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Description of the course evaluation process

A learning experience questionnaire was launched on the week following the final assessment of the course (15th December 2022) which closed on 30th December 2022. 14 responses were received (24% response rate). During the first half of the course, regular anonymous surveys were posted where students could provide feedback. In total, around 42 anonymous pieces of feedback were received regarding the lectures 1, 2 and 3 and labs 1 and 2. Unfortunately, no surveys were posted for lecture 4, and labs 3 and 4 and so no feedback was received for these.

A meeting with all of the teachers on the course was held in January 2023 to discuss the overall results of the course and to reflect upon how the course went. The issues raised during this meeting are discussed below.

Description of meetings with students

No formal meeting with students was organised prior to the completion of the course analysis.

Course design

The course was fundamentally redesigned for 2022, with an earlier start, longer duration, and with the final exam replaced by continuous examination in the first half of the course. The course was divided into two halves. In the first half, four lectures and four labs (0.5 hp) provided the students with an introduction to basic economic and financial concepts such as supply, demand, market equilibrium and discount rate; and the opportunity to apply these concepts through an energy market game, exercises to compute levelized cost of electricity and explore demand and supply in OSeMOSYS. While lecture 1 introduced basic concepts in a traditional lecture format, lecture 2 and 3 were very interactive, with students preparing material prior to the class and then discussing and presenting it to one another or the class. Lecture 4 was given by Francesco Fuso-Nerini and Daniel Adshead and covered multi-criteria analysis and indicators. The students appreciated the direct link to research of the work presented.

The first (theory) half of the course was assessed through two partial exams (1 hp each) consisting of three essay/exercise assignments each, of which four contributed to the final grade. This provided the students with the opportunity for formative assessment (feedback from the teaching team) and an opportunity to better manage their time - if happy with the grade from the first two assignments they could skip the third.

The second half of the course consisted of a group project (3 hp) and seminar. The project was completely redeveloped this year. In previous years students had to develop their own scenarios for a European country using an OSeMOSYS model they were provided. This year, students used existing scenario results from OpenEntrance project and GENSYSMOD model to write a 20-page report incorporating 6-10 indicators Rebellion for one European country. The group project was structured into multiple deliverables, some of which were individual,

and each contributing to an overall score for the individual. Draft reports were peer reviewed individually, and then the reports were presented by groups in a half-day seminar (0.5 hp).

Students Workload

MJ2383 is a 6-credit course and technically this requires 160 hours of study time. Over the 14 weeks of term, this requires approximately 12 hours per week. According to the 14 respondents from the LEQ, the mean value was 6-8 hours per week, maximum 12-14 hours and minimum 3-5 hours.

The comments from the respondents reveal that the overall course load was not an issue, but the course team need to be more aware of time needed to prepare for the lectures, and be careful not to schedule continuous assessments for the same time as lecture preparation.

Students' results on the Course

Overall, student results were good. There was a good progression and improvement over the course of the continuous assessment assignments (within KONA and KONB) that showed how feedback was effective in motivating improvements in the student's work. The quality of the final group projects was generally good, with a good standard of writing, analysis and reflection. This is an improvement on previous years in which the project reports have been varied and of lower quality – largely because in these earlier projects a lot of effort was expended upon modelling and debugging aspects rather than interpreting results and deeper analysis and reflection. In addition, the students receive considerable feedback on their writing during the first half of the course, which results in a noticeable improvement in the quality of the writing.

Students' answers to open questions

Students really liked the interactive aspects of the course, in particular the lab sessions where they applied theory in engaging exercises. For example; "*It was great that no coding experience was necessary to run the simulations*" and "*I really liked to implement or learn code right away*". Feedback from lab 2 showed that students appreciated the interactive nature of the exercise, and the links to concepts learned in the preparatory material: "*I liked that it was very interactive, and that it clarified on the processes which we read about in the preparation material*".

Many students responded favourably to the active learning approach in lecture 2 and 3: "*It is nice to have a lecture in which you get involved, it is easier to focus, especially at 8:00*" and "*Even though it is a bit more stressful than passive listening, the knowledge sticks better when there is interactive learning*" and "*I really enjoyed preparing information and exchanging it with my colleagues, I think it's a better way to understand and remember information than the traditional lecture format*".

The feedback also showed that the students were reflecting on their learning process. For example: "*I think it is very valid to get a learning experience through a healthy competition/gamefication type of class. It motivates the students to try hard to think about the problem and build a strategy/solution.*" *And "I liked the fact that it was a learn by doing*

process. First time step, I wasn't sure of my choices but I learned how to adjust in the next rounds".

A few respondents suggested that one of the discussion lectures (2 and 3) could move towards a traditional format, with more structured material.

On the flipped format of the course: "*I really like the inverted format of learning (with the self-study materials given beforehand). Helps me to address my questions during the lectures as I already have some background knowledge about the context of the lecture" and "I liked how the lecture was reviewing the pre-reading material interactively with the students. Very nice concept!*".

On the use of pause procedures to engage students during the lecture: "*it was great when you ask us questions and pause for hearing our answers."and "I felt student participation was achieved and encouraged."*

On the presentation of the course overview: "*The presentation of the course structure, different grading rubrics and activities was quite good and appreciated*."

On feedback: "*I really liked that Will gave some insights on what he liked about good assignments to learn from the others*."

One student recognised the constructive alignment in course design during the course introduction: "*The focus was on what is examined and what we, as students, are expected to do (as it should be)."*

The clear course structure was also appreciated – "*with enough time for coursework, labs and project*", but also the development over the course: "*The fact that the key concepts were explained clearly, but then we had to develop our own thinking about them. I think that is very stimulating and can develop a good critical sense within the students.*"

Several respondents highlighted the benefits of continuous examination: "*I really like[d] the format of assessment of the course. Continuous examination is way better than traditional exam and kept me in shape all the time, so I learn[ed] more and appl[ied] the learnt concept[s]*."

Opinions of the group project were mixed. Some mentioned the group project as a highlight, while others preferred the taught aspect of the course. Several respondents gave feedback on how the group project could be better organised. The high workload which results from the clash of lecture preparation and assessment was highlighted several times.

Also, one respondent highlighted the long delay in feedback over the course of the continuous assessment. In particular assignments 5 and 6 were marked very late due to the high marking workload of the course staff.

We also received some positive comments regarding the teaching environment "*the competent teachers who created an open and inviting atmosphere to discuss and learn*

together with other students. Will Usher was marvelous at creating interesting and engaging lectures. It was one of my favourite courses in my master's program!", and it is always nice to get a name check. Thanks!

Summary of students' opinions

Response rate to the LEQ was 24%, which is within the range of responses of 20-30% experienced at KTH. We could do more to improve the response rate. The lowest score was 5.5 (*I had opportunities to influence the course activities),* with the highest scores concerned variation (*The course activities enabled me to learn in different ways*) and constructive alignment (*The course activities helped me to achieve the intended learning outcomes efficiently*). The average score was around 6.0

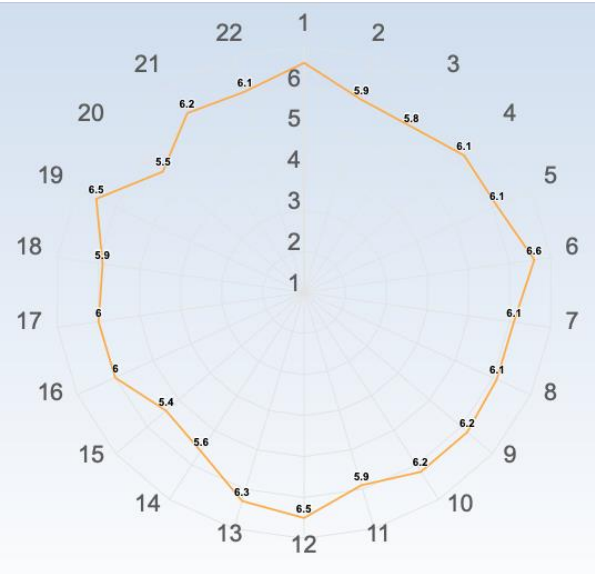

Figure 1 Mean results from the LEQ.

The respondents in the LEQ were positive. The students seemed to enjoy the course, with almost universal approval of the interactive nature of the lecture and labs in the first half of the course.

We received some specific feedback for lab 2 – on the choice of room that we should prefer a room that allows the students to work more effectively in groups e.g. not a computer lab. And that the students playing the system operators would have appreciated more advanced training – perhaps a preparatory video and access to the Excel spreadsheet prior to the session.

There were mixed experiences of the group project, and these were reflected in the feedback and the individual reflections submitted during the course. The feedback is well taken – and the respondents have provided some suggestions on where to improvements would be welcomed.

The key points for improvement were the scheduling of preparatory work and assignments; more support for the technical aspects of the project; replace one group activity with a lecture.

Overall Impression

The course was under-resourced this year with no course assistant available. This was the cause of a few of the issues highlighted in the feedback (such as delays with grading). On the whole, the course was successful from the teaching perspective. The students were very engaged during the course, particularly the first half of the course, and the overall grades demonstrate the high level of understanding demonstrated by the students.

Lectures 2 and 3 were very interactive – using Jigsaw and group presentations respectively, but were perhaps too similar. We might consider dropping the interactive part of lecture 3 and instead delivering it as a traditional lecture, however many students did like the interactive nature of writing the factsheets together. If this is retained, we need to be careful to plan the reading to ensure that it contains a mixture of background and up to date and relevant content.

Regarding assessment, there were some issues managing consistent "styles" of grading and feedback across the course team. This could have been better managed through the use of rubrics with clear links to the ILOs and example answers. Some of the assessments could be improved – in particular part A of assignment 5 and assignment 6.

The teaching team noted that student writing improved significantly over the six assignments which demonstrates that the feedback provided to the students during the continuous assessment assignments was effective.

Analysis

Scores on the LEQ differed considerably by type of student. International Exchange Students were less satisfied than International Masters Students, with Swedish Masters Students most satisfied (although note that sample sizes of these sub-groups are not available).

Prioritized Course Development

Direct responses to feedback:

- Use a classroom rather than computer lab for Lab 2 (market game)
- Reserve more time for discussion at the end of Lab 2 and Lectures 2 and 3

Some open questions about scope:

- Does multi-criteria analysis fit comfortably within the scope of the course? Could parts of lecture 4 and lab 4 be replaced with something more economics focussed? Or, could MCA be better incorporated into other aspects of the course, such as the project?

On the project:

- Modify the grading structure so that individuals are marked on the A-Fx scale for their peer review
- Reduce the weighting for the draft report and place a larger emphasis on the final report

- Remove the group reflections – these were not insightful when compared to the individual reflections
- Consider how to manage or limit the free-rider problem, which occurred despite the two track – pass (Fx-C) and stretch (Fx-A) projects

Some material was omitted from the current course round and should be included in the next:

- An interactive exercise (self-led) on Discounted Cash Flow, WACC, IRR etc.
- More content on marginal abatement cost
- Some self-led "test yourself" quizzes on later lectures and lab content (ungraded)
- More online preparatory material for the project (e.g. IIASA scenario explore, briefing on the models etc.)
- Provide a preparatory video for Lab 2 system operators and the Excel spreadsheet

Other information

Other suggestions for the next course round:

- Be careful when scheduling preparation work and assignments during the first half of the course
- Plan carefully to ensure that students receive grades from continuous assessments before the next assignment
- Ensure that formative course evaluation is integrated into every lecture and lab module on Canvas, and that student time is made for feedback during the teaching and learning occasion.
- Use an automated method to measure attendance at computer labs.
- Organise a student representative to manage feedback and comments to the course responsible.