TEACHING MEDIA DESIGN BY USING SCRUM. A QUALITATIVE STUDY WITHIN A MEDIA INFORMATICS' ELECTIVE COURSE

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ABSTRACT

Cross-disciplinary skills are today's key skills for media informatics students to gain employment after graduation. However, such problem-based learning projects almost never take place due to organizational struggles. The authors suggest Scrum, a framework that is increasingly used in software engineering, as a solution for the challenges. Scrum has been implemented in a 3D media design project seminar at Dresden University of Technology during the cross-disciplinary project "SUFUvet" which took place in cooperation with University of Leipzig in 2016. The authors evaluated the use of Scrum qualitatively during the project and after. This paper explains methodology and results of the studies. Results shall be presented in four hypotheses within this paper.

KEYWORDS

Visual media design, Scrum, 3D visualizations, Higher Education, Media Informatics

1. INTRODUCTION

As investigated in former courses (Kröber and Münster, 2016), complex learning settings like team problem- or project-based learning (PBL) require a high degree of supervision and much time to be carried out (cf. Blumenfeld et al., 1991, Barron et al., 1998). One of the reasons is the complexity and massive cognitive load for participants caused by the multitude of tasks especially in the initial stages of these seminars. With regard to these challenges, the employment of an organizational framework like Scrum, which was primarily used for Agile Programming approaches for software development (Davies and Sedley, 2009) has been proposed as a promising solution (cf. Münster et al., 2015). To assess this assumption empirically, the educational project "SUFUvet" took place in spring and summer of 2016 as a joint cooperation involving the Technische Universität Dresden and the University of Leipzig. The project assignment was to create 3D visualized multimedia material for an e-learning course about ante-mortem and post-mortem meat inspection of domestic pigs (cf. Maurer et al., 2016). 10 students from a media informatics master level course and 3 veterinary students from the University of Leipzig carried out the task. Both media informatics students and veterinary students formed teams, each of whom was responsible for one of three 3D visualizations. Due to the unique setting of the course, our interest was to qualitatively investigate, how Scrum works in an educational setting. Related questions are:

- How would the application of Scrum work in general?
- How would Scrum influence the overall workflow as well as the transparency and documentation of the project and students' performance?

2. METHODOLOGY

Complex learning settings as PBL for multimedia creation "require[s] deeper integration of ideas" and an intense coordination of team members (Mintzberg and Westley, 2010). Scrum seems promising for mastering some of the issues of relevance for complex learning scenarios as for instance the lack of "strategies for planning and guiding" for problem solving as well as the lack of knowledge of cooperative social interaction and discourse practices (Reiser, 2004) and to iteratively estimate, plan and perform tasks together using self-organization and collaboration.

Application of Scrum

The main focus of Scrum is to deliver significant value in short iterative production cycles as so called "Sprints" (cf. Figure 1). The cycle begins with a Project Vision which is created by the so called *Product Owner* with all stakeholders. Each Sprint starts with a Sprint Planning Meeting. The Scrum Team discusses which Backlog Items of high priority should be considered for inclusion in the Sprint. During the Sprint the Scrum Team realizes a potentially shippable Deliverable or product increment. During short Daily Standup Meetings team members discuss the daily progress, identify impediments or coordinate their current tasks. At the end of the Sprint, a Review Meeting is held during which the Team gives a demonstration of all Deliverables to the *Product Owner* and relevant stakeholders. The Sprint cycle ends with a Sprint Retrospective Meeting where the team discusses ways to improve processes and performance. While Scrum is basically used in software and web engineering, some teachers adopted Scrum for a production of e-learning courses and materials (eg. Tselentis, 2014, Davey and Parker, 2010, Boyle et al., 2006, Winckler de Bettio et al., 2013). Especially for those non-engineering scenarios and educational purposes the Scrum method needs to be adopted (Popovic, 2012, Winckler de Bettio et al., 2013).
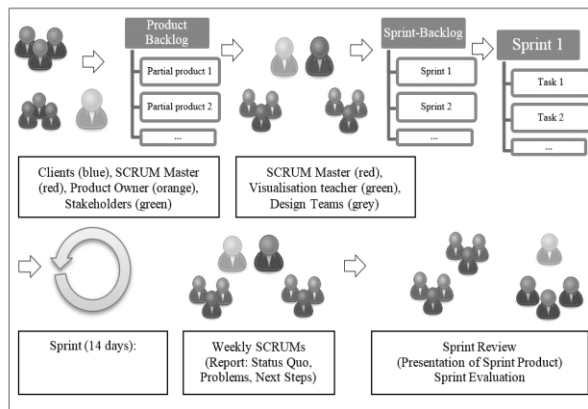

Figure 1. SCRUM procedure within the SUFUvet project (cf. Schwaber and Sutherland, 2011)
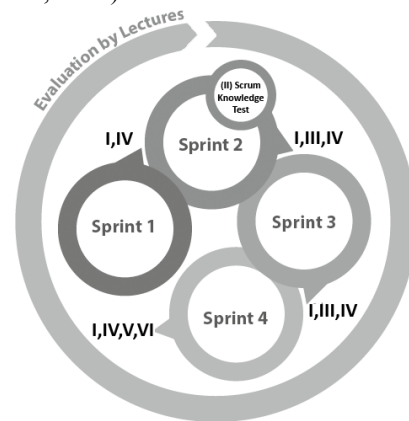

Figure 2. Assessment instruments within the SUFUvet project

Since visual media design class at university is a very particular setting for the implementation of Scrum, we applied various changes of the methodology as marked in Figure 1, in particular to Scrum meeting intervals plus several roles within the framework. At the beginning of the project, we expected it to be a main challenge "to split overall visualization goal(s) into independent subtasks that can be prioritized freely by each person in a design team" (Maurer et al., 2016), but we also hoped that this splitting would help students to structure and plan the work right from the start. Our project had four Sprints with durations between 1 and 3 weeks. Once a week students met in class for a three hour work session with a 20 minute break halfway through. They were tutored by a 3D modelling expert.

Assessment strategy

While a primary goal of formative assessment is "to provide feedback to teachers and students over the course of instruction" (Boston, 2002, p.1), a summative approach evaluates competencies or outcomes at a specific time and "sums up the performance or learning level of achievement" (Dumit, 2012, slide 10). According to several studies (eg. Igaki et al., 2014, Santos and Pinto, 2013, Scharf and Koch, 2013, Vasilevskaya et al., 2014), Scrum is a very handy method to evaluate workflow progress and assess team performance both formative and summative in a PBL scenario due to its periodic and intensive process

documentation. Furthermore, there are reflections on usability studies within Scrum (eg. Jia et al., 2012, Lizano et al., 2014) but none on how to check the surplus value of Scrum itself especially in university education. That is why the evaluation of Scrum in a non-software or web engineering surrounding is a pilot project. We installed the following formative and summative assessment instruments within the proposed PBL course (Figure 2):

I.   After each of the four sprints we arranged a review by guideline-based questionnaires to assess a quality of outcomes.
II. During the second sprint, students did a Scrum Knowledge Test in which they a) proved knowledge on the Scrum method as well as b) reflected on advantages and disadvantages. The latter was a qualitative evaluation by students in an open text question.
III. Following the second and third sprint, a teacher-provided assessment based on individual process information in Scrum desk was provided.
IV. After the sprints one, two and three, each Design Team held a Sprint Retrospective reflecting: "What was good?", "What was bad?" as well as set the Action Points for the next sprint.
V.   The end of sprint four marked the end of the project. Students were asked to do final presentations on their own progress, work and the Scrum implementations before the final review took place.
VI. After the last sprint, a Project Retrospective with all stakeholders and students assessed the Scrum implementation as well as further discussed results of stage III.

We find the **process quality** assessed through II, III and IV. The **performance** has been evaluated with the teacher-provided assessment mentioned in III. It shows that the possibility for III could be a first proof of Scrums handiness concerning a simple assessment. **Output assessment** was realized through I, V and VI and the installation of I also guarantees the **client satisfaction**.

3. RESULTS

3.1 Scrum Knowledge Test & Evaluation by Lecturers

At the end of the second sprint, students took part in a Scrum Knowledge Test that consisted of 15 compulsory questions, one additional question and an elective one: "What advantages or disadvantages do you see in the implementation of Scrum into media design processes?" Five out of nine students answered this question. Students appreciated the structure that was given by the Scrum framework and acknowledged clearly defined rules, efficiency increase by retrospectives and the team experience in Scrum as well as the well-organized overall project. Two students stated that the Scrum framework is a better approach for organization and coordination than the approaches previously known to them. Scrum was also seen as a possible bridge between traditional software engineering and traditional design processes by one student. On the other hand, one student declared that there are no advantages about the Scrum implementation and that it is a useless theory. Also, it was declared a disadvantage that the Scrum theory and application needs to be trained first. Considering this in addition to the repeated complaint about the Scrum organization being very time consuming and parts of it not always being useful or doable for media design processes (e.g. documentation and splitting the product into pieces that can be done by different persons), one student's statement summarizes the overall evaluation: *"It is a way of organization, and that is always depending on preferences. Though, it is nice to get to know it"* (translated from German by Authors).

Lecturers have been asked to evaluate the implementation separately at the end of the class. From a Scrum master's point of view, Scrum helps to define the media product with the highest business value for the client because there is a steady communication about it. This is also supported by short iterations which imply fast intermediate results which the client can comment on so that it can be improved easily and to the client's needs. In this case, design teams do not spend too much time on unnecessary work. During Scrum, teams estimate workload and time effort and if so, the client gets planning certainty. Transparency eliminates the risk of immoderate expectations of what the teams may accomplish. Creativity and problem solving are provided by the whole interdisciplinary team. On the other hand, media design products often have to be aesthetic in a way, and it is difficult to find hard criteria of what is aesthetic. This affects the Scrum organization partly (so-called acceptance criteria). Media design products often cannot be split and combined in the end (unlike programmed software elements). Moreover, tasks are rather dependent of one another, and

for Scrum to be effective, the question is how this can be altered. For a media design expert, the advantages of team communication which is necessarily part of the Scrum process as well as its quality protection throughout the iterations by transparency and feedback are obvious. On the other hand, the team organization workload and the dependence on others as well as the splitting problem gives cause for consideration.

3.2 Sprint Reviews & Retrospectives

Veterinary project students & stakeholders have evaluated the design work during the Sprint Reviews in Scrum. Therefore, they filled in their data in a questionnaire that was solely created for the documentation of these reviews. To give an idea, we have the documentation of all three design work pieces for the first and the second sprint. Due to some project related events[1], only one of the work pieces reviews is available for all sprints: the gastrointestinal system (design piece 1). These documentations show that a) the students' priorization did increasingly meet the clients' priorization from sprint to sprint, b) the students produced little during the first sprint and then started to design schematic models of almost all parts during the second sprint which c) met the clients' acceptance criteria in sprint three already and d) the visualization has been finalized in sprint four. This documentation leads to the following interpretation:

- Reviews helped the students to gather the information they needed and to overcome problems which popped up at the very beginning of the design process because they could request e.g. image sources that met their needs for 3D modelling.
- The regular feedback during the reviews led to an improvement of the media design product.
- Especially it eased the design teams' work to meet the clients' needs.

Let us look at the Retrospective of the teams to gain even more insights. The design team of design piece (2) consisted of two persons. The work was done by mainly one person who was experienced in 3D modelling but did not communicate or exchange data as well as it was expected but absent during the first review. Both design team members complained about Scrum and refused to document their work in Scrum desk from the very beginning. Design team of the work piece (3) got the unexperienced team member during sprint three. Because he, but also another team member, were missing every now and then but did not communicate about it, the team got into time troubles. Meanwhile, they were able to solve a data exchange problem via Dropbox which is documented as an action point and reflection in the retrospectives of sprint two and three. While this team was able to split the work very well, it was an issue for the design team (1) of the gastrointestinal system from sprint three on in their retrospectives. The latter design team, though, got the experienced team member of team (2) and therewith had a pretty helping hand. We assume that,

- the speedy result of design team 2 is rather due to the experienced team member in 3D modelling than to Scrum organization, but also
- the workflow of design team 1 may be due to the Scrum organization but also because of their experienced help from sprint three on.
- Scrum is only working with reliable and team-minded persons and
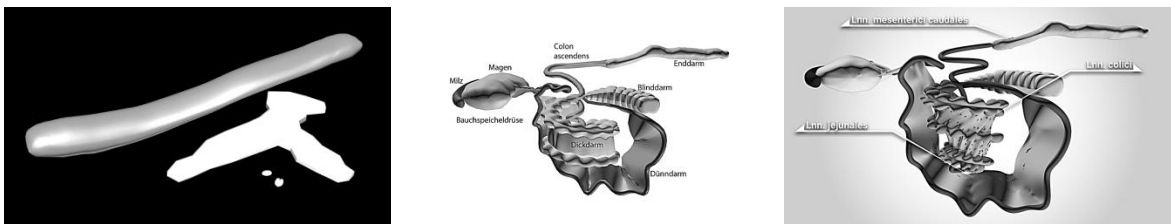- Retrospectives have the potential to identify problems of the teams and to solve them.

Figure 3. Results of the first, third and fourth sprint of the design team "gastrointestinal system"

3.3 Students Presentation & Project Retrospective

Students had to give short presentations on their progress and results and to reflect the learning and working process for themselves and their design team critically. These presentations included various reflections on

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[1] For example, one of the pieces was finished after the second sprint and only the visualization was then slightly changed to fit afterwards. There is only one other documentation for the fourth sprint.

the class & project. It has been stated that the use of Scrum led to effective time management as well as to good teamwork. Other reflections cannot be linked to Scrum. Still, we compared the students' reflections with those from a previously mentioned former project to indicate changes. Whereas the students of the former project reflected on the fact that they felt lost and needed a lot of input to get structured and to understand what the work was about, students in the recently done project focused on time and software problems. Although, the students involved in our current project argued, that the Scrum organization consumed much time yet. Additionally, we had a final group discussion with all participants involved in our last session. The so called Project Retrospective, referring to the sprint retrospective, had a time-line design and concluded all reflections on the class and project itself (see Figure 3). All parties wrote positive, neutral and negative feedback on colored paper and talked about it. Also, every student could mark the statements that he or she most agreed with. Two students voted positively for the Sprint Retrospectives to improve the project's work flow as well as the combination of Scrum and 3D modelling, and the visits by the veterinary students during the reviews in Scrum. One student voted neutral for Scrum desk as it is not always useful for media design, for example to keep record of who does what. A non-digital solution was not preferred. Three students voted negatively for the Scrum overhead. Still, already in sprint two, there are two positive votes for a structured work and routine and ten positive votes for a relaxed atmosphere.

4. CONCLUSION

Summarizing, it can be said that Scrum helped to structure the work and improve the work process of this project class. But it needs to be even more simplified to meet the requirements of a 3D modelling even better. We conclude that

- Scrum supported the complex PBL scenario in the SUFUvet project. Both the lecturers and students voted positively on the structure and the review culture that is given by Scrum. In comparison to the last project, there have also been fewer complaints about challenges to organize the work. Instead, students stated that Scrum helped them a lot on that matter but they faced struggles with a Scrum-work-overload.
- Scrum simplifies a formative and summative assessment. The documentation of all steps of Scrum allows an all-time overview of what is happening and how it is evaluated by the persons involved. Our additional tools, like the questionnaire for the students from Leipzig, helped to gain more information on how usable the media products were and how these could be improved during the short iterations.
- Our assumption that the use of non-digital documentation instead of Scrum desk would minimize the overload of Scrum has been declined by the students in the Project Retrospective. When looking for ways to solve this overload problem after all, we come to see that:
- Generally speaking, Scrum is transferrable to other fields like media design and can be useful for them. But we plead to reduce Scrum to its helpful elements such as reviews and retrospectives instead of clinging to the original concept and to support a documentation structure that only covers meaningful items for the assessment.

To us, the parallel work of design teams and design team members is particularly useful for 3D contexts since for a 3D scene one often has to create and texture multiple 3D models. To artificially separate parts of 3D models, though, is not recommended. In Scrum, it can be seen as a challenge to create work tasks that take about the same amount of work for everyone involved as well as to train the necessary communication level within and between the design teams. Since the described research was intended as initial exploration, we currently plan for a more detailed study to validate findings.

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