

3BYX0P: a multidisciplinary Systems & Control CBL course

Departments Applied Physics & Mechanical Engineering

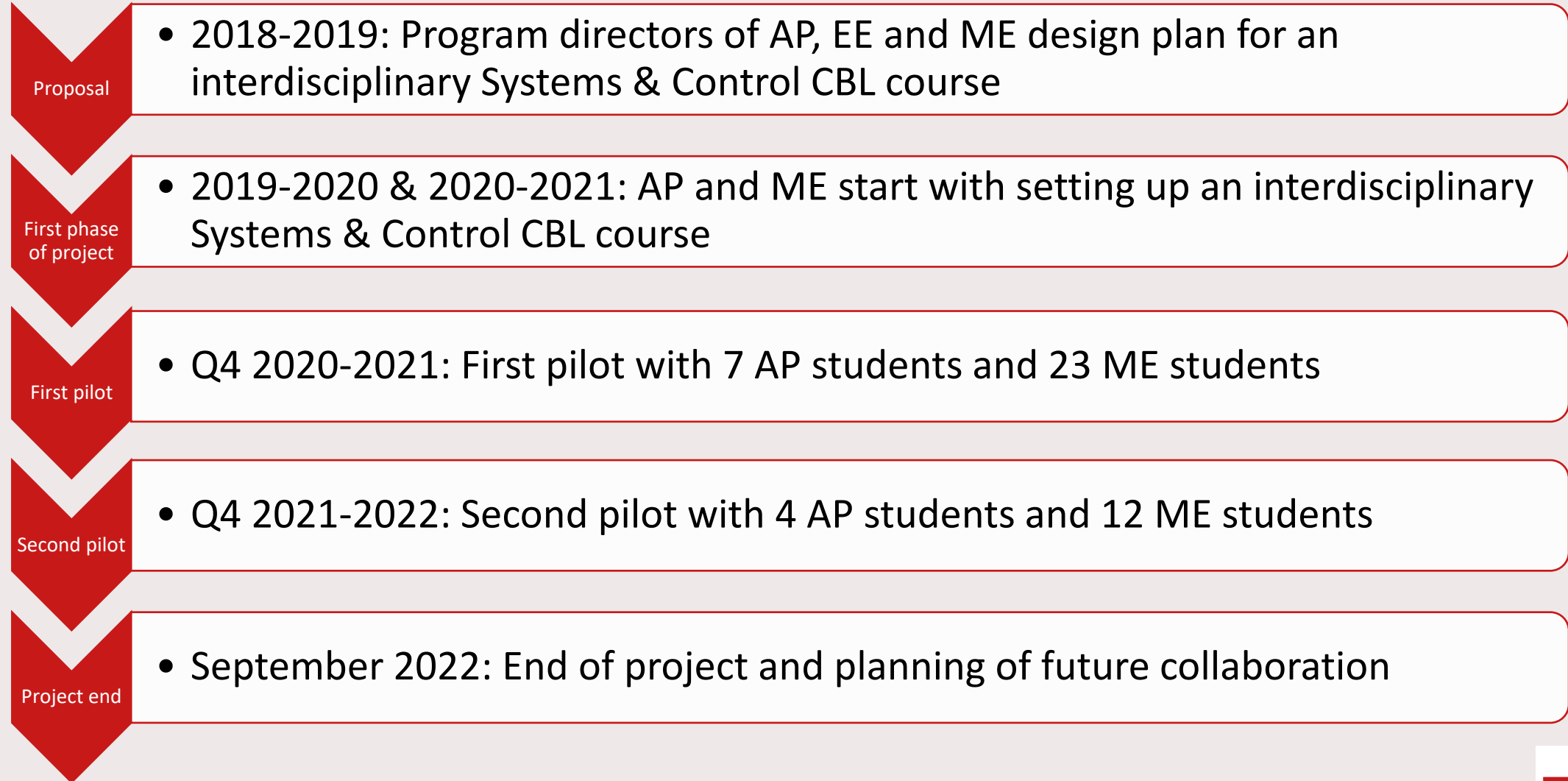
Aim of today's meeting

Wrap up of the Project "Signals & Systems AP and ME: implementing interdisciplinary challenge-based learning"

Aim of the project

- Design a new challenge-based project course for AP and ME students, that may replace the ME course 4GB00 OGO Robot arm and the AP course 3BYX0 DBL Signals and Systems
- Investigate how students work and learn together in an interdisciplinary team on an open-ended real-life challenge

Timeline of the project



Characteristics of the first pilot: Q4 2020-2021

- 30 students participated (on voluntary basis), 7 AP and 23 ME
- 5 interdisciplinary groups of 6 students, some groups only 1 AP student
- Student groups coached by a tutor (MSc. student ME)
- 2 new experimental setups (pick-and-place robot system), more options compared to existing Robot arms in order to work on real life challenge (AP: feedforward control, ME: other gripper, “loopband”)
- Vanderlande Industries acted as a stakeholder
- Introduction lecture and skills trainings online, in class and online group work on project
- Assessment: interim test, presentation, reflection report, final poster presentation, oral

Professional Skills:

- AP: Collaboration skills, Presenting, Planning & Organizing
- ME: Collaboration skills, Presenting, Reflecting, Information Skills

Results of the first pilot

Teachers' observations and students' feedback:

- High student motivation (bias: voluntary participation?)
- Students liked the practical and applied nature of, and freedom in the project.
- All students passed the course, all components of the robot have been used, students worked on real-life challenge but were not able to integrate all parts due to time constraints
- Too much focus on the ME side in de assignments. Some AP students felt lost
- No equal distribution of disciplines in the group, some groups only 1 AP student and 5 ME students.
- Experimental setups had some "growing pains"
- Software to control experimental setup was not optimal
- Doubting the value of the interim test

Results of the first pilot – Research ESoE

- Lack of pre-knowledge of control theory ($\frac{2}{3}$ of all respondents) acted as a barrier for multidisciplinary teamwork. ME students had to explain AP students about control theory in the first weeks of the course
- Exchange of disciplinary perspectives ($\frac{1}{3}$ of all respondents) between AP and ME students was suggested as another important facilitator of successful teamwork.
- The disciplinary connections of the design challenge is the most significant factor for successful multidisciplinary teamwork (50 percent of all respondents). Results indicated that the design challenge, mainly drawing knowledge and methods from ME compared to AP was a barrier for teamwork.
- Tutor guidance ($\frac{1}{3}$ of all respondents) is found to contribute by extending discussions where AP and ME students offered different insights.

Points for improvement, based on the first pilot

- Organization and clarity of information (study guide and course organization)
- Better technical guidance on the set-ups
- More interaction with the stakeholder Vanderlande
- Improve clarity and transparency of the assessment criteria
- Improve the AP niche of the assignment/challenge

Characteristics of the second pilot: Q4 2021-2022

- 18 students participated (on voluntary basis), 4 AP and 14 ME
- 3 groups of 6 students per group, 2 interdisciplinary groups (2 AP, 4 ME) and 1 monodisciplinary group (6 ME)
- Student groups coached by a tutor (MSc. student ME or AP)
- Fully on campus
- Vanderlande Industries acted as a stakeholder, more involved and visible (incl. company visit)
- Setups significantly improved (incl. vacuum control)
- Manuals and study materials improved (both didactically and technical content)
- Written interim test removed from course, replaced by tutor review
- More guidelines in assignment/challenge, more AP based

Professional Skills:

- AP: Collaboration skills, Presenting, Planning & Organizing
- ME: Collaboration skills, Presenting, Reflecting, Information Skills

Results of the second pilot

Teachers' observations and students' feedback:

- High student motivation (bias: voluntary participation?)
- Based on the student survey: the ratings of the pilot course have increased (compared to first pilot). Overall rating the pilot course was higher than ratings of the original AP and ME courses.
- Perceived difficulty (no difference between AP, ME) of the course and effort spent on the course has increased based on last year & regular courses
- Students like the freedom they have, the multidisciplinary team and the hands-on nature of the course
- All students passed the course, all components of the robot have been used and integrated, students worked on real-life challenge (together with stakeholder).

Research ESoE (first observations)

- Students define sub-tasks, assign 2-3 team members from AP and ME to work together.
- During weekly team meetings, all six students are present, they discuss around a chosen topic/task.
- Students felt the need to do self-study using Canvas or other external sources. Mostly done by AP students.
- Certain roles were assigned based on AP-ME expertise.

Future

In the new BC-2023, Systems and Control will become a joint major course for both 2nd year AP and ME BSc. Students. First run, academic year 2024-2025

In the upcoming years this new course will be further developed