Gunnar Tibert

Course analysis for the course SD2900 Fundamentals of Spaceflight

Course design

In 2021, the course SD2900 contained the following:

- Pre-recorded KTH Play overview lectures by the course responsible and complementary on-line YouTube lectures.

- A large engineering project, where the students work in teams.

- Teamwork workshops where the student teams work with a larger project, helping each other solve problems to understand the theory better.

- Several deliverables during the project: Work Breakdown Structure, Concept sheet, draft paper, peer review, oral presentation, final report and team check-out.

- A two-hour concepts test as an individual written examination where the students could use textbooks and on-line resources but was not allowed to collaborate.

- An optional oral dissertation to get a higher grade.

In 2021, one new thing was introduced:

- On-line quizzes with questions from previous concepts test, so that the students quickly could understand the level of the individual examination.

and things removed due to Covid-19 pandemic reasons were

- Guest lectures.

- The back-of-the-envelope calculations as part of the course and examination.

Student feedback methods

Student course representatives for continuous feedback on the course, e.g., changing deadlines for assignments, etc.

A quick interview/chat/debriefing after the oral exam(s) has over the years been found to be much more useful that the typical on-line questionnaires (which typically very few students bother to answer). The oral feedback is significantly richer, and the dialogue form leads to a better understanding between students and teachers regarding what root causes are for perceived problems and different options to improve the course. I find that this form of feedback mechanism leads to more constructive ideas on how to improve the course. Also, feedback from engaged students who are not shy of expressing their opinions is more valuable for the course responsible.

What was good with the course?

The interviewed students described the following aspects of the course as good:

- Overall, a very well-organized course

- The check list for the report to avoid common errors.

- That all material is available at the start of the course.

- Mix between individual work and teamwork.

- Frequent quizzes to stimulate continuous work.

- The "How Did I Do?" function in Möbius.

- The prior experience questionnaire produced more balanced teams.

- The fact that the course has optional parts

- The structure of the course on Canvas.

What should be improved in the course?

The interviewed students highlighted the following aspects of the course that should be improved:

- A time schedule for the viewing of the lectures would help with the time management (the course SD2601 Fundamentals of Flight has a good viewing schedule).

- The teacher Matthew Peet's YouTube videos are very long so a clarification which parts of the videos that are relevant for the SD2900 course is needed.

- More guidance on the technical part of the project would be appreciated.

- The *Honors level* problems in Möbius is not in the lecture slides, so to solve them require more information from the book. This should be described better.

- The topological conditions at Gärdet, i.e. launch position situated higher than the landing zone, could be explained.

- The deadlines for the quizzes are too frequent and the course felt very fast in the beginning.

- More clear explanations about the *Honors level* for the optional oral exam: How detailed do you need to be for the presentation to be awarded Honors? What skills need to be demonstrated to achieve Honors?

- Q & A on Canvas before a live session.

- The course handbook is very long, so a 1-page overview of the course would be useful.

- Force mandatory in-person sessions where the teacher meets all teams.

- Follow-up sessions after quiz submission to straighten out any remaining question marks.

- A clear project "kick-off" would be good.

- The most difficult topic is launcher dynamics. Would be useful to spend more time on this topic as it is central for the project. The Moon landing Matlab code was useful, but not sufficient.

- Reduce the bottle rocket project and start the larger project earlier. Too much time was spent on the bottle rocket calculations.

- Unbalance between the points for the optional oral exam and the project, with respect to the invested time.

- The parallel courses SD2601 and SD2900 could be better coordinated.

- Better start with the Möbius calculation problems and then move to the Canvas concepts quiz questions.

- Add more modules to the course.

- Problem having the concept quizzes non-mandatory!

- Activate the teaching assistants more to explain to students.

- Introduce clear milestones so that the students can keep track of their progress. Milestones were successfully used in SD2601 Fundamentals of Spaceflight. An improved calendar on what to do and when?

- Better visualization of the orbital parameters for low-thrust orbital changes as the graphics in the lecture slides are still hard to understand.

Other comments

- Stressed by the fact that one should select different topics for each session of three students. How to solve if two students want to present the same topic in a session?

- Hard to find the answers for the satellite operations concepts quiz questions in the lecture slides.