From PBL Supervisor to Product Owner

SCRUM based supervision of student projects

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1 INTRODUCTION

In recent years, projects, and project based learning (PBL) have become an integral part of engineering educations [1], [2].

In the engineering disciplines, focusing on competences for teamwork is more and more important, see e.g. the CDIO framework [3], [4]. A project supervisor is often attached to a project group to guide the students through the project. However, this role is very loosely defined [5]. In [6], the role as supervisor was described as: "*The role of the supervisor is to give response to the students' project process along the way and not least to run the examination*" [6]. Which again does not provide a clear guideline, leading to ineffective and frustrating supervision meetings, with little real outcome.

While supervising students it has often been my (the first author) experience that the students have issues communicating professionally with each other. This is often the case in the lower semesters for project groups of 6 to 8 students.

This lack of communication is often at the root of the students' poor grades in the project exams, rather than a lack of technical skills. Often the individual modules of the project are technically well made, but do not fit together. The definition of interfaces between software and hardware is often badly written, or the students have not

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coordinated the integration of parts. I have on several occasions observed that borders are not specified, and the distribution of assignments have been misunderstood. These issues are either not solved or only solved because I, as supervisor, have interfered.

The students complain that communication issues arise because they do not meet often enough or because part of the group met without informing the other part. It furthermore appears that many groups only meet during the one-hour supervision meeting I have with them each week.

These problems could be avoided or be less prominent if the group communicated better, or had a tool to improve communication.

Many companies use an agile development process known as SCRUM [7]. SCRUM consists of a set of rules, roles, and artifacts. In SCRUM, guidelines for communication and the roles are clearly defined.

By using SCRUM for supervision, my role of supervisor has changed. Instead of just observing the students and trying to heuristically guide the process, I take on the role of the product owner according to SCRUM. As product owner, my role is now to be the owner of the learning goals and eventually the exam. I give back the responsibility of the work and in particular the communication to the group members. SCRUM defines how the team communicates. Also, SCRUM provides tools for students to track and evaluate the communication internally in the group.

SCRUM, has not traditionally been used in the supervision of student projects. This study explores whether SCRUM is a useful tool for the supervision of student groups.

My goal is thus: **to teach the students a tool that allows them to communicate professionally, while also communicating my role as supervisor in a professional way.**

In this paper, we will briefly introduce SCRUM and how to use it in PBL. In a limited case study of two student groups, we will explore how to apply SCRUM to supervision in PBL. Lastly, we will evaluate the study, discuss the results, and conclude on the case study.

2 SCRUM

In software companies, SCRUM is widely used as an agile [8] project management framework [9]. SCRUM is inspired by how high-performing teams work. It consists of a simple set of rules, artifacts, and roles of the participants that support iterative development of software or other products.

The roles in SCRUM are *Product owner*, *SCRUM master* and *team member*. The product owner has the responsibility to prioritize tasks and assess results. The SCRUM master is a facilitator that has the overview and knowledge of the work process but has no authority or responsibility. He should make sure to be a buffer between the product owner and the work team. He ensures that the team is not given too many tasks. The SCRUM master could also be a member of the team. The team members have responsibility for their own work and tasks. Team members should be seated together to ensure synergy and communication.

The work is organized in sprints of 1 to 4 weeks of length; only one sprint is planned in advance. In the sprint planning meeting, the tasks are prioritized by the product owner. All tasks are assigned time estimates by the team members and they commit to how many tasks can be completed in each sprint. After each sprint, a sprint review meeting is held, where the completed tasks are approved by the product owner, and a sprint

retrospective is held to evaluate the work process. To keep track of progress, the team members have a daily SCRUM meeting.

The SCRUM board consists of all tasks. All tasks in the project are put in the project backlog. The tasks specific for the current sprint is in the sprint planning meeting organized in the sprint backlog. These tasks have a time estimate and a priority. Each team members should use the SCRUM board actively to solve the tasks with the highest priority and to mark tasks as either “in progress” or “done”.

3 METHOD

The study program in focus includes a research and development project in each of the first four semesters. The background for this is to teach the students cooperation as much as teaching them to implement a real electrical product. This is reflected in the learning goals. At this level, the students are taught and evaluated for their use of system and interface specifications. Usually, these parts cannot be made by a single individual of the group, but needs to be made jointly by the group. Communication problems in the group usually lead to some integration error. The organization of the group’s professional communication is thus important.

The purpose of introducing SCRUM to these student projects is twofold; Firstly, to improve the work process in the group work as it helps the students to organize their team work [10]. It also defines the supervisor’s role. Secondly, the engineering students are expected to work in companies where SCRUM is used [9]. Learning SCRUM is thus a learning goal in itself.

We will introduce the elements of SCRUM to the project work [7], as presented in the previous section. The students will be given the roles as SCRUM master and team members. They are encouraged to use SCRUM in their projects, and given the opportunity to participate in a SCRUM course (external course). The implementation of SCRUM will be their responsibility and is part of their exam.

To better define the scope of the supervision, the supervisor fills the role of *Product Owner*. The product owner’s function is to prioritize tasks and to assess the team. The tasks here are the curriculum and the learning goals of the course. This defines the supervisor’s role more clearly; the product owner is thus a more well defined version of the supervisor’s real function.

SCRUM supports the supervisor into giving structured and thus improved supervision. This alleviates the frustration of having loosely defined tasks, and gives the supervisor a new, well defined, role in teaching the students teamwork. This new role allows the supervisor to give the students much better and more structured feedback and guidance, while also changing the supervisor from almost purely observer to active mentor.

The SCRUM product owner assigns priority to tasks according to how the students are evaluated at the exam. The sprint will end in a review meeting, where the product owner assesses the sprints of the project. The work process and communication are then assessed in the sprint retrospective meeting.

How the supervisor / Product Owner assesses the students during the course is transparent in the form of review meetings, retrospective meetings and finally the exam. Furthermore, the students are made aware of the priority of all tasks with respect to learning outcome in the sprint planning meetings. SCRUM is also used as a platform to enable the students to enter into a dialogue with the product owner. We have given the supervisor a tool to structure his or her supervision, and thus enabling him or her

to give better supervision. Usually the product owner plans the sprint with respect to what priority the tasks have.

We redefine the role of supervisor to that of SCRUM product owner. The role of product owner is an active role, and we argue that this role can be used to define the supervisor. The parameters by which the product owner assesses the team are well defined.

4 SETUP

This study is carried out at the Aarhus University School of Engineering with third semester engineering bachelor students from electronics, information and communications, and power engineering programs. In the 5 ECTS project course, groups of 6 to 8 students must make a novel electrical product. Typically, a supervisor holds a weekly meeting with the groups. The goal of the course is to learn group management and to learn to apply technical knowledge from other courses [11].

In this study, we compare two groups that have used SCRUM for their project course. Groups A and B both consist of students with mixed courses and specializations within electrical and computer engineering. The course programs of individual students are not completely comparable. But the technical skills within the two groups are the same, and the project was the same.

A member of each student group was appointed the role of SCRUM master, which is the student responsible for the management process. It is also his job to read up on SCRUM and educate the group on SCRUM.

One of the main mantras of SCRUM is that the group should be seated together. Since the students follow different schedules and courses, we address this issue. The task board for SCRUM is therefore organized in an online tool. Both group A and group B have tried three different formats of the daily SCRUM: public logbooks, physical meetings, and a common Facebook chat.

Group A did not have a physical place to meet, and meetings took place at tables in hallways. Group B had by chance acquired a physical group room.

The supervisor acted as product owner for both groups A and B; she prioritized the learning goals for each sprint, and received material for the review meetings, where she evaluated the progress.

In both groups A and B, a sprint length of 3 weeks was decided on.

5 EVALUATION

The experiment runs three months in spring 2016. The results are collected from the process meetings: daily SCRUM, retrospective, review and planning meetings and weekly group meetings.

Product Owner:

The team updated the product owner on the completed tasks during the review meetings. The completed tasks were evaluated according to the learning goals of the course. The future tasks were discussed at the sprint planning meeting, where the product owner put special emphasis on the priority of the learning goals of the project.

As an experiment, the product owner planned sprint 2 for group A. This meant that the product owner went through all tasks and prioritized them. In the general case of SCRUM, the product owner would do this for all sprints.

Observations for this sprint planning meeting: The meeting was very lengthy (more than 2 hours). This was because the team should have had an updated backlog with

tasks and time estimates before the meeting but did not have that. Furthermore, all completed tasks should be updated in the SCRUM board. However, since this was the second sprint, the team had not yet gotten into a routine of updating all tasks and time estimates. The team found the meeting to give them the tools to plan the future sprints themselves, and the meeting and outcome were positively received by the team.

As product owner the role of the supervisor was to prioritize the tasks, e.g. the learning goals of the course. It was also to review finished material. These two points the supervisor brought up at each sprint startup and review meeting. This gave a guideline on how to supervise; which learning goals had been worked on in the sprint, and which ones should be prioritized in the next sprint. This gave both the supervisor and the students clear goals, and made the progress of the groups evident.

SCRUM master:

The two SCRUM masters of groups A and B have (as opposed to previous semesters) read up on agile software development, and have on their own initiative made their own reflection sheets on how their role as SCRUM master is.

Both SCRUM masters handled the online task board, and took control of meeting agendas, and acted as meeting leaders. They also had the responsibility to check up on the daily SCRUM in the form of logbooks from the team members. In both groups, it appeared that the SCRUM master in the beginning did not influence the work process. The teams did thus not adapt to using SCRUM boards and daily SCRUM. The supervisor explained the role of the SCRUM master as a facilitator. Based on previous experience, the supervisor stressed that the SCRUM master was not a manager and the responsibility was on the whole group.

In group B, the SCRUM master then changed behavior, in such a way that the review meetings were more structured. He began asking more specific questions. Before the questions were: “What is the progress and do you have any problems”. Later the questions were: “What was the plan? Did you deviate from the plan and why?” This gave a more reflected response from the team members. The produce of each sprint increased dramatically after this chance. The group estimated in the sprint before the change that they were less than 50% on track, and the sprint after that they were 80% on track. Numbers are with respect to the sprint backlog. The produce of group A did not chance significantly in the same two sprints.

Both group A and group B mistook their SCRUM master for either the project manager or the secretary. E.g. in at least three instances, different team members in the two groups have complained that the SCRUM master did not make the minutes or had not made a meeting agenda. At the same time, they referred to the fact that he was SCRUM master, and therefore it was his job. In at least one instance a team member mistook the SCRUM master for the project manager: in a review meeting, he blamed the SCRUM master that the group was less efficient because the SCRUM master did not hand out assignments to the team members.

The Team:

The responsibility of work is on the individual members of the team. In the first 2 to 3 sprints, the two groups experienced several problems with taking new tasks from the SCRUM board, and also experienced problems with team members solving problems assigned to someone else. This was due to lack of daily SCRUM and general lack of communication. The students had the possibility to attend a course in SCRUM after this.

In both groups A and B, the team members worked better with SCRUM after a few sprints. They learned to prioritize tasks, and to use the retrospective meetings actively to reflect on the process. For both groups A and B, a retrospective meeting was held after all sprints.

Daily SCRUM:

In the initial setup, groups were not seated together. Daily SCRUM is thus extra important. The students in either group did not think it feasible to have a daily stand up meeting in the whole project period. Because of this, the supervisor asked them to make a logbook for each day. They could see each other's entries. Stand up meetings were done in each group for one week only (in the middle of the project period).

Most students did make a logbook entry each day, but almost all the students did not check other students' entries. Since the students did not read each other entries, the logbook was useless for communication.

Both group A and group B tried to have stand up meetings for one week. For group A, the supervisor attended the meetings. The students themselves concluded that they had many joint activities, and the information given at those meetings was superfluous. In group B the supervisor did not attend, and the group concluded that the outcome was limited as no real information had been given at the meetings.

In the last sprints, both groups A and B held their daily SCRUM over an asynchronous Facebook chat. This worked to some degree, as most of the students read each other's entries. However, some students still forgot to write an entry on the chat when they began a new task. At least in one instance, a student forgot to check the chat, when he had asked for help on a problem that another student had solved.

6 DISCUSSION

For both groups A and B, the supervisor acted as product owner of the learning goals. This gave clarity to the supervisor's role. The students knew what was expected of them in the project, as the product owner prioritized the tasks. Furthermore, the project was reviewed every three weeks in the sprint review meeting. At the sprint meetings, it might even have made sense if the supervisor had a written out copy of the learning goals to be used as backlog of the project. This would also have made the role of the backlog clear for the students. This would emphasize the supervisor's role as the product owner of the learning goals. I (the first author) intend to adopt the practice in the Fall semester.

It appeared to make sense for the students to view the supervisor as the product owner. Both groups A and B sent material for review for the sprint review meetings. Furthermore, both groups A and B demonstrated (opposed to previous semesters) software and hardware implementations at the review meetings. This assisted both the team and the product owner to know the current status of the projects.

It is difficult for the students to understand the role of the SCRUM master. In one group, the efficiency of the group was greatly improved by more direct communication from the SCRUM master. The conclusion is that the teams need supervision to teach them about SCRUM, as little improvement in SCRUM was seen in the periods with few supervision meetings and before the teams had attended a SCRUM course. The SCRUM master furthermore appears to be significant in respect to the efficiency and elements of SCRUM in the group.

The daily SCRUM worked best on a platform the students were comfortable with, namely a Facebook chat. This is not a professional tool, but as the focus is on teaching

the students communication, this appears to be a good way of having daily SCRUM. In later projects, a Facebook chat should be changed to a professional platform or to physical meetings.

Group B was, as opposed to group A, seated together. SCRUM advises that the team should, if possible, be seated together. The communication and synergy in group B, was better, the attendance of meetings in group B was better than group A. It appeared that group A often only met once a week. Miscommunication about meetings and material was more outspoken in group A than B. It would appear that having a common room assisted group B in both communication and meeting frequency.

Usually, success of SCRUM is measured in the amount of retrospective meetings the team has held. Retrospective meetings have been held by both groups A and B, and have been very relaxed and honest. The supervisor has participated in approximately half. The retrospective meetings have clearly improved the process.

7 CONCLUSION

I have in this study communicated to the students that my role is that of product owner in SCRUM. Thus I have stated that I have prioritized the learning goals for them, and that I review the group every three weeks and at the exam. The students understood my role better than at previous semesters, and the role also assisted me with a very clear agenda for each meeting.

In the study, the students have also learned how to use SCRUM for project management, which will also be part of their exam.

This study has compared the SCRUM retrospective meetings from each sprint. In the study we have also assessed the challenges of using SCRUM for supervision, such as the daily SCRUM meetings and the online task board.

The communication of the group that had a group room was much better, and interfaces were better defined. This fits well with the fact that a SCRUM team should be seated together.

Daily SCRUM has been very important to improve communication, but face some challenges. Tools such as stand up meetings and logbooks have not been a success, mainly because it was seen as an inconvenience to the students. As not all students participated, the communication was still lacking with these methods. The best results were with a Facebook chat. Since all students were online on Facebook most of the time, and the groups already had a common Facebook group, this was not seen as an inconvenience, and communication was thus better. Overall both group A and group B solved their disagreements and communication problems better than previous groups on the same semester. Retrospective meetings, as well, have been a key to improving communication.

The students have been very positive towards SCRUM, even though they faced challenges in the implementation of SCRUM. The students have begun changing their perspective of the supervisor by asking specific questions regarding interpretation of learning goals, and asking for specific reviews of their work. They relate to the supervisor as the product owner, which made the meetings and review processes more efficient.

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