DM1588

0. Author: ciolfi@kth.se

1. Description of the course evaluation process

As this is a bachelor course, the students had two student representatives that collected feedback before the *länkmöte*. This feedback was summarised and presented to me in a meeting with the representatives, and to the board at the länkmöte (both by me and by the Study Board representative). Each student also had the opportunity of writing an individual reflection about their own experience in the course, as well as filling in the KTH course evaluations. As a course responsible, I reminded them about these different channels during class meetings (first class, mid-term class, and last class).

The personal reflection was set up as an ungraded quiz assignment on Canvas, and one of the requirements to get a grade in PRO1. Students were told, however, that they did not have to answer all the questions if they did not want to. The questions were complementary to those in the course evaluations: they were mostly about their personal experience while doing the project, their main take-away from the course, as well as any concerns they had about their participation. Responses were submitted by around 97% of the students. One of the 75[1] registered students did not actually take the course, and from the other 74, only one did not fill in the reflection. Gender and disability data were not collected because it would not have been anonymous.

The KTH course evaluations were filled in by around 12% of the students (9/75); all Swedish students in years 1-3. Regarding gender, this 12% includes students who are women and students who are men, but the gender distribution is not available in the generated report. Similarly, this 12% includes students with disabilities, but it is not possible to know how many. Students did not make specific comments on gender or disabilities in their evaluations.

2. Description of meetings with students

I had a meeting with the two student representatives where they presented a summary of the feedback they got from their classmates. After analysing the feedback, I presented the main insights in a class meeting to the whole group, which were the following:
Some students wanted e-textiles to be part of a mandatory lab (this was not a feasible change in the timeline); some students wanted a 'crash course' on Arduino (but this was not the case any longer by the end of the course, where students highlighted how much they learnt about this in the course); some students told the representatives that they started feeling confident in this course; that they appreciated being able to give us feedback about assignment instructions; that they valued the freedom of coming up with their own ideas, developing their creativity and having flexibility to implement them; that they highlighted a good time distribution along the course so far; that they appreciated getting the hardware from KTH; and in general that they were *"happy"* that they *"learnt a lot"*, including Processing, Pure Data, communication protocols, etc.

3. Course design

The course has:
- seven class meetings consisting primarily of seminars lead by the course responsible (except one with guest lecturers);
- five lab assignments to be done in pairs during six lab sessions where students get support from the course responsible and teachers (the last session is also for catching up with prior labs if needed);
- one mini-lab assignment to be done individually at home;
- a practice quiz on the theoretical part of the course;
- one project where two lab pairs collaborate to create an interactive installation, and where they get support from a teacher during 3 supervision meetings before presenting a demonstration video.

[1] The template shows 73 "first registered students" because 2 were re-registered students.

Seminars include interactive lecturing and in-class exercises where students engage with each other and with the lecturer by talking and typing in the chat. Attendance is mandatory for seminars (students can miss up to two), and is optional for lab support sessions and supervision. The first week, the groups (self-made) are given a kit with all the material they need to complete the course. The students get extra support from teachers via email; from teachers and peers via the Discussions forum on Canvas; and from MIDDLA personnel by booking slots with them on campus (for example, to get help in soldering their electronic components).

Regarding the constructive alignment, each of the class meetings and lab assignments contribute to one or more intended learning outcomes (ILOs) and building blocks of the project, so that succeeding in the labs equips the students to succeed in the project, where they further acquire teamworking and presentation skills. The students receive continuous formative feedback when they submit each lab until they get a "pass", as well as during project supervision. The project's grading criteria is designed to assess that the ILOs have been achieved, and the project is graded only after students have the opportunity of getting peer feedback and improving their final submission.

This is the third time that the course was run. I further developed it based on my own course analysis from 2021 (mostly based on student feedback), from last year's TAs experiences, and from my own notes along the course about potential improvements.
Changes implemented to improve the course include:

- proposing and getting approved changes in the syllabus (simplification of the ILOs, and making seminar attendance mandatory) the previous semester;
- improving the Kurs PM and publishing it by the beginning of the course;
- adding resources on Raspberry Pi;
- adding references and videos to inspiring novel sensors and actuators;
- adding a practice quiz to help the learning of the theoretical aspects of the course;
- adding an optional field in each assignment so that students can critique the description (asking them to report if they had struggled with a specific part of the description –not with the solution– and why);
- allowing the student group to decide on when they wanted to have the final deadline for their iterated deliverables post-presentations;
- adding in-class exercises to the seminars, and in general delivering the content of seminars in more depth;
- improving the explanation of the grading criteria for the project, so that they were aligned with the updated ILOs.

In addition, I dealt with getting back last year's equipment kits, keeping the stock updated, and ordering new material to make sure each kit was varied enough to achieve the ILOs.

A relevant point here is that I was in sick leave or partial sick leave during almost the whole period 4 this year. For this reason, two additional teachers replaced me for project supervision and helped with lab grading, whereas lab assistance was handled by the other two teachers already assigned to the course.

4. Students' workload

The course is 6 credits and the period lasts 10 weeks, which is equivalent to 16 hours a week in average. The course has 4 scheduled hours per week during 9 weeks (except the first week that has 6), plus an estimated load of 10 hours per week to dedicate to the project, which starts half-way through the course. The time to complete the labs and preparatory tasks must also be accounted for within the total of 160 hours.
From those who filled in the course evaluations (9), 2 students perceived that they spent more than what was expected (21-23 hours a week) and the rest (7 students) estimated that they spent 14 hours or less. The few comments about the workload indicate that for some it was evenly spaced, although logically felt as increasing towards the end, with the project deadline coming close. They also appreciated being given more time when they needed it. One student commented that it was hard to estimate their weekly workload.

5. Students' results on the course

All of the students who followed the course and submitted their work have successfully passed (73/75). Only one student did not submit some of the assignments and so they have not passed yet, and only one other student registered but did not take the course at all, and so they did not pass.

6. Students' answers to open questions

In the course evaluations, several students highlighted how interesting, fun and enjoyable it was for them to work with sensors, actuators, and Arduino, as well as having the freedom to be creative. They also emphasised having learnt a good deal and doing so by interacting with others along the course. A few students mentioned the labs or the practical side as the best part of the course. Two students struggled with group dynamics or time management and wished that the course schedule would enforce participation in group work (for example, with an attendance requirement for each group member and/or scheduled 'project work' days before the final presentations). Regarding improvements, two students would have liked to have more technical assistance for the project, and in particular, more material about internet communication between Arduinos; and, one would have liked to know which physical materials were available in MIDDLA.

7. Summary of students' opinions

The course evaluations (although not filled by many) show that students appreciated the course. Most respondents (7/9) said they worked with interesting issues, that the course was challenging in a stimulating way (8/9), that they got formative feedback (6/9), that the assessment was fair and honest (7/9)[2], that they were able to learn by collaborating with others (8/9), and that they got support (6/9) – all in line with their answers to open questions.

The personal reflections (filled in by 73 students) show a generalised positive outcome and constructive feedback. Personal concerns about participation were few but included: challenges in coordinating with the collaborating lab pair (two students); making sure they could fulfill the project's requirements (one student); difficulty in connecting lectures to the rest of the course (one student); and wanting to have the course fully on campus (three students). Some students highlighted getting a lot support from the teachers (described as "*friendly"*, "*patient"* and "*helpful*"), while others would have liked to have more sessions scheduled for that.

The answers show that many really enjoyed the course –and besides saying it was *"fun"*, *"interesting", "inspiring"* and that they valued the *"freedom"* to be creative– they listed a variety of take-away learnings that not only align with the ILOs but also go well beyond them. Some students mentioned wanting to continue using Arduinos after the course for creating more ambitious projects and even attempting to do art with them; others mentioned a spark towards designing for physical interaction, building one's own sensors, honing material knowledge, and a desire for creating innovative artefacts. Moreover, some students said this course reinforced their will to apply to the Interactive Media masters programme at KTH *(*e.g.: *"I very much liked this more practical course, I am planning to apply to the interactive media masters and this course gave me more motivation, inspiration and assurances that that particular masters [programme] is something I am interested in studying!").* Some mentioned it was one of their favourite courses at KTH or even *"the best"* they took so far. Specific arguments included the creative and hands-on aspect combined with theoretical concepts, and the rewarding sensation of seeing *"real results from applying what we have learned"*; and another student highlighted that the course *"has a clear purpose within the program"*. Students also mentioned acquiring theoretical and practical knowledge on *"engineering"* and *"electronics";* appreciating how challenging it is to consider aesthetics/experience of use and not just the programming side of interactive systems; getting a broader understanding of how software and hardware work; and collecting experience with rapid prototyping skills. Some students praised the course organisation, the workload distribution, the clear instructions, the *"careful preparations on the teaching material",* and valued the *"really detailed feedback"* from the course responsible, which they considered key in student's participation. Moreover, another student stated: *"It's been nice to take a course where formative assessment is taken seriously and where it feels like the course responsible really do care about the students' opinions"*. In addition, one student said: *"I wish it [the course] were longer. That's a good sign",* and another wrote: *"This course is what I expected KTH to be like".*

---

[2] The assessment had not happened yet when they filled in the evaluations, so they are probably interpreting this question differently. They might be referring to formative feedback.

Several students mentioned acquiring or refining general skills thanks to this course, such as: creative thinking, logical thinking, problem solving, teamwork and leadership, taking an active role in learning, managing time, searching for information effectively, improving oral English skills, etc. Many students reflected upon an increase in not just their skills but in their self-confidence when it comes to manipulating hardware and wiring, programming, and in general undertaking practical projects with a variety of technologies. A sense of achievement at the end of the project was evident in the reflections. For example, a student stated: *"This is one of the first time[s] that I've created something that I am proud to show to friends"*. Finally, several students reflected upon their newly acquired ability of incorporating sensors in technical solutions during their future studies, as well as becoming aware of the pervasiveness of sensors and actuators in daily life. On this regard, one student said that what they learned in this course made them *"think of the world around me in a different way."*

8. Overall impression

My overall impression is that the course was well received this year too, accounting for the students' feedback as well as their participation in (and not just attendance to) class meetings. Adding in-class exercises to the seminars worked quite well, increasing the interaction between the lecturer and the students and between each other. Adding the optional field to critique the assignment description worked really well –some students caught specific parts to clarify, which I was able to quickly address during the course, and some students realised that they had not read the assignment in enough depth to know what they struggled with, which made them actually *read* the assignment description. I have the impression that students understood that they were able to influence the assignment and thus started getting a feeling of ownership over the course content and delivery. From the personal reflections, I find that exchange students were very pleased with the course and their key take-aways were particularly elaborated.

9. Analysis

Students did not comment on gender or disability aspects in the course evaluations. However, certain gender stereotypes were present in the way they interacted with each other in mixed-gender groups – as I have previously reported. For example, a male student (judging from pronouns students used) called their groupmate *"my beautiful assistant"* in the final video deliverable (as if they were a male illusionist and their female assistant). This might be pointing to broader gender stereotypes in society, and so the reasons should be further explored at the programme level at KTH. In addition, group dynamics should also be further addressed at the programme level, as some students seem to struggle with this aspect. Time management in relation to group work is mentioned by only some students but it seems to be a recurrent pattern across bachelor and master courses, according to my experience. Wanting to work only on campus is also an expected need for a course relying on hardware, although only mentioned by 3 students.

10. Prioritized course development

In response to student feedback, a set of improvements will be prioritised as development for next round. First, 'project work' sessions will be included in the schedule, to help students with teamwork and time management. Classrooms will not be needed for this, nor teachers, since these sessions will be suggested blocks of time for students to meet and do group work, closer to the project's deadline. Second, a lab and/or a seminar will go more in depth about internet communication between Arduinos using Processing, in order to provide students with more technical assistance for the project *earlier* in the course's timeline rather than during supervision. In addition, one of the sessions now dedicated to the last lab will be repurposed for technical assistance for the project; the last seminar (currently a short one focusing on wrapping up the course) will also be devoted to this (and the material will be moved to a previous seminar). The scope of this last lab will then be revised. Third, we will coordinate with MIDDLA's new studio manager (who will start their job in November 2022) to show students in a more consistent way what physical materials are available there or could be bought for the course –as it would be good to increase the variety of sensors and actuators so that the ILOs can be achieved without unnecessary struggle on everyone's side.

In addition to this, the labs' description, scope, and order will be further assessed to continue strengthening the matching with seminars and project work; and the seminars will continue being refined to keep engaging students interactively.