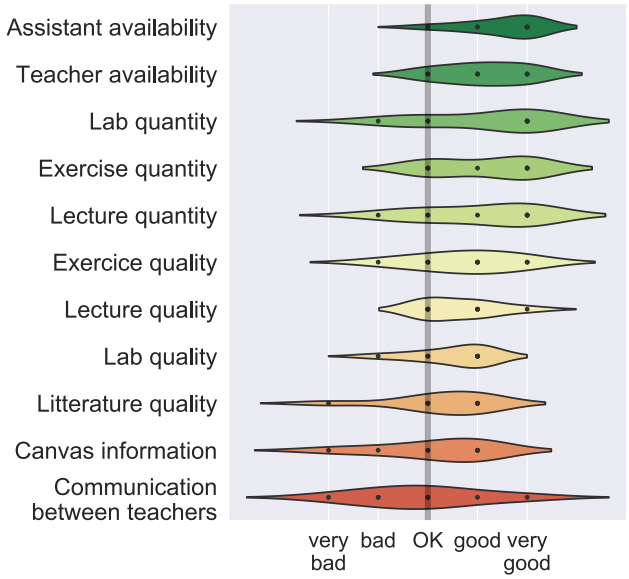
KEMM30 Evaluation HT2019

Overview

This is the first time the course ran and we had 11 students regularly attending lectures, 9 attended and passed the exam, and 8 handed in evaluation forms. Five got grade VG, four G. The course has five parts, each of 8 days:

1. Python scripting, plotting, and data analysis. Including lab focusing on organic chemistry and biochemistry (*Uhlig & Lund*)
2. Quantum chemistry and electronic structure calculations (*Persson & Hedegård*)
3. Statistical thermodynamics (*Lund*)
4. Intermolecular Interactions (*Forsman*)
5. Spectroscopy (*Zigmantas*)



Notably (1) is completely new at KC and is the first element of programming or *scripting* that chemistry students are exposed to. The idea is to provide students with an overview of what is possible and give them enough skills to advance their level on their own.

Main results and action plan

The teachers felt that the students did a considerable effort working with the topics, most stating having spend 25-30 hours or more per week. Many students struggled with math although we do not go beyond the topics covered in the initial math course. Part of the problem is that this was taken during year one and little used in between.

At the exam 1 students achieved 75% or more (VG threshold) while 2/9 were just below the 50% limit (G threshold). With bonus points all student passed, five with VG. A possible change for next year is to require 75% *at the exam* to achieve VG, while bonus points count only to cross the 50% bar. This would effectively make it as easy to pass, but more difficult to get VG.

The above graph shows so-called *violin plots* of the distribution of scores given by the students for each topic; averages are roughly located at the shape mass centres. The illustration is btw. made with the Python tool introduced in Part (1). While almost all average scores are above the midpoint, *i.e.* to the right of the grey, vertical OK line, the **reddish shapes** need improvement before HT2020.

Note that there's a rather large spread in the scores and some students have given very detailed and constructive written feedback. Based on this, the teachers have the following comments and action points to be improved prior to the next course event:

1. Mikael: *Improve Canvas content and make sure information for each sub-part is clear and up-to-date at the beginning of the course. Time table and instructions for labs should be available early on; Clarify what is required to pass the course incl. bonus point system and rules for the exam; For the python part, limit the coverage of matrix transformations and shift focus to basic plotting. Go over the projects and make sure they are fully consistent with the lectures.*

2. Jan: *Somewhat less lecture time devoted to formal derivations, and more time spent on physical interpretations, and consequences. I might hand out, or upload, some of the derivations instead.*
3. Mads: *Making the programming part longer; Give more hands on exercises (make student understand thoroughly each part: datatypes, variables, operations, data structures, manipulating of data structures, functions etc.); Give more home work and stress it is important to do them; Slow Jens' part down, and give more hands on exercises; Have students make the programming labs individually.*
4. Jens: *Adapt shape to self learning notebook like the first part. Cut content to the hours that are available (of was designed for 3x4h instead of 3x3h). Provide clearer structure between home and course work.*
5. Junhao:
    - *Before the course starts, we can list all the math knowledge that are necessary for each lecture. We can further classify these math knowledge into several topics and make mini-review for each topic*
    - *Each mini-review can be short lecture note or short video, 3 to 5 minutes video, for example.*
    - *Students can access to these reviews on Canvas so they can review them whenever they want.*
    - *If possible, we can also make some basic questions for each topic and ask the students to do them before the course so they can know better which topic they will need to review.*
    - *The drawback of this idea is that the students need to spend time on these. Therefore the questions need to be very basic and the mini-review should also be short.*
    - *The advantage of this idea is that the students can hopefully be more confident when facing math and not get freaked out. Also once we made these materials we can reuse them next year. – As for the exercises,*
    - *The exercise sessions can possibly be shifted by one day, i.e. the exercises are about things taught in the previous day, so the students can study after the lecture and prepare for the exercise sessions in advance.*
    - *The difficulty and number of home assignments perhaps need to be decreased.*
    - *Since the Canvas has the function of assignment, we can publish the assignments and ask the students to submit via Canvas, so the deadline can be more clear.*
    - *Another alternative could be that work and hand in the home assignments in pairs. And each pair can be asked to solve the assignments on the blackboard during the*
    - *exercise session in turns.*
6. Donatas: *there are a lot of complains that the spectroscopy lab was not originally in the schedule and that it was announced late. We should obviously write that we will fix this issue. Many also complain, as in previous years, that the lab was too close to the exam. The only option that I see to fix this issue is to shift the spectroscopy part to the earlier part of the course. The single requirement for that is that it should be given after the QM part. I think we should also mention that we will improve communication between the teachers. I suggest that we arrange at least one meeting of all involved teachers every year, maybe before the course starts.*
7. Erik: *We will introduce self-study pen-and-paper exercises concerning the theory relevant in each computer-lab. The student will hand in the exercises before each lab (handing in may even become mandatory to take part in the lab). Apart from this; my take on the course is that 8 days is perhaps very limited to introduce both QM theory and practical procedures. However, if this is the framework we of course have to work with this. In this framework, I think that we could communicate the learning outcomes better to the students. The learning outcome (as far as I know) to be acquainted with how to practically perform QM calculations (although i may add; how many lab courses only last 8 days?). Apart from this, perhaps the python part can perhaps be better integrated in the QM exercises - in fact some of the scripts to analyse the results actually use python but the students more or less use them*

blindly. Would it be possible that the students constructed some of these scripts in the first part?

8. Petter: *In addition to what Erik contributed, I would say that with the new QM structure I can see that there is less overlap with the regular text book. My suggestion is that I take some time during the spring to develop some further elaborated notes and supplementary materials to guide the students in terms of content and that this could also hopefully make it more clear to them what they need to learn from this part. I also agree with Donatas that it should be easy to make a few improvements to coordination between the teachers of the different parts. In my experience a lot of it comes down to providing complete instructions to cover everything for bonus points, labs, and exam format already from the start as the students have this clearly in their minds and start asking about it essentially from day one.*

Some student excerpts

"Väldigt tacksamt att övningsledaren alltid var tillgänglig och välkomnande."

"Kursens tempo var något för högt."

"Programming was the absolutely most valuable part … if it had not been included, I would never have tried it and missed important knowledge."

"I don't see why anyone who is not interested in physical/theoretical chemistry would need this course."

"This course should be mandatory for all chemists."

"In the beginning I found this course difficult. Now, after the course, I'm happy I took it."

"The bad: Late lab description."

"The good: Learning how to program with computers."

"Varying levels of communication within different sub-courses."

"More exercises for the QM part, not only computer exercises."

"It was unclear what was mandatory and what was not."

"Exam easier than expected."

"This course is good, but the bachelors programme doesn't prepare for it.… Now in hindsight, I think the bachelors programme is way too easy. One can pass many exams without learning any useful and important things."

The full student evaluations are available here:
https://lu.box.com/s/upgwfi9zo3408qhqsrgnu6lu17eqthm4