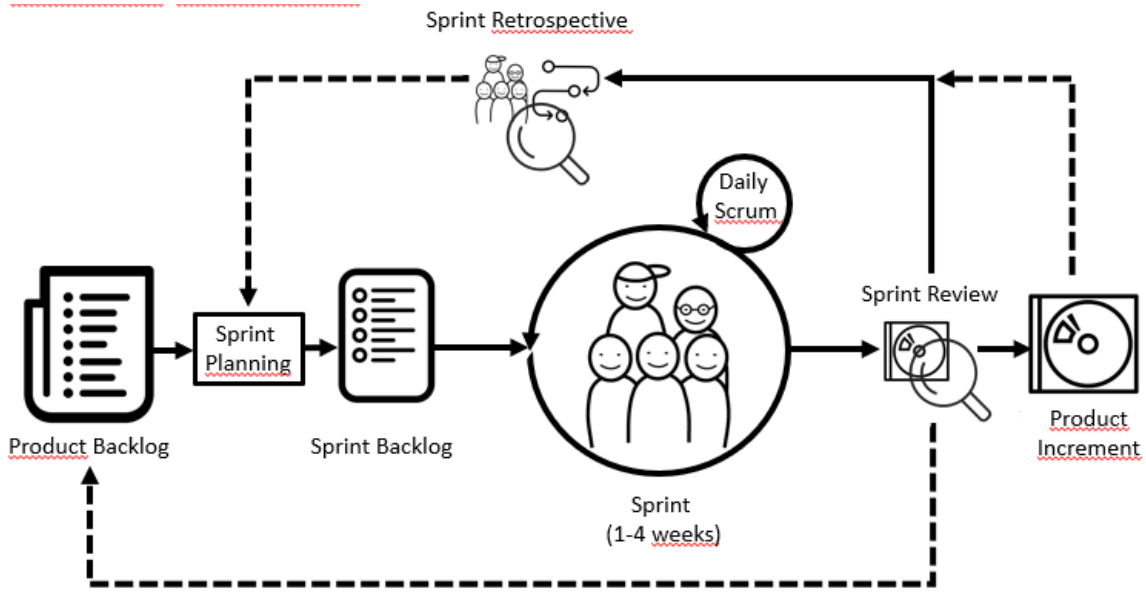

Figure 1: The Scrum process with its artefacts and events.

Design Thinking as an innovation method for new product development as well as management and organizational development was originally introduced by the design consultancy IDEO. It was spread through several design thinking education programs, for example, the D.Schools in Stanford, University of Potsdam and Ecoles du Ponts in Paris, as well as more business-oriented programs at the Rotman School of Management, Toronto (Canada) and St. Gallens Management School in Switzerland.
The methodology is based on former research in design, creativity and innovation within companies, teams and individuals. Core principles of the design thinking methodology, like working closely together with users at every process step (Holt, 1988) or recognising design as a strategic tool for a company (Kotler & Rath, 1984) were developed as part of such research. The basic process steps of the design process as it was initially defined and discussed around the 1960s (Jones, 1966) are present in the Design Thinking process and many of the tools in the Design Thinking Toolkit have been around for decades, e.g. the lead user method (Von Hippel, 1986) or brainstorming techniques (Osborn, 1942). As such Design Thinking is not a completely new methodology but transfers knowledge from Design and Design Science into a framework addressed to and applicable by non-designers (as in not a designer by profession).
Different representations of the Design Thinking methodology exist; we refer to Design Thinking as it is taught at the HPI School of Design Thinking and described by (Wölbling et al., 2012) or (Thoring & Müller, 2011). As illustrated in Figure 2, the methodology consists of an iterative process, with six phases: Understand, Observe, Point of View, Ideate, Prototype, and Test. The project team can move back and forth between these phases as necessary. The first phases, Understand and Observe, are aimed at understanding the project's context and the

users. The Point of View (also called Synthesis) phase aims at converging the information gained from the first phases into the team's point of view of the problem to solve. The Ideate, Prototype and Test phases aim at finding, building and testing creative solutions to the problem.

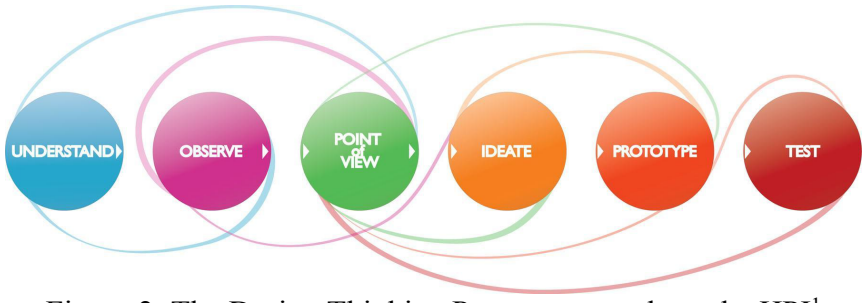

Figure 2: The Design Thinking Process as taught at the HPI[1]

While both methods seem to be very different, they share some important concepts, making an integration of the two methods possible. Both Design Thinking and Scrum rely on self-organizing teams. Furthermore, both methods value reflective practice and the concepts of testing and improving through iterations.

3 Related Work

Since Scrum was developed, various researchers have adapted the method for non-software projects, e.g. for hardware development (Punkka, 2012), strategic planning (Cervone, 2014), sales and account management (van Solingen, Sutherland, & de Waard, 2011), purchasing (Weinreich, Neumann, Riedel, & Müller, 2015) and even managing research groups (Hicks & Foster, 2010). Additionally, companies have reported of the method spreading from their software departments into other departments "infecting" the whole company. Thus, Barton reports from two case companies that have extended Scrum beyond their software development departments and could improve their innovation value chain (Barton, 2009). Doshi and Doshi from ThoughtWorks report how agile became second nature to them and thus is applied for various non-it activities, for example training, recruiting or strategic decision making (Doshi & Doshi, 2009). Sutherland and Altman report how OpenView Venture Partners adapted Scrum for their project management throughout their company and how the continuous usage of Scrum drives organizational transformations in their company (Sutherland & Altman, 2010).
Scrum has also frequently been used in higher education, especially in project-based courses. Due to its origin in software development it has been used in various IT courses, e.g. (Bosnić et al., 2015; Mahnic, 2012; Scharff & Verma, 2010) and a few non-it courses. Tollestrup describes using Scrum elements in a design project (Tollestrup, 2015). He describes how the project was separated into different length phases, similar to sprints with a defined deliverable. This approach helped students to feel a faster pace throughout the process and achieve an earlier framing of the project compared to former project courses using a different project management approach. However, Tollestrup does not report the use of other Scrum elements. Pope-Ruark reports about using Scrum elements in a grant writing course (Pope-Ruark, 2015). Similar to Tollestrup, she makes use of different length sprints with predefined deliverables. Additionally, she also introduces the Scrum meetings for the students to learn how to plan, reflect, and adapt their process. She reports a mixed reception among students but feels that students who embraced the new approach delivered better results. However, the approach seems to have been more useful in the beginning of projects and was less used towards the end. Grimheden makes

[1] https://hpi-academy.de/en/design-thinking/what-is-design-thinking.html

use of Scrum in a capstone mechatronics project (Edin Grimheden, 2013). The project was divided into three 8-week Scrum sprints including Scrum meetings. Compared to earlier formats of the project course, the introduction of Scrum led to more and earlier prototyping as each sprint required a working prototype instead of having just a final prototype. The incremental approach helped students to define core values and set the right priorities. The decentralized project planning allowed all students to gain project management experience instead of one project lead per team. Gestwicki and McNely report of using Scrum alongside Design Thinking for a fifteen-week game development seminar (Gestwicki & McNely, 2012). They use 2-week sprints that include all the Scrum meetings. The roles of Product Owner and Scrum Master are filled by the faculty mentor, not by the students. Their report focuses more on the advantages of adding Design Thinking to the software project than on Scrum as a project management tool but concludes that Scrum "facilitated the team's adoption of—and competence with—iterative development processes".

4 Case Study

During the 2017 summer term of the HPI School of Design Thinking we experimented with adding Scrum elements to the course in order to improve project planning and management.

4.1 Advanced Track at the HPI School of Design Thinking

The Advanced Track is a 16-week program open to students who have already acquired a fundamental understanding of Design Thinking, e.g. by completing the HPI School of Design Thinking's Basic Track or a similar program. It is a project-based course in which teams of students work on a real-world problem with an external project partner such as industry partners, public institutions or non-profit organizations. The students work a minimum of two full days per week on their project. Along the way the teams are guided by dedicated coaches. Over the course of the program, the students receive lectures as well as milestone assignments structuring the 16 weeks into three iterations. Each iteration is marked by a presentation to project partners and fellow students.
We report from our experiences within the summer term of 2017. The class was comprised of 40 students divided into 7 teams, all working on different projects. The student teams were taught and mentored by 16 coaches and one program lead. In addition to the coaches and the program lead, the class was accompanied by two special Scrum coaches, who were responsible for introducing Scrum to the Advanced Track.

4.2 Setup of the Scrum Experiment in the Advanced Track

As Scrum was new for the Advanced Track coaches and students, the Scrum coaches gave a general introduction to the Scrum framework for all teams at the beginning of the class. The teams could then decide whether they wanted to try out Scrum during their Design Thinking projects or not. This was consistent with the Advanced Track's goal of empowering the teams to run their projects in their own way. 6 of the 7 teams initially declared interest in using Scrum and were given a deeper introduction to Scrum, including required roles, meetings and artefacts. The responsibilities of the Product Owner were taken over by the participating Design Thinking teams. The Scrum Master role was initially fulfilled by the additional Scrum coaches and was later handed over to either the regular coaches or the team as requested.
It was decided that the participating teams should use two-week sprints, as this seemed to fit best with the pre-planned assignment and presentation schedule. However, over the course of the project, several teams decided to change the length of their sprints to different, shorter timespans.

After the deeper introduction, the Scrum coaches facilitated the initial planning meetings with the teams. Introducing them to Scrum boards and filling an initial Backlog and Sprint Backlog. Two weeks later the Scrum Coaches concluded the first sprint with an initial Review and Retrospective Meetings, introducing different retrospective activities to the teams. For some of the teams, the role of the Scrum Master was transferred to the general coaches or team members later on. In those teams the Scrum coaches were then acting as observers.
During the retrospective meetings, the Scrum coaches listened for problems with and around Scrum and proposed suitable changes or tools to help the teams. For example, two of the teams were concerned with estimating how long tasks would take them. For the following sprint those teams were introduced to Planning Poker as a tool to help them with estimating. Two other teams reported having trouble seeing what they are trying to achieve during the sprint and how to decide what task to add and how to prioritize them. These teams were introduced to Sprint Goals as a simple way to first summarize the main goal of the sprint and then decide whether a task is important for the sprint.

5 Evaluation Method

We used multiple tools in order to evaluate our efforts around Scrum and its fit within the Advanced Track. We observed a majority of the Scrum meetings of the participating teams and recorded the retrospective meetings because we expected to get feedback about the method during this meeting.
Additionally, we held two meetings with the team of regular coaches. In the first meeting we explained our efforts and exchanged observations about the teams and their progress. In the second meeting we discussed tools from the Scrum toolkit which can be helpful for Design Thinking coaches. Finally, we prepared questionnaires for coaches and students evaluating Scrum and the methods we introduced during the class.
The retrospective meetings as well as the meetings with the coaches were transcribed. The transcripts as well as the notes from observing the other meeting were coded for problems, solutions, suggestions, and positive as well as negative feedback about the method in general and specific tools.
The questionnaire was build using simple yes / no questions and questions using a 5-point Likert scale. Most questions were followed by an optional free text question asking the participants to explain their answer. This free text question, allowed us to gather additional insights on the experience of the students and coaches. The questionnaire included the following questions:

- Did you / your team decide to use Scrum?
- If you used Scrum, did you decide to stop using Scrum?
- Was there tension between Scrum and the rest of the Advanced Track?
- If so, that tension was due to?
- How likely is it that you would use Scrum in another project?
- Please rate Scrum according to how well the method worked for you / your team.
    - Scrum in general
    - Possibility to plan ahead
    - Possibility to see what was achieved
    - Possibility to see progress
    - Time needed
    - Quality of team work
    - Quality of results

For each specific tool or technique, we introduced we added the following questions:

- Did you / your team use [tool / technique]?

- How valuable do you find [tool / technique]?

The questionnaires were answered by 10 students, at least one from each participating team, and 5 coaches.

6 Results

Most of the Scrum elements introduced could be integrated into the workflow of the class. However, the Advanced Track also included group activities like lectures, warm-ups, cross-sharing, and visits from project partners, and these activities often interfered with planned Scrum meetings. Therefore, Scrum meetings were frequently rescheduled or shortened. Over the course of the class several of the teams reverted to planning just a single day and only maintaining a rough backlog. This somewhat reduced Scrum to having 1-day sprints which resembles the project management present within the class before our Scrum experiment. It included the creation of longer project plans that tended to be forgotten (Häger & Uflacker, 2016) and day plans during check-ins or check-outs.

6.1 Students' perspective

6 out of 7 teams initially decided to take part in our Scrum experiment. Over the course of the class, one team stopped using Scrum altogether, while the remaining 5 teams adapted the process to their needs only using elements they found helpful. As to the question of why they wanted to try out Scrum, 5 of the students that answered our questionnaire mentioned better structuring or planning of their work. Thus, our assumption that students feel a need for project management techniques was confirmed.
6 Students felt that there was tension between Scrum and the rest of the Advanced Track. Looking at the explanations, students commented on not having enough time for the meetings especially on days when there was a planned lecture in the morning. Additionally, one student found the introduction of Scrum too short. However, most students would use Scrum again in another project, as can be seen in Figure 3.

Figure 3: Likelihood of students to use Scrum again

Scrum was rated highest by the students for its ability to show them what was achieved. and lowest for the time needed. This corresponds with comments given in free text fields throughout the survey and our observations during the various meetings. The ability to see what was done was mentioned several times as a "pro" for Scrum in the survey as well as during reflection meetings. In former DT projects student sometimes had the feeling of not having done anything. Seeing the "done" work pile up helped conquer that feeling even if no tangible results were achieved. On the other hand, the time necessary for the meetings often came up as a "con" against Scrum. Students repeatedly rescheduled the meetings or shortened them because other things, e.g. lectures or workshops during the class, had taken up the time. Several comments in

our questionnaire mentioned that there had not been enough time for Scrum. Figure 4 displays the student ratings for Scrum.
The students did like the Scrum board, including the Backlogs and the Scrum meetings, and rated them mostly valuable. The teams that used Planning Poker did value it as a way to learn estimation as a team and to shorten lengthy discussion about how long a task should take. Figure 5 displays the ratings for these tools and techniques.

Fig. 4 Student ratings for Scrum

Fig. 5 Student ratings for the Scrum tools and techniques

6.2 Coaches perspective

All 5 coaches who answered the questionnaire felt that there was tension between Scrum and the rest of the Advanced Track. The coaches mostly commented that the prescribed course schedule already contained enough detail making a backlog unnecessary and that Design Thinking is too unpredictable to plan. Accordingly, most of the coaches that answered the questionnaire are hesitant to recommend Scrum to teams they are coaching.
The coaches rated the possibility to plan ahead highest, and similar to the students, rated the time needed lowest. Figure 6 displays the coaches' ratings for Scrum.

Figure 6: Coach ratings for Scrum

Discussions during the first coaches' meetings centered around the Scrum board and the Scrum process. Coaches discussed which sprint length might be right and whether or not all the meetings are necessary in the Design Thinking class. Overall, they agreed that planning ahead to some extent is useful for the team and that the Scrum board provides a useful way to facilitate ad display such plans. However, the coaches struggled with the various meetings and did not necessarily see a difference between the Scrum meetings and existing meetings in the course. The review meeting was mostly deemed useless as the teams review their work as necessary along the way. Planning meetings seemed to take too much time and Retrospective meetings were nothing new to the teams and coaches but were used less frequent before the Scrum experiment. A long discussion that we could not agree on an answer to was about the level of detail in the backlogs. Some coaches reported that their teams were too general in backlogs, while other coaches reported too much detail and connected that to time wasted in planning. Overall, it seemed that the general plan for the class, along with milestones, main activities and deliverables, already provided a good general backlog for the class; students actually just needed to fill in the details during their sprint and daily planning.
In the second coaches' meeting, the Scrum coaches presented several tools from the Scrum toolkit that they found helpful even without using the complete methodology. They included Scrum boards, Sprint goals as a way to plan ahead to some extent, Planning Poker and Bucket estimation as ways to estimate time or value and a collection of retrospective games as reflection tools including "peaks and valleys,", the sailboat metaphor, and team awards. The coaches reacted very favourably to these concrete tools and found them interesting and useful.

7 Discussion

Even though several of the student teams reverted to a minimum version of Scrum, the two methods of Scrum and Design Thinking seemed to fit well together during our experiment. Both methods use reflective practices and count on self-organizing teams. Some students even mentioned that it was nice to see that some of the things they do in Design Thinking are also part of Scrum. Overall, the chosen Scrum techniques and tools mostly made sense in the Advanced Track, as ratings from our questionnaires and comments throughout the class show. The daily Scrum meetings resembled the team check-ins, which were already well established in the class, and thus naturally fit in. Retrospectives were also not new to the teams, as a similar reflection is sometimes held during the class, though not as regularly as proposed by Scrum.

The review meeting felt somewhat unnecessary, as most teams reviewed their work during the existing daily check-out. The Scrum boards with the backlog items provided a good overview over upcoming tasks, as well as created a record of work achieved, which both students and coaches appreciated. These boards will most likely find a place in the toolbox of most coaches and students.

Giving the introduction to Scrum during the regular D.School days on top of everything else that was going on was not a good decision and might have caused some of the negative perceptions reported. Students as well as coaches mentioned that a pre-class workshop would have been better. Such a workshop would have allowed a deeper introduction of all the Scrum elements and thus would have given students and coaches a chance to better understand the methodology. Since we introduced it at the beginning of the class, alongside all projects and other setup information, students and coaches were very busy with getting to know their projects and could only partially take in the information provided. Furthermore, it was not a good decision to work with separate Scrum coaches. It made the team coaches less invested in getting to know Scrum, as the lower recommendation rating suggests. The coaches sometimes even felt someone else was trying to do their job. In hindsight, it would have been better to train the coaches in advance and let them do the Scrum facilitation.

The perception of many of the coaches and some of the students that Design Thinking is too unpredictable to plan ahead was very notable. Scrum is explicitly designed to be a flexible project management alternative suitable in fast changing projects, so we were surprised by this argument about why Scrum was not as helpful as expected. It might be due to the fact that we did not spent enough time to a) get the coaches on board with our experiment and b) did not explain well enough how Scrum supports flexibility.

The notion mentioned by students and coaches that Scrum takes too much time or that not enough time was given to Scrum is a common problem in agile adoptions (tod ref). Looking at other activities that took place during the Advanced Track, we feel, however that there would have been room to give enough time to Scrum meetings and have regular sprint planning and retrospective meetings in addition to daily planning.

For example, a fun game contest between the students was a long-standing popular element of the Advanced Track, however we think that it could have taken up less time. The amount of time devoted to the games exercises was reduced later in the semester, but the exercises were not cancelled because they were popular with some of the students. Instead of devoting an hour to such games every week, we could have taken 30 minutes every two weeks in order to plan the upcoming weeks and reflect on the process and the team work. In the future, Scrum planning time should be integrated into the class as a fixed appointment.

As in other courses were Scrum was introduced, reception was mixed, with a tendency towards liking Scrum and experiencing it as useful. The students liked Scrum after our initial introduction and perceived it as an easy-to-understand project management tool. Being eager to try out Scrum, they soon noticed that mastering it proves just as hard in the classroom as it does in organizations (Lopez-Martinez, Juarez-Ramirez, Huertas, Jimenez, & Guerra-Garcia, 2016). Similar to not getting management on board when moving to agile, not getting the coaches on board proved to cause difficulties later on. We also experienced another problem common in organizations: finding enough time for Scrum meetings can be hard if too many other activities are scheduled, thus leading to the perception that Scrum costs too much time.

8 Conclusion and Summary

In our 2017 Summer Term we experimented with adding Scrum to the Advanced Track at the HPI School of Design Thinking. We hoped to give our students a useful and flexible project management techniques that would fit in well with the rest of the Design Thinking toolkit. We

presented the Scrum elements that we introduced into our course and reported on their perception and usage. Overall the students liked Scrum and the techniques and in several discussions with our coaches we could agree on a set of useful tools from the Scrum toolkit that will find their way into the coaches' toolbox. Our biggest issues in adding Scrum to the class were not getting the coaches on board early on, introducing Scrum during the start of the projects along with a lot of other new information, and not having enough time reserved for it. For the upcoming Advanced Track instalments, we have decreased the intensity of our Scrum introduction. Instead of presenting the full methodology, we only provided a short introduction to project planning for our coaches, along with the tools that we identified as useful. The coaches are free to use Scrum, as well as these tools, in whatever way they deem valuable.

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