Responseware TurningPoint: the first steps

1. Go to: responseware.**eu**

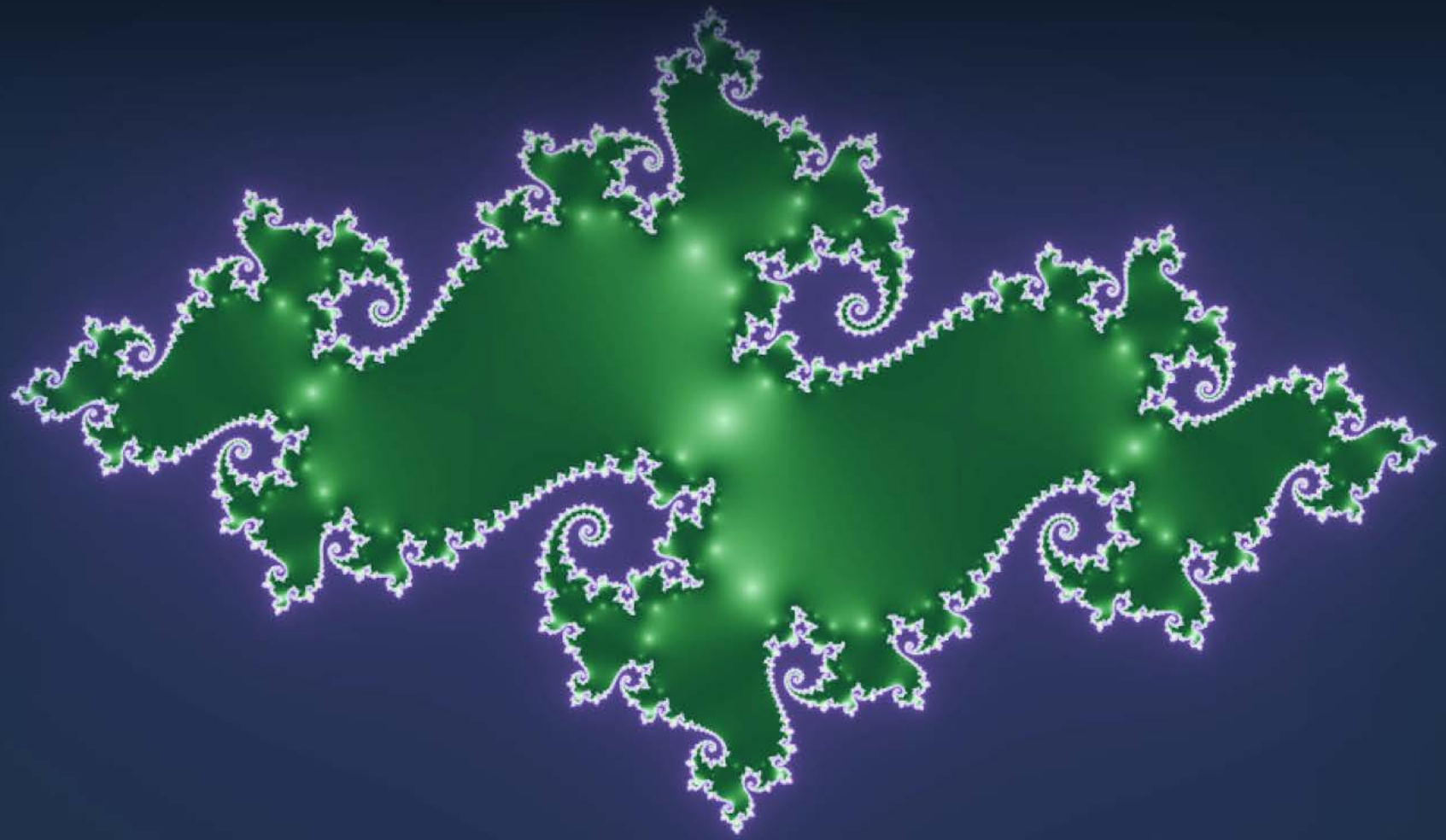
2. Use the Session ID Dekker

3. Wait for a question to appear

Large scale innovation of mathematics courses for engineers

Annoesjka Cabo

TU Delft



Programme

- Who are you?
- The story of the lonely innovator
- PRIME

MIT report; www.math-explained.nl

Responseware TurningPoint: the first steps

1. Go to: responseware.**eu**

2. Use the Session ID Dekker

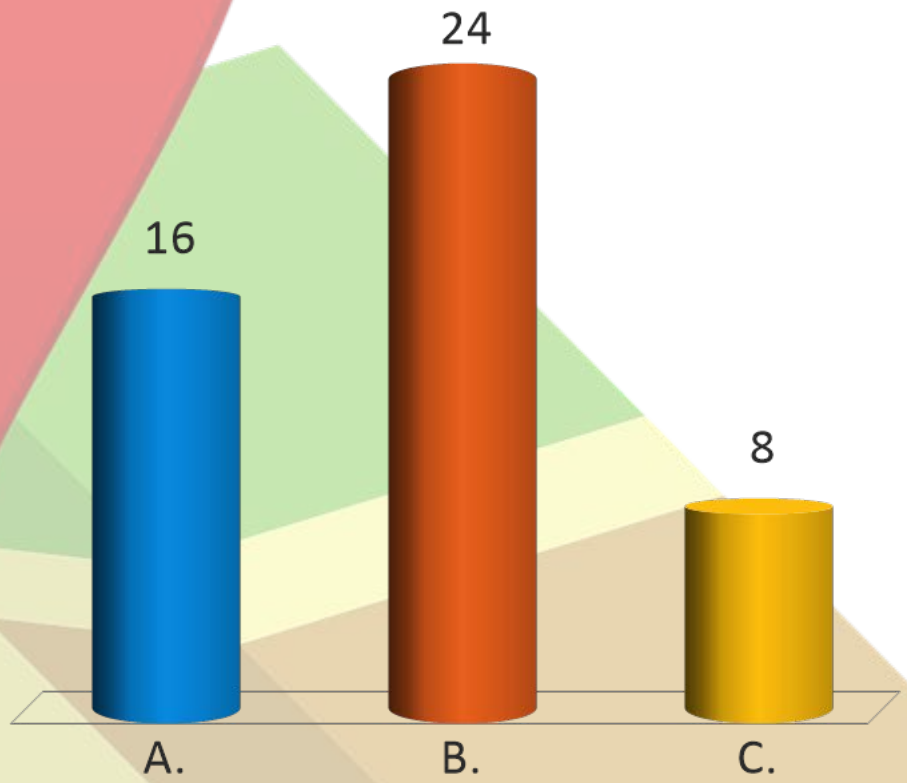
3. Wait for a question to appear

Hi! Where are you from?

A. Universiteit Leiden

B. TU Delft

C. Erasmus University Rotterdam



What is your main role?

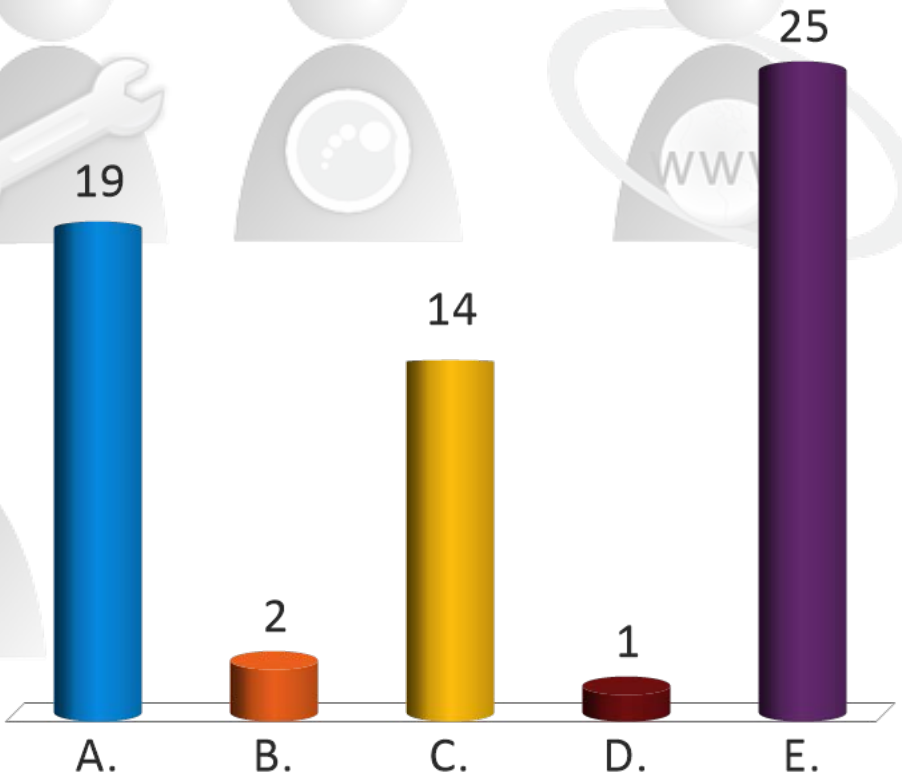
A. Educational support

B. ICT support

C. Lecturer

D. Student

E. Management



The lonely innovator

PRIME

The global state of the art in engineering education

MARCH 2018

DR RUTH GRAHAM

Mathematics at TU Delft

Faculty EEMCS

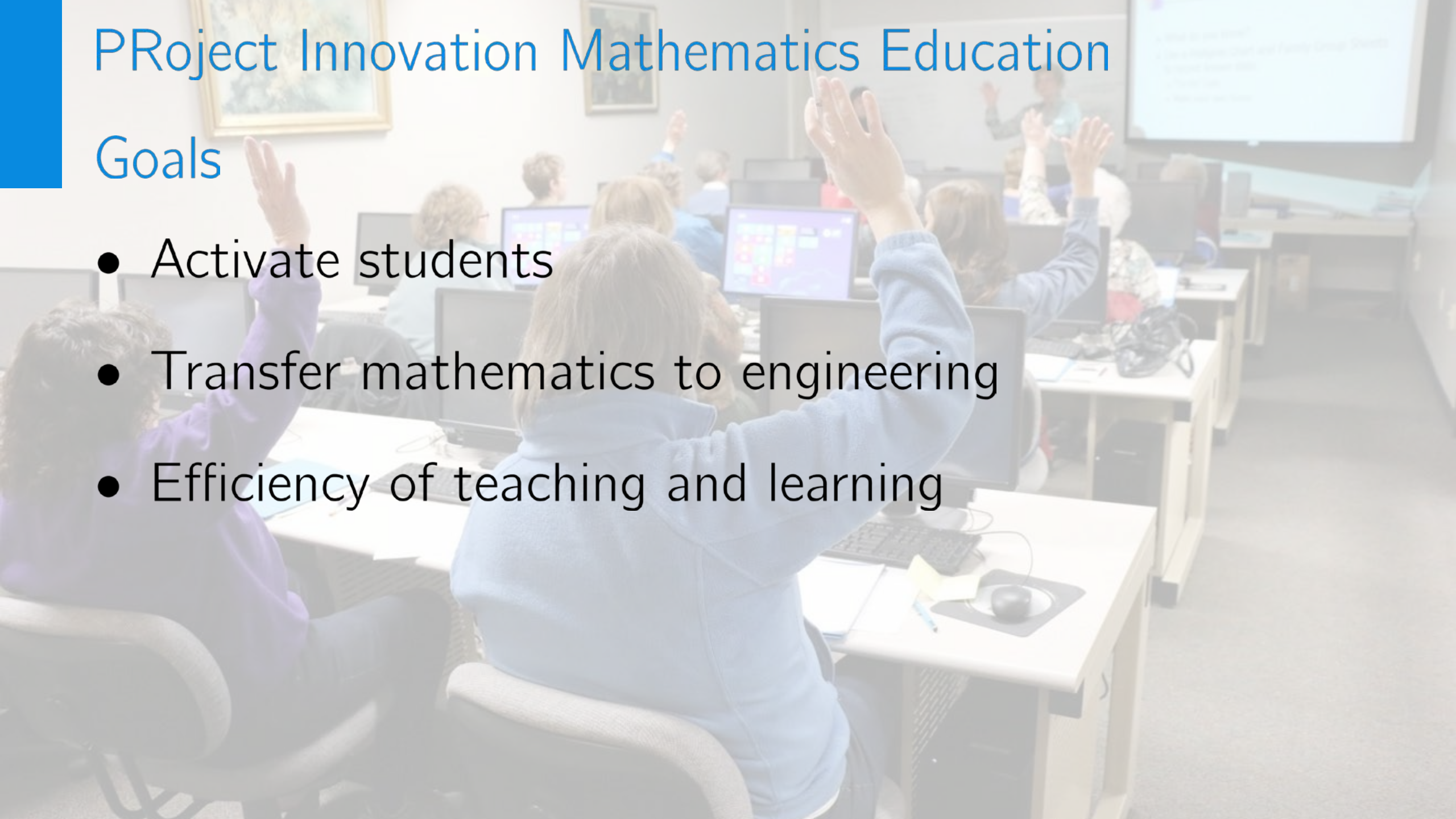
Interfaculty education: 15.000 students

48 fte

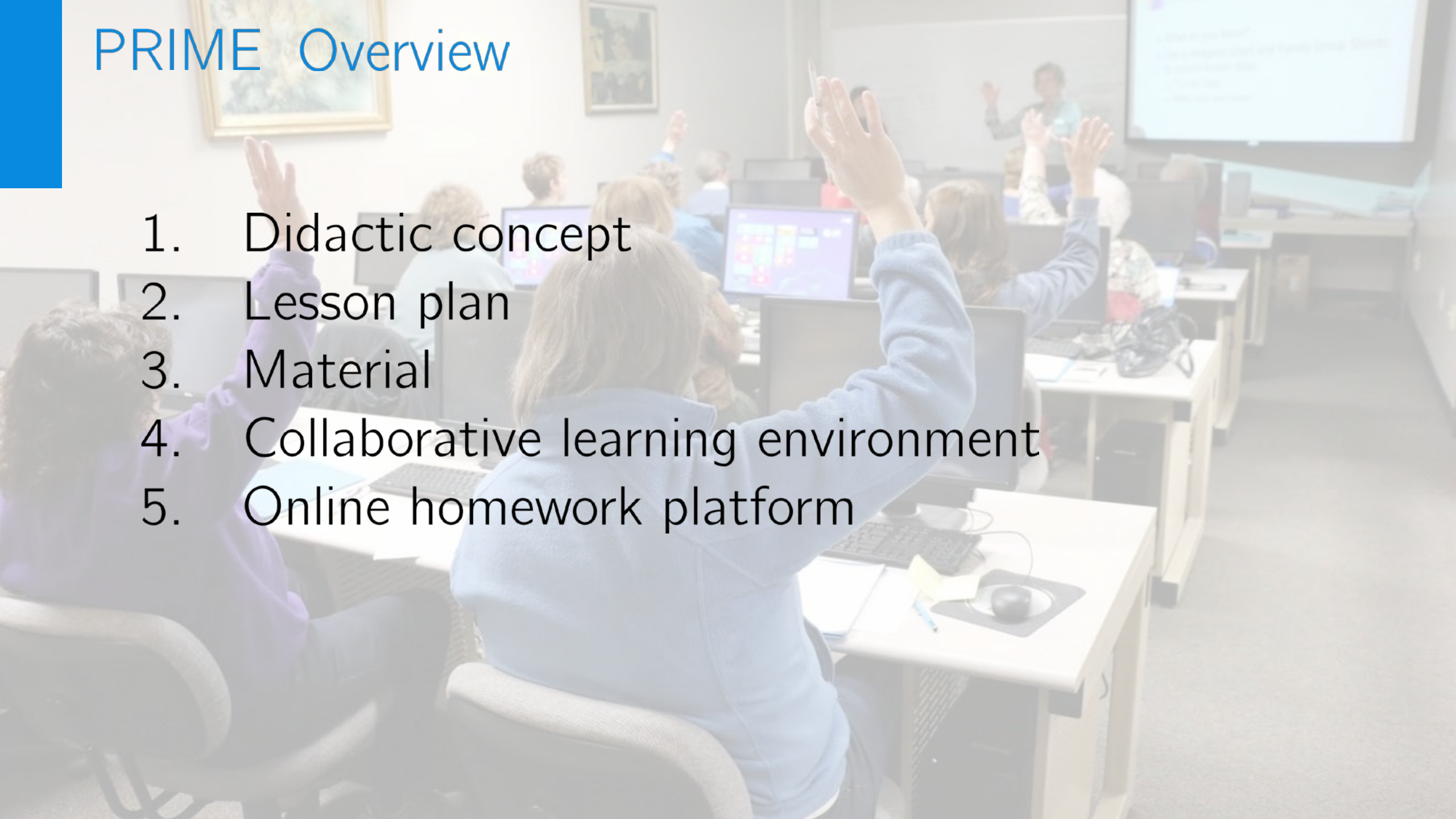
PRoject Innovation Mathematics Education

Goals

- Activate students
- Transfer mathematics to engineering
- Efficiency of teaching and learning

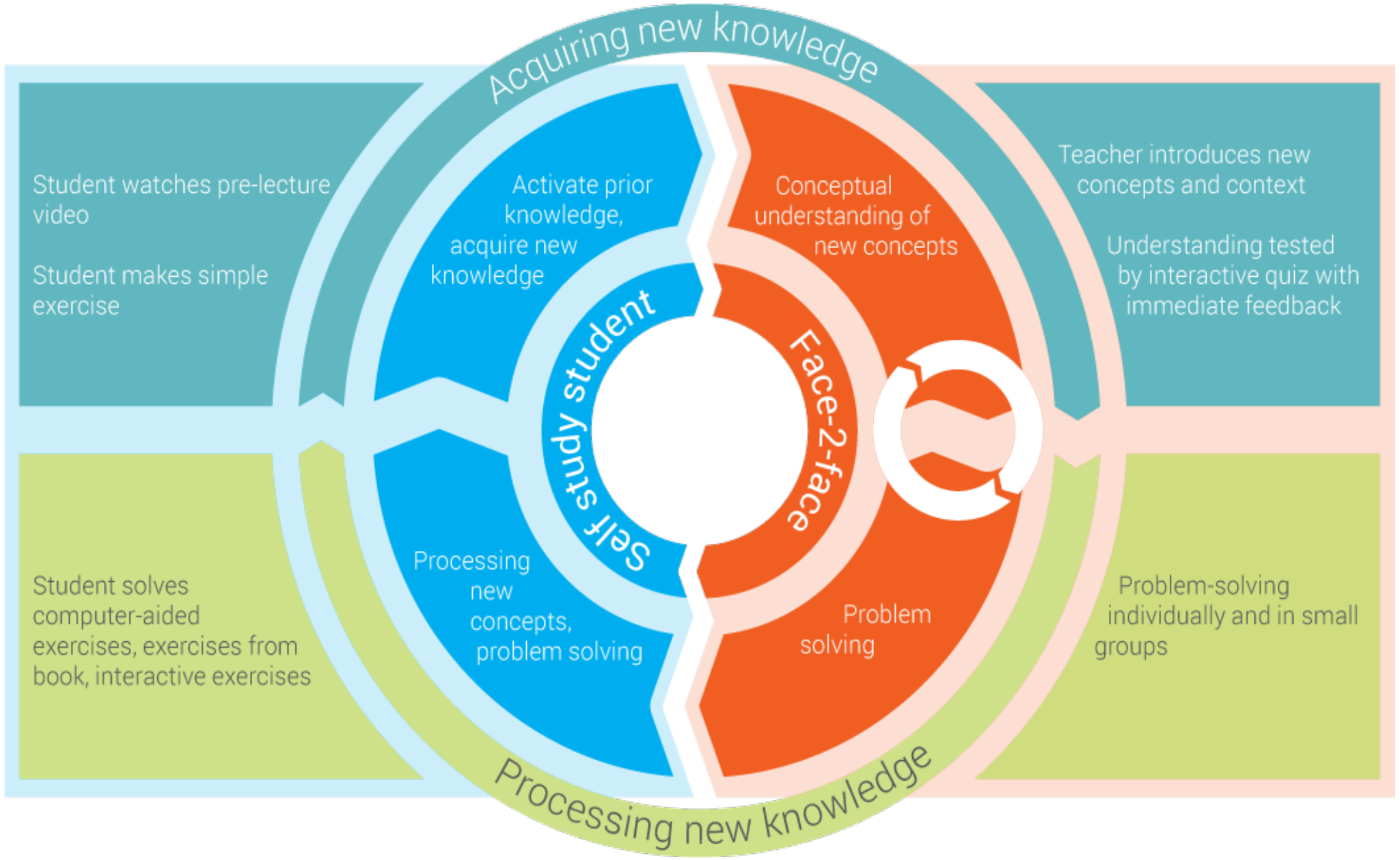


PRIME Overview



1. Didactic concept
2. Lesson plan
3. Material
4. Collaborative learning environment
5. Online homework platform

Didactical concept: Prepare, Participate, Practice



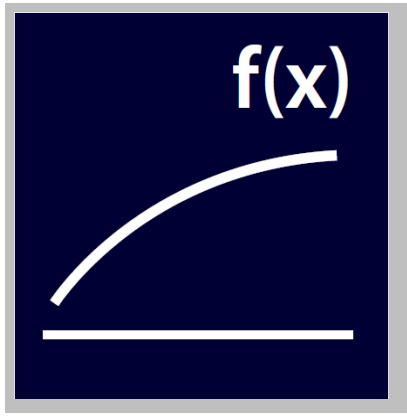
Didactical concept: Prepare, Participate, Practice

- Prepare:
  - Pre-lecture activity (video and/or exercise)
- Participate:
  - Interactive quiz
  - New theory/Meaningful example
  - Do exercises
- Practice:
  - Do online exercises, get immediate feedback
  - Do exercises from the book

Mathematical modelling

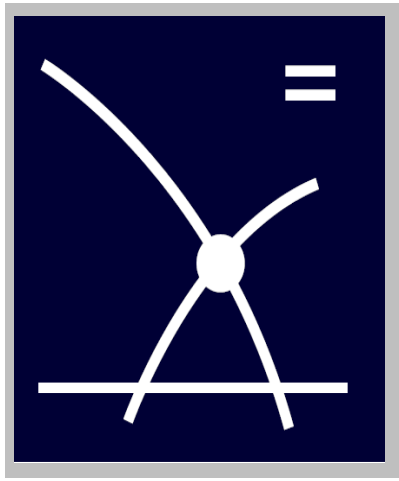
Real-world Problem

Formulate



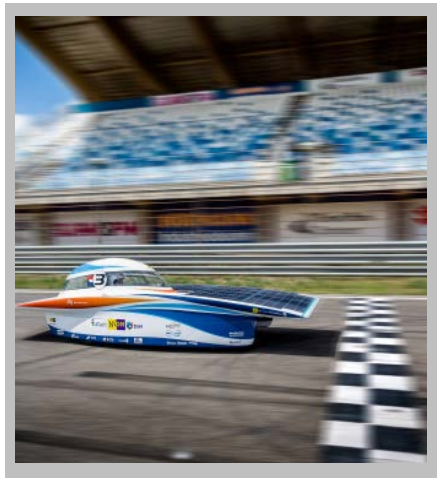
Mathematical Model

Solve



Mathematical Conclusions

Interpret

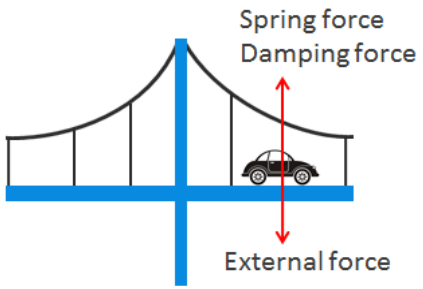


Real-world Predictions

Test

Transfer mathematics to engineering

Cable bridge



Newton's law

$$F = ma$$

$$F_s + F_d + F_{ext}(t) = m_c y''$$

$$-ky - cy' + F_{ext}(t) = m_c y''$$

Spring constant: $k = 7$ kN/m

Damping constant: $c = 4$ kNs/m

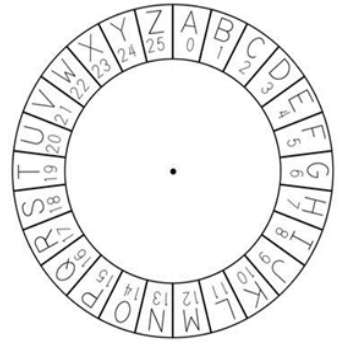
Mass cable: $m_c = 10$ ton

$$10y'' + 4y' + 7y = F_{ext}$$

Book Page 1168-1172

Encryption

$$\text{Key} = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$



C	O	M	P	U	T	E	R	S	C	I	E	N	C	E
2	14	12	15	20	19	4	17	18	2	8	4	13	2	4

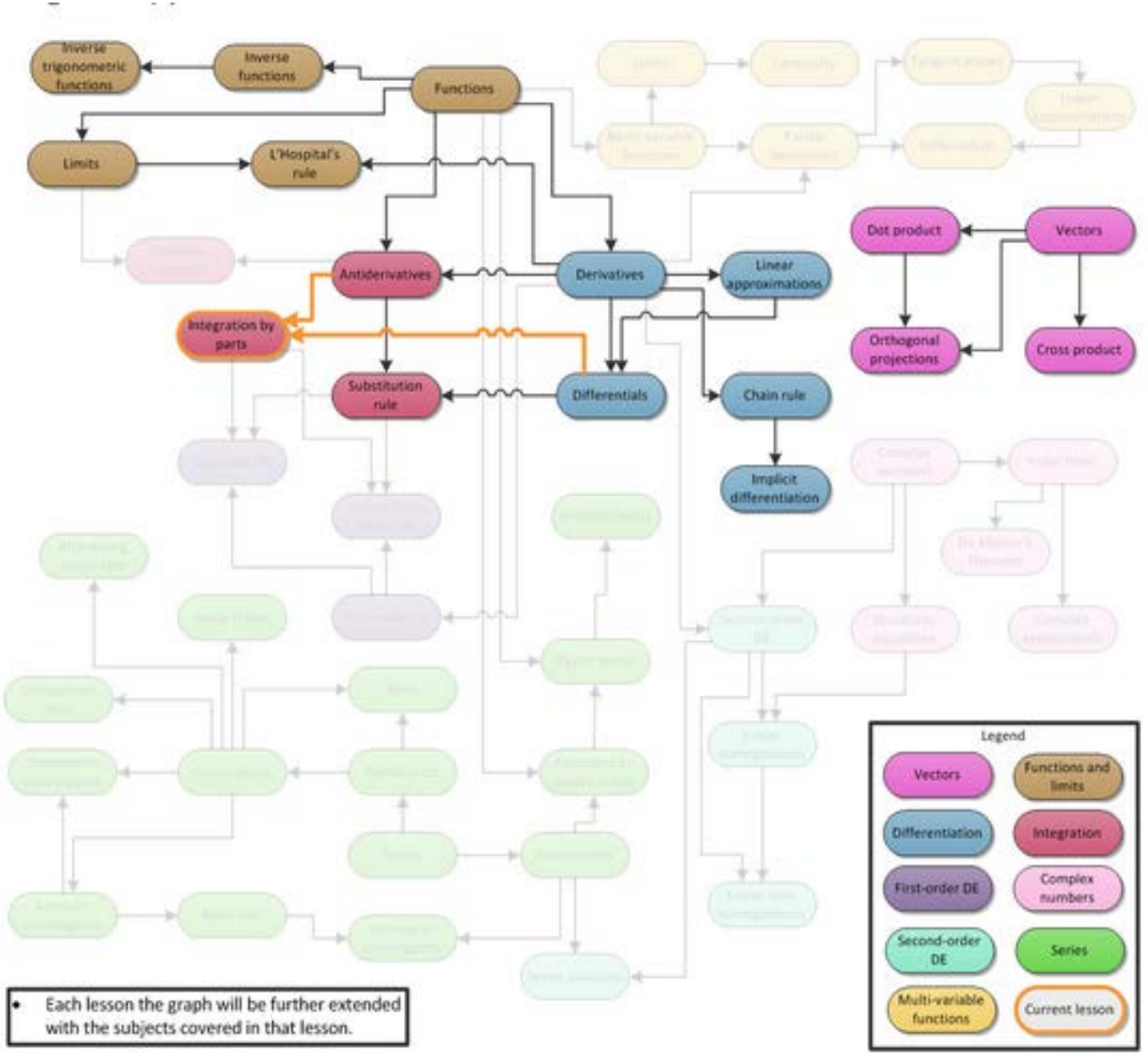
$$\text{Message} = \begin{bmatrix} 2 & 15 & 4 & 2 & 13 \\ 14 & 20 & 17 & 8 & 2 \\ 12 & 19 & 18 & 4 & 4 \end{bmatrix}$$

$$\text{Encrypted message} = \begin{bmatrix} 28 & 54 & 39 & 14 & 19 \\ 26 & 39 & 35 & 12 & 6 \\ 12 & 19 & 18 & 4 & 4 \end{bmatrix}$$

Brightspace

- Overview graph of topics of the course
- Organisation per lecture
- Prepare, Participate, Practice

Brightspace



Online Homework Platform

Courses and Faculties

Courses and faculties

	Calculus 1, 2, 3	Linear Algebra 1, 2	Probability and Statistics
CE	**XX**		
EE			**X**
AE		**X**	
3mE			
CS			
TPM			
AES			

2016-2017
lecturers involved: 7
students involved : 900

Courses and faculties

	Calculus 1, 2, 3	Linear Algebra 1, 2	Probability and Statistics
CE	XX	XX	
EE			X
AE	XXX	X	X
3mE	XX	XX	
CS	X	X	X
TPM	X	X	X
AES	XX	X	X

2018-2019
lecturers involved: 25
students involved : 2700

What do you need?

What do you need?

- Team
- Training
- Support
- Supervision

Team work

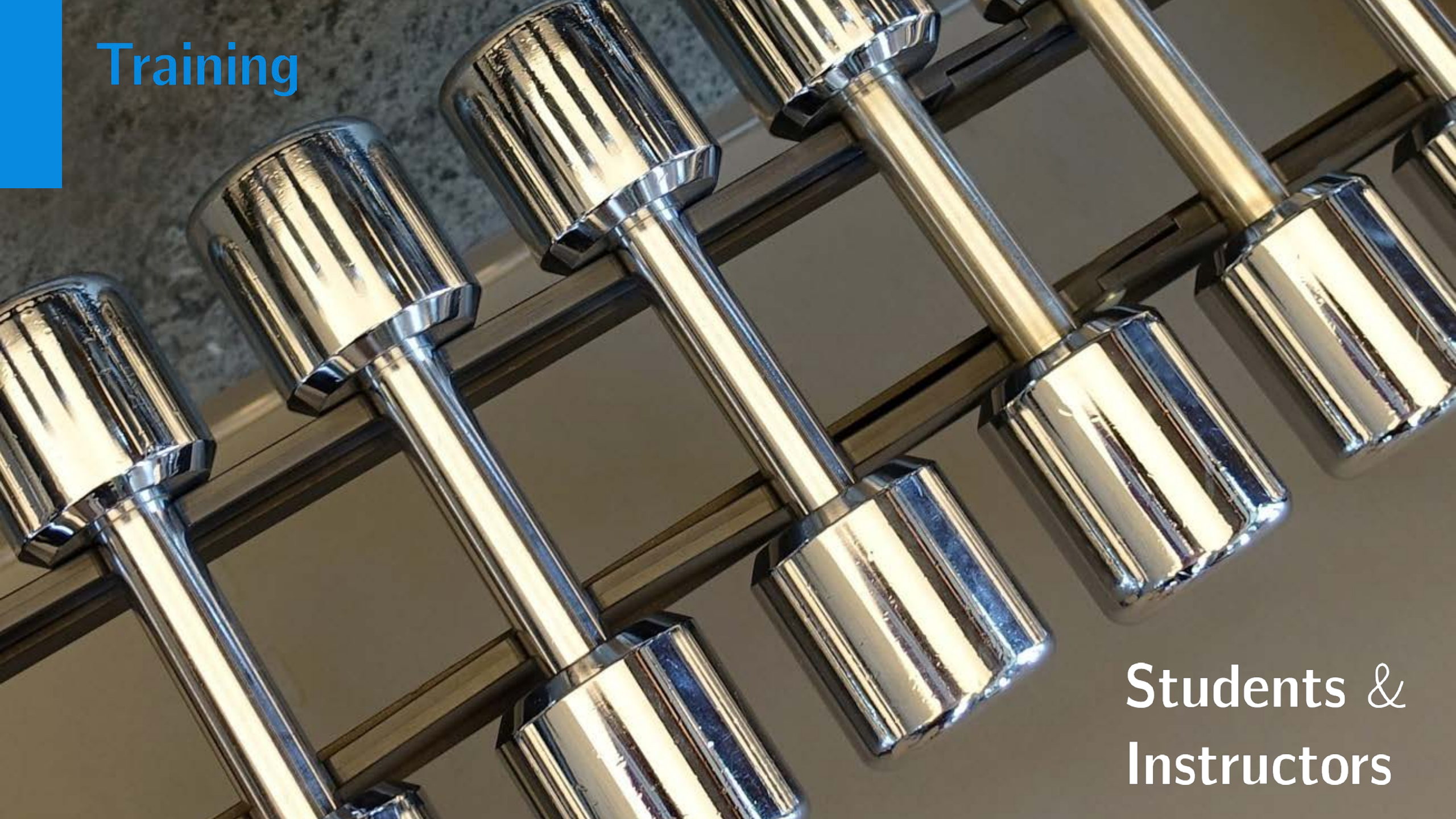
Team

- Dedicated lecturers (time)
- E-learning developer
- Educational advisor
- Project leader
- Master students from other faculties

Team

- Team of responsible teachers (time)
- E-learning developer
- Educational advisor
- Project leader
- Assistant project leader
- Student assistants (4)

Training



Students & Instructors

Training students

- Video how to study
- Continue/Start/Stop

Training instructors

- Presentation in front of a camera
- ICT workshops
- Observations
- Peer observations
- Video coaching
- Lunch meetings

Support

Supervision

Results

Passing rates

	2013/14	2014/15	2015/16	2016/17
LinearAlg AE	61%	72%	52%	75%
Prob&Stat AE	54%	19%	56%	67%
Prob&Stat EE	67%	79%	54%	70%
Calculus 1 CE	73%	68%	64%	68%

Continue/Start/Stop

We appreciate your feedback with respect to all aspects of Mathematics 1 (AESB1211)

CONTINUE with

START with

STOP with

Continue/Start/Stop

Number of responses: 670; Survey period: first quarter 2017-2018

Interactive quizzes **189**	Clear explanations **132**	Online homework **83**	This way of teaching **77**	Pre-lecture videos **62**
Explain tough homework questions **89**	Recording lectures 32	More test exams 25	More time for working on exercises 20	Discuss exam questions during class 17
Pre-lecture video's **29**	Make students pay for the homework system **19**	Interactive quizzes **18**	The book **11**	Online assignments **9**

Efficiency

- Less preparation time for teachers
- More time for feedback during class
- Community building

Future

Future

- Adaptive learning
- Learning analytics
- How to test

Summary

Innovation = success and fun IF AND ONLY IF

- Teamwork
- Support
- Training

Summary

Never ending story!!

Outreach

Thank you for the talk. I enjoyed it, and found some of the sensible things you had to say (and that the Netherlands had done) refreshing and worth copying (insofar as that is possible).
It was well received, and gave those who care about the quality of education a chance to meet each other.
It should not require a stranger from Europe to do that, but it did.

Alan Siegel, Courant Institute of Mathematical Sciences, New York

Summary

All we need is