“Hard Skills” working group

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Working Group aims

- Determine whether what we teach in the realm of “hard skills”, and the way in which we do so, is still appropriate, and suggest improvements
- Focus on:
  - Mathematics (mostly the mandatory courses: Calculus A, Calculus B, Linear Algebra NS, Complexe Functies)
  - Programming (quality of the mandatory courses Programmeren 1 and Programmeren 2, as well as use of programming in other courses)
  - Machine Learning / Artificial Intelligence

Open questions (1)

Have your smartphone ready!

https://app.wooclap.com/THNXRC?from=event-page

1. Do you use programming in your lectures?
2. How do we best ensure that programming skills are used throughout the curriculum?
3. Does the Complexe Functies course need to remain a mandatory course?

Open questions on mathematics & ML/AI

We propose that, given the limited time, in your group you focus on **one** of the following:

1) What probability theory, statistical inference and data analysis skills need to be in the mandatory program?

2) Should we introduce a mandatory Introduction to Machine Learning course, following Programmeren 2? If so, what should be the learning objectives of such a course?

(Preliminary) findings and recommendations

Programming: findings and recommendations

There has been some concern about the Programmeren 1 course in the past; however, in this academic year, the course worked much better

- Thanks to small structural changes, better IT, and a new assessment method
- Some further points of improvement and coordination with Programmeren 2 have been identified

The residual concern is mainly with retention of skills (see Wooclap questions)

- Following the Programmeren 1 course (Y1 Q1) as well as after the Programmeren 2 course (Y1 Q2)

Recommendation: ensure continued use of programming in other courses

Mathematics: findings and recommendations (1)

The Lineaire Algebra NS course (Y1 Q2–3) is new in its present form, with P&A students not taking the Lineaire Algebra A course anymore

- This addresses a long-standing desire from the P&A students' side and allows for closer connection to other courses. Its first evaluation is yet to come

There is dissatisfaction about the weak connection of the Kansrekening course (Y1 Q3) to the remainder of the Bachelor curriculum

- Obvious connections: probability theory in QM, statistical inference as part of the lab courses

Recommendation: replace the Kansrekening course (for P&A students) with a course that is better connected to the rest of the curriculum

- Notably integrate (modest amount of) material on statistical inference, and do more with programming
- Move the course from Q3 to Q2, so as to precede the (relevant part of) the Y1 lab course

Mathematics: findings and recommendations (2)

There does not appear to be a need to have Calculus A and Calculus B courses (Y1) taught separately to P&A students

The use of the Complexe Functies course material seems to be very marginal in the remainder of the Bachelor curriculum; we are not sure that it should remain a mandatory course

- Only identified use in the Bachelor curriculum: Cauchy's integral theorem in scattering theory
- Main application in the MA curriculum: Quantum Field Theory

Machine Learning / AI: findings and recommendations

At present there is no mandatory ML/AI course

There is an elective Inleiding Machine Learning course (Y3) in the context of the Neuroscience specialisation, which is quite generic

Recommendation: have a mandatory introductory ML course (which could be this course)

- In Y2, so that it can be followed by (an)other elective ML course(s)
- Explicitly include programming aspects (already the case in its present form)
- Coordinate the learning objectives with Programmeren 1 & 2