Course analysis, Spring 2018
II1305 Project in Information and Communication Technology

Course Data

Examiner and coordinator: Fredrik Lundevall.
Teachers: Fredrik Lundevall, Cicek Cavdar, Anders Västberg.
Guest lectures by Simone Stefani and Phillip Gajland.

Course dates: Monday, 2018-03-19 through Monday, 2018-05-21.

Registered students: 66. Examined students: 66 (100%).

General

The course is offered in year 2 for two programs: the Swedish-language Civilingenjörsutbildning i informationsteknik (CINTE), and the English-language Bachelor's Program in Information and Communication Technology (TCOMK). All written material for the course is in English.

Conceptually, the course turns technology students who have unconnected skills, into junior developers who combine and extend their skills as needed. Students form teams of 5-8 persons. Each team conceives, designs, and implements a project with software, hardware, and/or communications technology. An outline is shown in Figure 1.

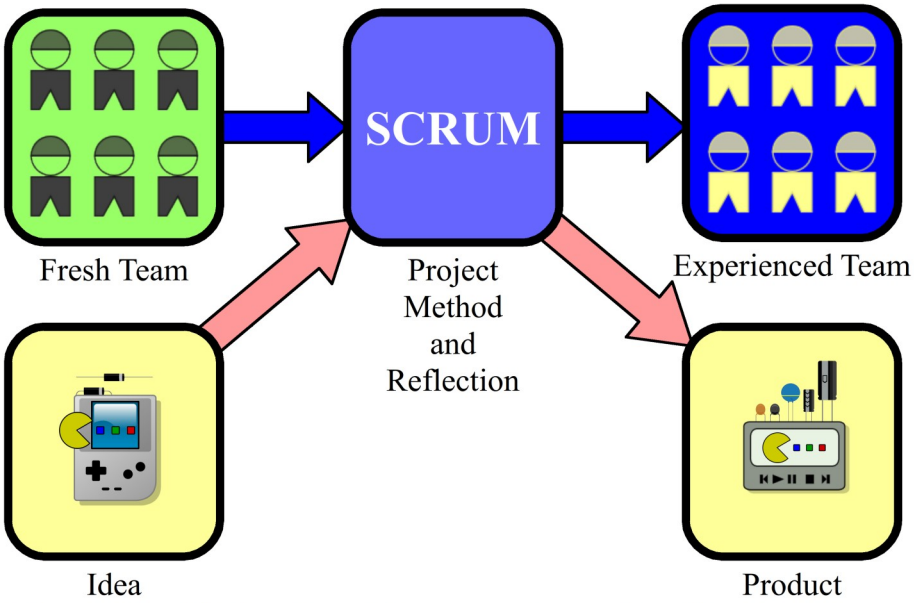

Figure 1. A very simplified outline of the course, in graphical form.

As shown in Figure 1, the course actually involves two transformations. A fresh team of students becomes a more experienced team, and an idea becomes a product. The product is necessary for the team's experience, and the team is of course necessary for the product.

Teams can tend to prioritize the product over their own learning. To counteract this, the course involves structured reflection, orally and in writing, to ensure that students process their experience into knowledge for the future.

The course has three distinct phases: *preparation*, *project weeks*, and *reflection*. In the **preparation phase,** students read up on the method (Scrum), and on version control systems (Git). Students also form teams, and discuss product ideas with the examiner. The examiner must sign off on the team's product idea before the team can start their design. The preparation phase is shown in a simplified, graphical form in Figure 2.

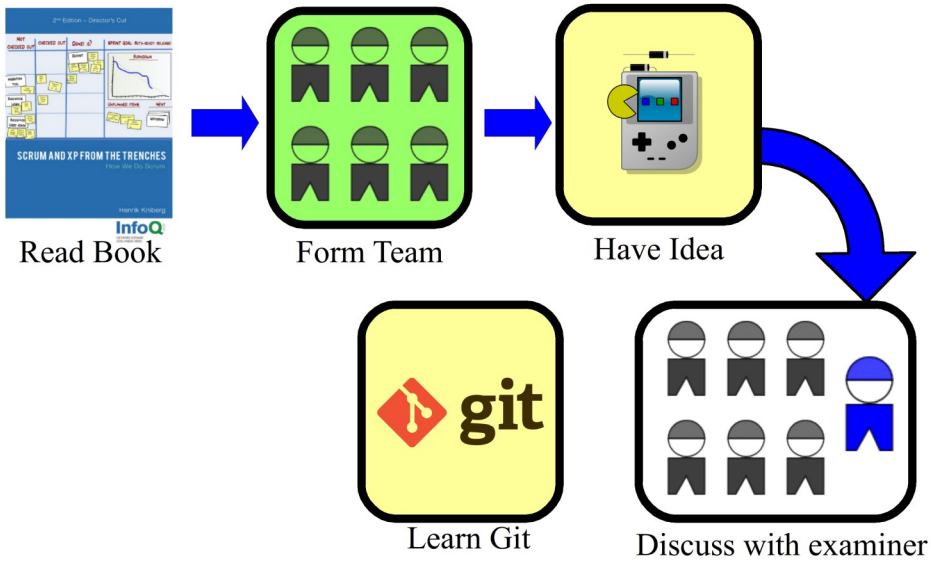

Figure 2. A simplified, graphical representation of the preparation phase of the course.

The main literature is a book by Henrik Kniberg, a former KTH student. The book is available from the publisher as a zero-cost download (requiring a zero-cost registration). Experience has shown that some students prefer to skimp on reading the book. However, for the teams to work well, all team members must be familiar with the main concepts from the book. Therefore, quizzes were introduced into the course this year (2018). Students took four quizzes in Canvas, and each quiz had 6 or 8 questions on specific parts of the book.

Teams are formed by the students, but the examiner has the last word on who goes in which team. Each team is encouraged to invent a product idea, through brainstorming and other structured creative activities. Project-ideas from external stakeholders are welcome. Some students have contacts with external stakeholders.

In 2018, some external organizations contacted the examiner with proposals for project-ideas. Some of these ideas resulted in course-projects for 2018.

Students are strongly encouraged to learn Git, which is the version-control system used in the course. Two seminars on Git are given by a former student, Simone Stefani. An additional seminar on test-driven development was given in 2018. This seminar was given by Simone Stefani and another former student, Phillip Gajland.

The three seminars on Git and test-driven development were well-attended, and received praise from students.

In the **project weeks,** teams work in four so-called sprints. Each sprint is one week long, and starts with a session of structured planning. The sprint ends with a demonstration, followed by a session of structured reflection.

The session of structured reflection is called a *sprint retrospective*. This is a one-hour meeting with structured discussion about the team's way of working during the sprint, focusing on possible improvements. According to the book, the retrospective is the most important meeting of the method (Scrum).

Discussions during the retrospective are summarized into a one-page memo. This memo can be taped to the wall of the team-room, for easy reference. A template for the memo is shown in Figure 3.

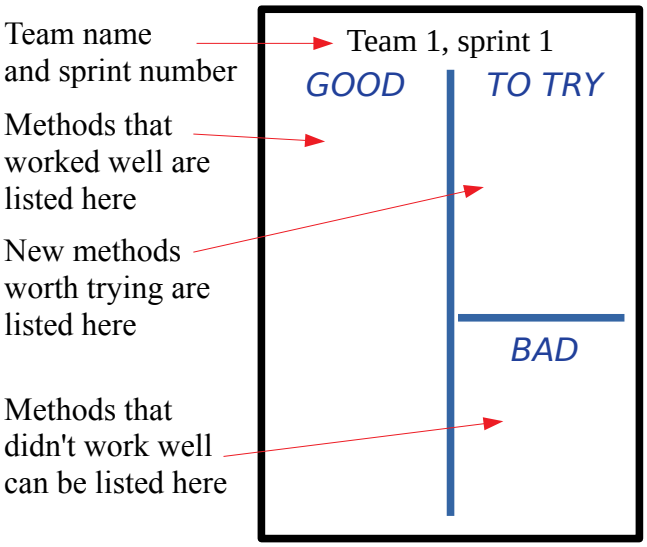

Figure 3. Template for retrospective-memo.

The sprint-retrospective sessions need guidance from teachers, at least the first couple of times. With two teachers in the course, and a four-hour afternoon for reflections, about half of the teams must wait until the second sprint to have their first guided sprint-retrospective.

During the sprints, students work weekdays from 08:00 through 17:00, with a one-hour lunch break. The specific working hours fulfill two purposes. Firstly, the method requires the team to be seated together, in the same room and at the same time. This ensures good communication within each project. Secondly, these working hours simulate actual developers' work-hours.

Each team has a team-room. The room is the workplace for the team during the project weeks. The project method recommends that planning material is taped to the walls of the team-room. To this end, a number of group rooms are booked for the course during the project weeks. The passage-control system is set up to only allow course-participants access to the booked rooms.

In each room, the team covers one or more walls with protective plastic, held in place by a kind of tape that does not harm the paint on the walls. This way, the team can freely put planning material on the protective plastic, without damaging the walls.

The final phase of the course is the **reflection phase.** Immediately after the project-weeks, there is an expo, where all teams show their products to the general public. Following the expo, there is a week during which each student writes an individual reflection, to be handed in to the examiner.

To summarize, the course lets students perform real development work in a controlled environment.

The three phases of preparation, project weeks, and reflection is part of a general pattern. The same pattern is repeated within each single project week: plan and try, demonstrate and then reflect. This pattern can be described as **"plan – try – reflect".**

Students can achieve knowledge and experience in at least two different ways. One way is to do something right and be happy about it. The other way is to do the same thing wrong, and reflect on the consequences. This is a simplification, and the "right" and "wrong" ways should be seen as extremes on a scale, with lots of possibilities in-between.

Reflecting on mistakes, and learning from them, is a very powerful learning activity. This powerful learning activity is employed throughout the course.

Students' view of the course

The students gave their view of the course mainly in two ways: through comments in their individual reflections, and through a learning experience questionnaire. There were also some oral comments during the project-weeks.

The learning experience questionnaire was open from 2018-05-10 through 2018-05-23. The public expo was on 8 May, and the individual reflection was due at 21 May. This means that the period for the questionnaire mostly coincided with the time when students were writing their individual reflections. The questionnaire was filled-out by 14 out of the 66 students who took the course – an answer rate of 21%.

In the questionnaire, most questions have the form of statements. For each statement, respondents indicate their degree of agreement on a scale of 1 through 7. There is also a separate comment field for each statement. Statements are worded so that a higher score indicates "better".

The statements fall into three categories: Meaningfulness (statements 1 through 6), Comprehensibility (7 through 16), and Manageability (17 through 22). The average response to the statements are shown in Figure 4.

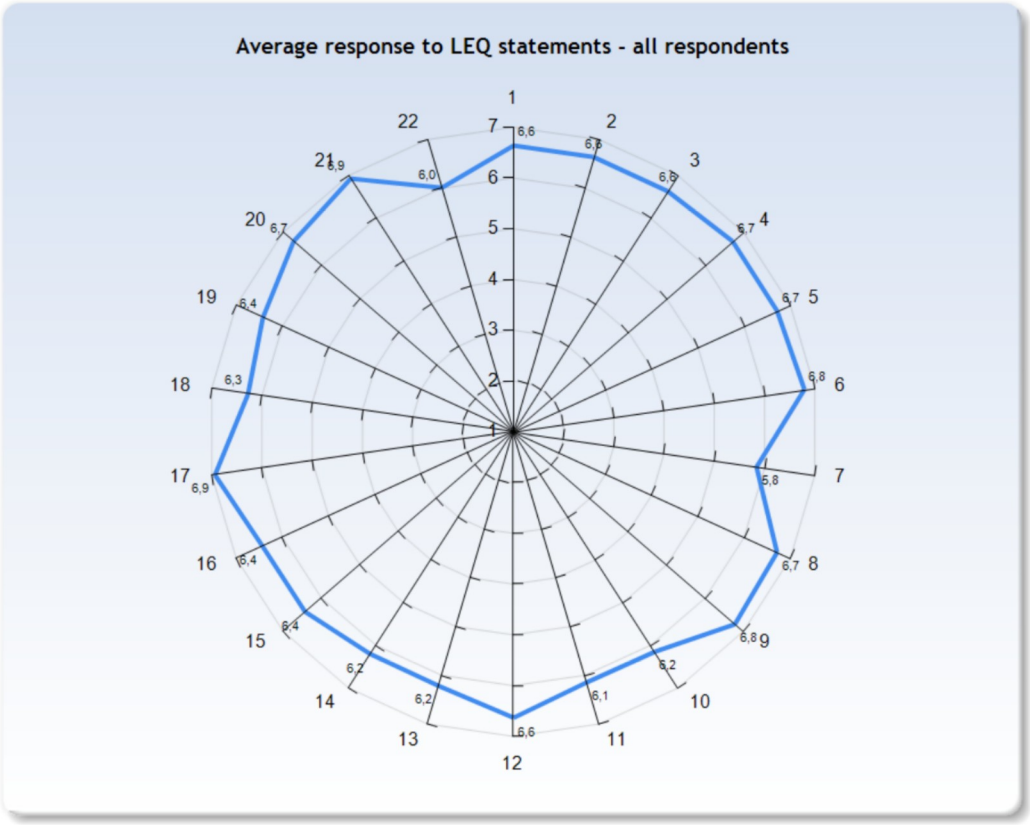

Figure 4. Average response to the statements of the learning experience questionnaire for II1305, 2018.

The respondents were very positive to the course. The Meaningfulness responses go from 6.6 to 6.8, indicating that students find the course very relevant. The Comprehensibility and Manageability responses also have very high averages.

A few questions in the questionnaire do not have statements to agree with (or disagree with). These questions include group membership, workload, gender, and type of student. There are also four general questions, with only comment-fields. These questions are: “What was the best aspect of the course?”, “What would you suggest to improve?”, “What advice would you like to give to future course participants?”, and “Is there anything else you would like to add?”.

As an example of the positive reception of the course, one answer to “What was the best aspect of the course?” is quoted here in its entirety (translated from Swedish; translation by the examiner):

“What a course! First and foremost, the structure of the course was very good. Fredrik L and the course page on Canvas has given all the information one can possibly need, to understand what and when things need to be done. During the project I learned a crazy amount of stuff. Programming has been central, but I also learned a lot about techniques and support services that organizations use to launch and administer software projects.”

In response to the question “What would you suggest to improve?”, suggestions included these:

- Improve signs at the expo to show more clearly that it is a public event.
- Improve information about working hours.
- Have more guidance during the preparation phase.
- Have more exercises with the version control system Git.

When writing the individual reflections, many students added suggestions for improving the course. Students also gave oral comments during the course.

The learning experience questionnaire has a low answer rate of 21%. However, oral comments and comments in the mandatory individual reflections confirm the positive reception of the course. These additional sources also give several specific suggestions for improvement.

Many oral comments during the course, and a few comments in the individual reflections, concern the group-rooms in Electrum. The rooms are considered uncomfortably small. Specific complaints include the following:

- Several persons need to rise from their seats whenever one person needs to move.
- There is not enough standing-room near the whiteboard for discussions.
- There is no wall which is easily accessible, and also large enough for the planning material.

Several comments in the individual reflections concern the expo. These comments can be summarized as follows:

- There were too few visitors to the expo, apart from the course-participants and teachers.
- Too much time were set aside for preparing the expo.

Further comments in the individual reflections concerned the time-table for the end-of-sprint days. The main concern in these comments was that there was too much slack time. This slack time was felt to be unproductive.

One comment pointed out that project web-pages and end-of-sprint presentations varied a lot between teams, and suggested that requirements should be more clearly communicated.

Some other comments and suggestions in the individual reflections can be summarized as follows.

- Please have a Scrum seminar during the preparation phase of the course. This could include mock-up sessions of each type of structured meeting.
- There was too little time to read the book, so some students just tried the quiz questions again and again, until they got the right answers.
- The seminar on Test-driven Development was very helpful, and could be supplemented by a quiz or other exercise.
- A little more guidance during the preparation phase would have helped. There could be a clear guide or checklist, and some tips about good practices and pitfalls.
- Making a social contract helped creating a very positive environment.
- Sprint-planning sessions should have guidance from teachers at least once during the course.
- End-of-sprint retrospectives should always have guidance from teachers the first time.

To summarize, the students are very positive to the course. They find the course meaningful, and feel that they learn a lot during the course. As always, there is some room for improvement.

Analysis by the examiner

The course has a new structure this year. Previously, there were different courses for hardware projects and software projects: IS1204 for hardware and ID1003 for software. Now there is instead a unified course (II1305), where software, hardware, and communication can be combined in every project. Software-only projects are allowed. This year, 9 out of 10 projects combined software and communication. The 10th project also involved the design of custom hardware.

The new course has stricter admission requirements than those of the courses offered previously. This was not known to all students. Several students applied for an exception from the admission requirements. Information from KTH about the admission requirements should preferably be disseminated more widely among students.

Action point 1 for 2019: Make the course's Canvas pages for 2019 public, and make the page on admission requirements available as soon as possible.

The rest of this section is structured as follows. First, the course analysis for the earlier course ID1003, given in 2017, is summarized. Actions prompted by that course analysis are discussed.

Second, student feedback from 2018 is discussed, and action points suggested. A brief summary concludes the course analysis.

When ID1003 was offered in 2017, there was only one teacher available (Fredrik Lundevall). The most negative impact of this limitation was related to the sprint retrospectives. As sprint retrospectives must happen in one afternoon, for all teams, having only one teacher meant that some teams had to wait until the last sprint for teacher-guidance at their sprint-retrospective.

The average response to the statements in the learning experience questionnaire for ID1003 in 2017 can be seen in Figure 5. To summarize, respondents were very happy with the course in 2017, too.

Comparing the graphs for ID1003 in 2017 and II1305 in 2018 shows a small but easily observable improvement in the responses from 2017 to 2018.

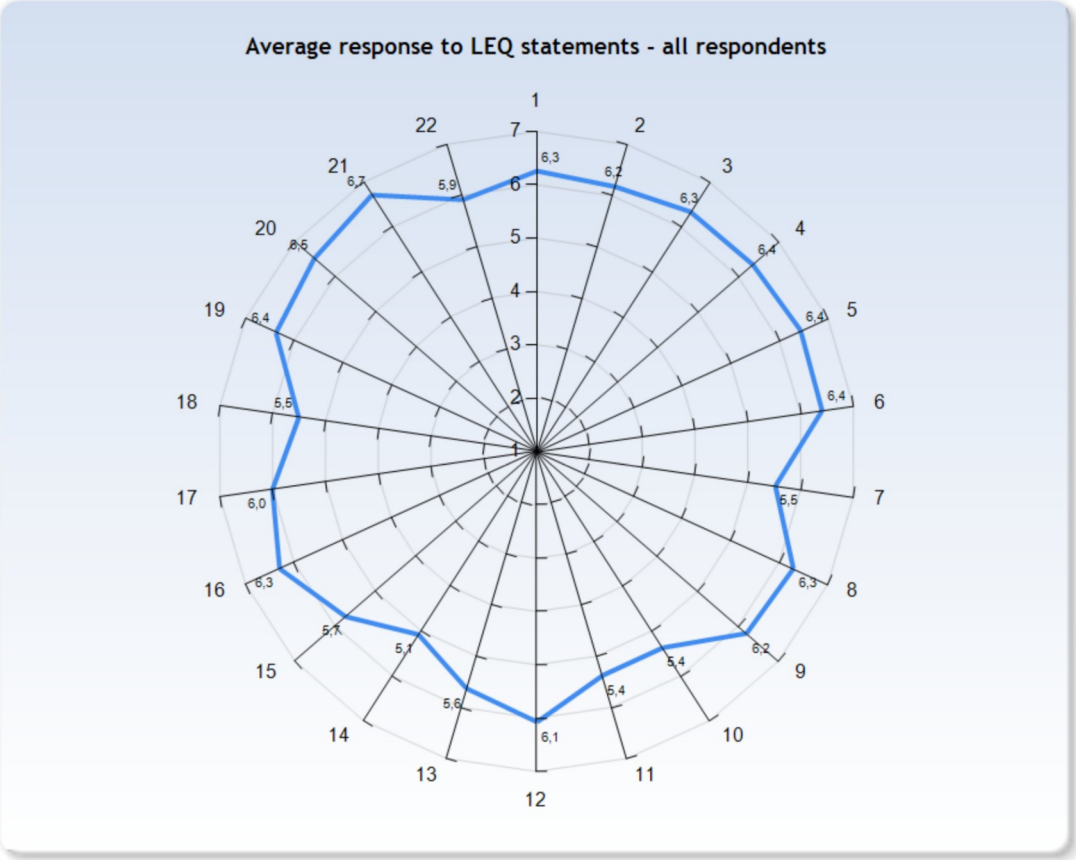

Figure 5. Last year's course, ID1003. Average response to the statements of the learning experience questionnaire for ID1003, in 2017.

In 2017, group sizes were 8-10 persons. Larger groups are somewhat desirable in the course, since when more than 6 persons work together, the amount and complexity of intra-group communication increases markedly. This means that students have to perform additional communication tasks, learning more in the process.

Students' comments in 2017 included complaints about the rooms, which were considered too small. In 2017, most group-rooms assigned to the course were designed for six persons, making a poor fit for groups of 8 to 10 persons.

Students also wanted more guided preparation with Scrum, and improved co-ordination with the methodology course IV1303.

The course book received praise from students in 2017. Some teams created a social contract for the team, and found the social contract to be very helpful.

A small number of students commented that some other students reported ideal working hours instead of actual working hours.

The examiner's analysis from 2017 indicated the following four points of priority:

1. Having additional teachers in the course, so that all teams can have guidance during their first sprint-retrospectives.
2. Co-ordination with IV1303 needs to be strengthened.
3. Additional learning activities are needed for the preparation phase, to strengthen and secure students' knowledge of Scrum.
4. Social contract and reporting of working hours need to be considered.

These points of priority will now be discussed, one by one.

Point 1: in 2018, Cicek Cavdar started co-teaching the course, particularly with guiding sprint-retrospective meetings. This addressed point 1, though not completely. Anders Västberg also worked with the course, in the role of product-owner for one of the teams.

Ideally, there should be enough teachers in the course to enable all teams to have their first sprint-retrospective be guided by a teacher. The amount of work for an additional teacher is small: a couple of afternoons during the course.

Point 2: informal discussions with the examiner of IV1303, Mira Kajko-Mattson, indicate that IV1303 has somewhat moved away from Scrum, towards other methods and methodologies. Therefore, additional learning activities concerning Scrum was added to II1305.

Point 3: four quizzes were created in Canvas, each covering a specific part of the book. The first quiz contains mostly simple, multiple-choice questions. In the other quizzes, each question typically has the form of a short scenario with multiple possible actions suggested. The student marks those actions that would improve the situation (and not the other actions).

Point 4: the social contract was presented as mandatory in the introductory lecture of 2018. The examiner also paid brief visits to all team-rooms early in the mornings the first project week. The visits were very friendly, but the existence of them did address the reporting of working hours. No problems with reporting of working hours were detected, nor reported, for 2018.

Student feedback from 2018 is presented earlier in this course analysis.

In student feedback, the size and furnishing of **team-rooms** is a recurring topic, since the move to the Electrum building in the summer of 2014.

In an ideal team-room, there should be ample desk-space for each team-member. The layout of the room should be such that the whiteboard can be easily seen from all seats. The planning material, taped to protective plastic on some wall, should also be easy to see from all seats. There should be standing-room for the whole team by the whiteboard, and by the wall with the planning material. All group-rooms in the Electrum building fail most or all of these requirements.

There have been complaints about the rooms every year, since 2015. Before 2015, the course was offered in the KTH Forum building, which had larger group-rooms. However, the KTH Forum building is no longer available.

To alleviate the problems of working in small rooms, team sizes were reduced from 2017 to 2018. Team sizes went from 8-10 persons to 5-8 persons.

Only one team in 2018 had 8 members. That particular team was assigned a group-room designed for 8 persons: Ka-G321. Yet, this team could easily demonstrate how unsuitable that room was for their work. When all 8 persons were seated, only the two sitting closest to the door could move. Like most group-rooms in Electrum, Ka-G321 is a very narrow room. The room is so narrow that anyone not sitting closest to the door have to ask others to rise before moving in any way.

Most group-rooms do not have standing-room by the whiteboard, unless the people in the room rise and move the furniture. To have standing-room by another wall, for working with project-planning material, the furniture would typically have to be moved in the other direction.

Desk-space for each person in a fully occupied group-room is 350 by 600 millimeters, or 0.21 m^2. This area stands in stark contrast to, for example, offices for Ph.D. students in Electrum. In such offices, each person normally has a desk measuring 800 by 1600 millimeters, or 1.28 m^2.

Oral comments about the team-rooms often described the air as hot and stale.

Even with the reduced team-sizes in 2018, the working environment in the group-rooms can only be described as far from good. The conclusion must be, that the group-rooms in Electrum are not well suited for use as team-rooms in a project course, and that using other rooms must be investigated.

Action point 2 for 2019: For 2019, the scheduling department has been asked to set aside two larger rooms (övningssalar) for the course. The intention is that a handful of teams can work in each room, with each team occupying one corner or one wall.

The expo in 2018 was a quiet event. The date, Wednesday 9 May, was the day before a national holiday (Ascension day), which may have contributed to the small number of visitors.

Each year, the schedule for the course is planned and adapted to the structure of the academic year at KTH, with particular regard to holidays such as Easter and Ascension day. It is vital that the four project weeks run without a long interruption for Easter break.

In 2019, Easter break ends on 22 April. The project-weeks are planned to commence on Tuesday, 23 April, running through 22 May. The expo will then be on Thursday, 23 May. There are no special holidays in that week, which should mean that more people are likely to be at work on the expo day. Further informational activities may be possible, to encourage external visitors.

Action point 3 for 2019: For 2019, advise all students to invite friends, relatives, work colleagues, and others, to the expo. Additional informational activities may be considered.

More than one student commented that **end-of sprint days** felt unproductive, since the schedule had slack-time spread out across the day: before and after the demo, and (usually) after the sprint-retrospective. There were similar comments concerning the schedule for the expo-day.

Action point 4 for 2019: The schedule for the expo day and the end-of sprint days should be reworked. The goal of reworking is to make these days more productive, and/or to explicitly give students free time for activities outside the course.

Some comments wished for **more guidance from teachers** during the preparation phase, and also during sprint-planning meetings. It should be noted, that the course methodology of "plan – try – reflect" works particularly well when students do not get things completely right the first time. Therefore, providing too much guidance could very well be counterproductive. Nevertheless, additional learning activities concerning Scrum in the preparation phase could be considered. Further material on test-driven development could be investigated.

Teachers sitting in on one or more sprint-planning meetings should also be investigated. With only two teachers, not all teams can have this guidance during the first sprint. Perhaps each team could have a teacher for guidance at one sprint-planning meeting.

Action point 5 for 2019: Investigate the possibility of additional learning activities on test-driven development, and/or Git, during the preparation phase of the course. Also investigate if each team can have guidance from a teacher for one of the team's sprint-planning meetings.

Action point 6 for 2019: Continue discussions with colleagues and management, with the goal of having more teachers in the course.

Also related to the preparation phase of the course, there was a comment about having too little time to read the book. This meant that students may have tried the quiz questions repeatedly, without much thought, until finding the right answers.

When planning the course for 2018, having the four project-weeks run without a 4-day break for Ascension day was considered more important than a longer preparation phase. In 2019, the proposed schedule for the course will have the project-weeks starting on 23 April, leaving much more time for preparation.

In summary, the course is very well received. Areas where students suggest improvements are mainly the group-rooms, some scheduling aspects, and more guidance from teachers.

Six action-points for 2019 are identified by the examiner, in order to improve working conditions and learning opportunities in the course even further. The actions points are repeated here, for easy reference:

Action point 1 for 2019: Make the course's Canvas pages for 2019 public, and make the page on admission requirements available as soon as possible.

Action point 2 for 2019: For 2019, the scheduling department has been asked to set aside two larger rooms (övningssalar) for the course. The intention is that a handful of teams can work in each room, with each team occupying one corner or one wall.

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