Responseware TurningPoint: European version!

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

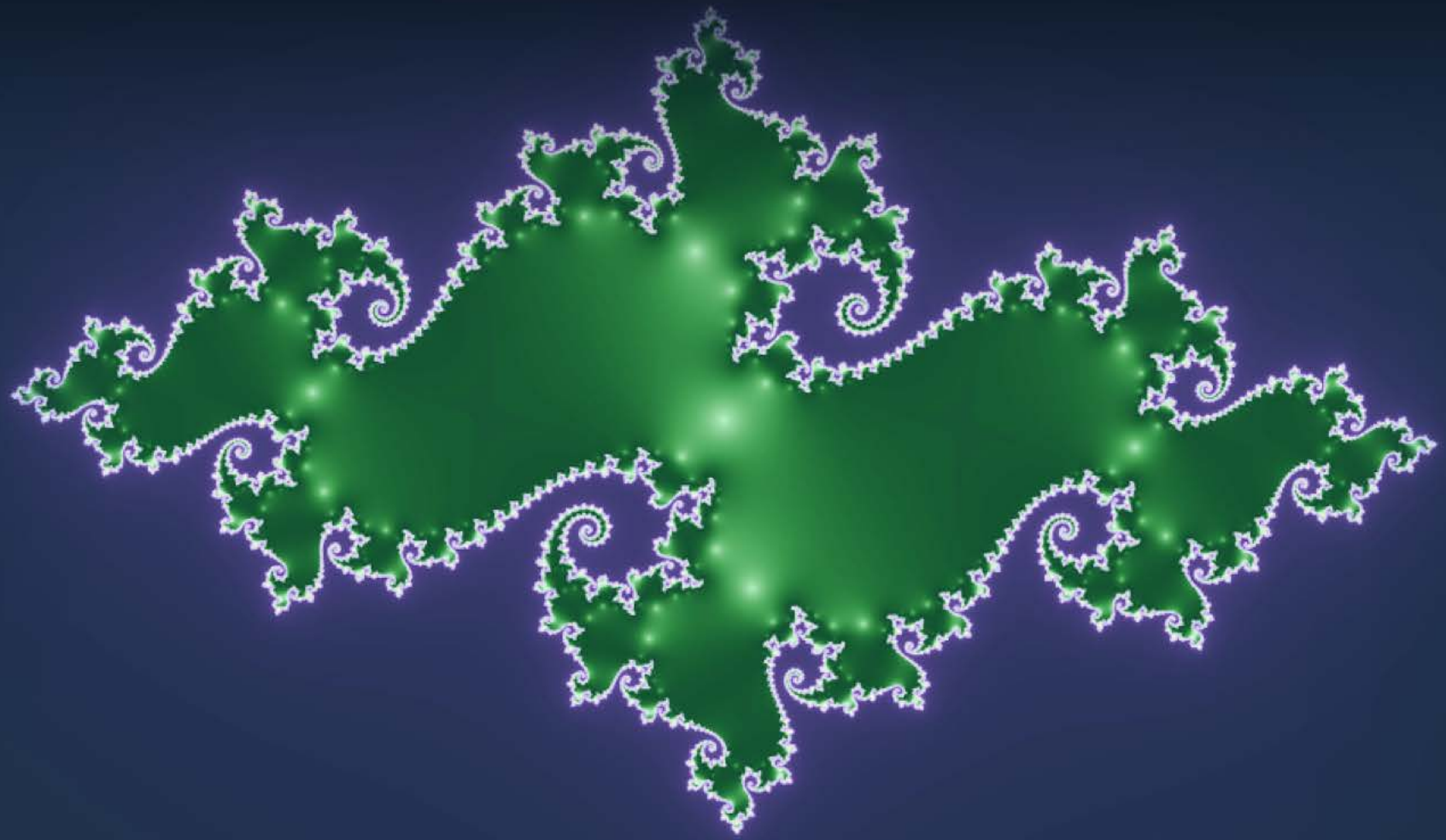
2. Session ID: xTalk

3. Wait for a question to appear

Innovating Education on a large scale: What, Why and How

Annoesjka Cabo

TU Delft



CC BY

FORUM

Responseware TurningPoint

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

2. Session ID: xTalk

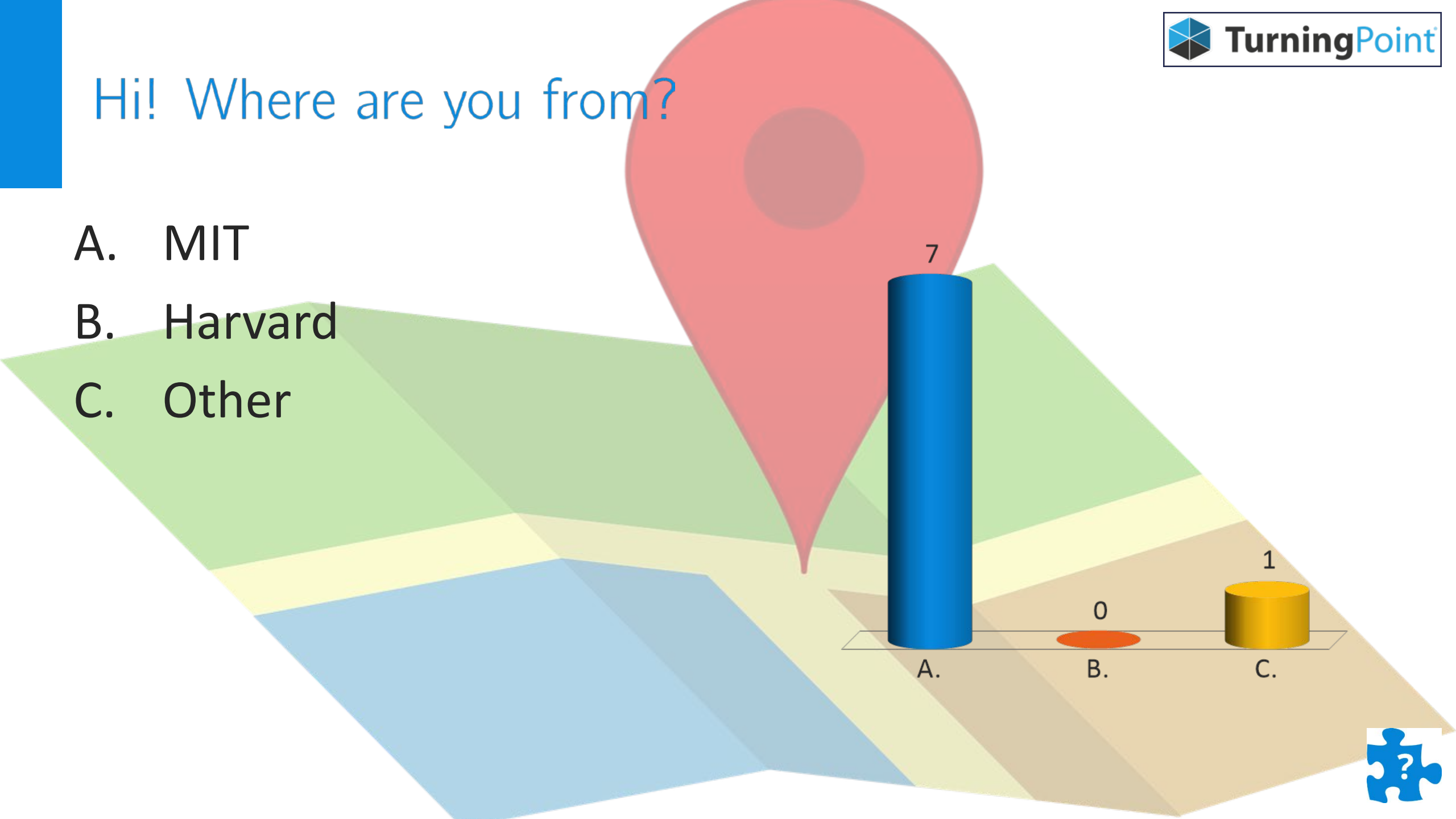
3. Wait for a question to appear

Hi! Where are you from?

A. MIT

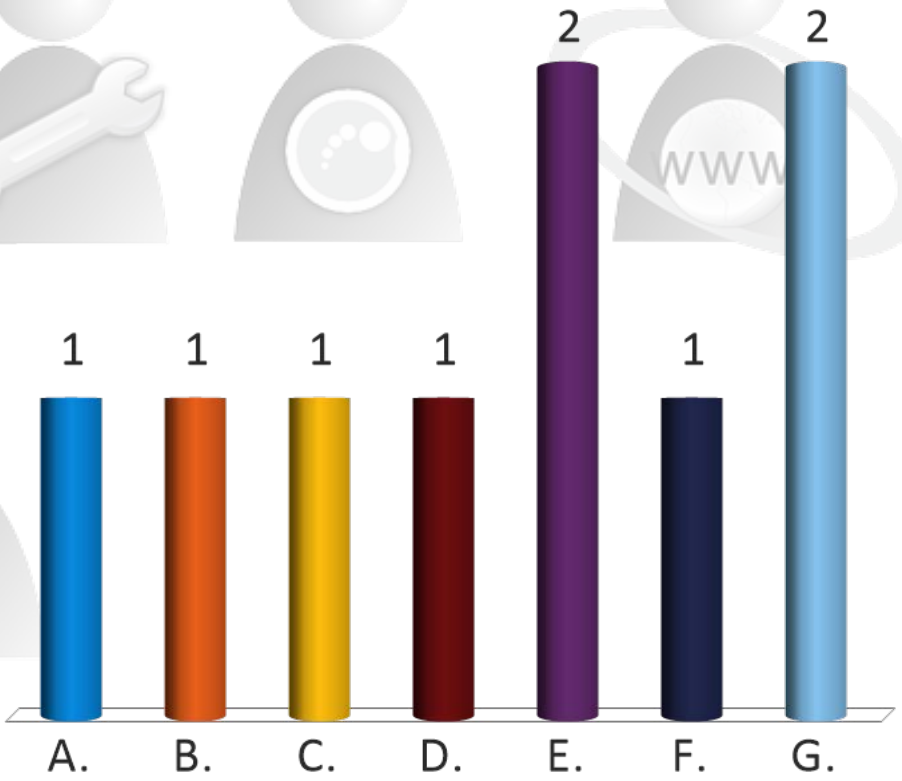
B. Harvard

C. Other

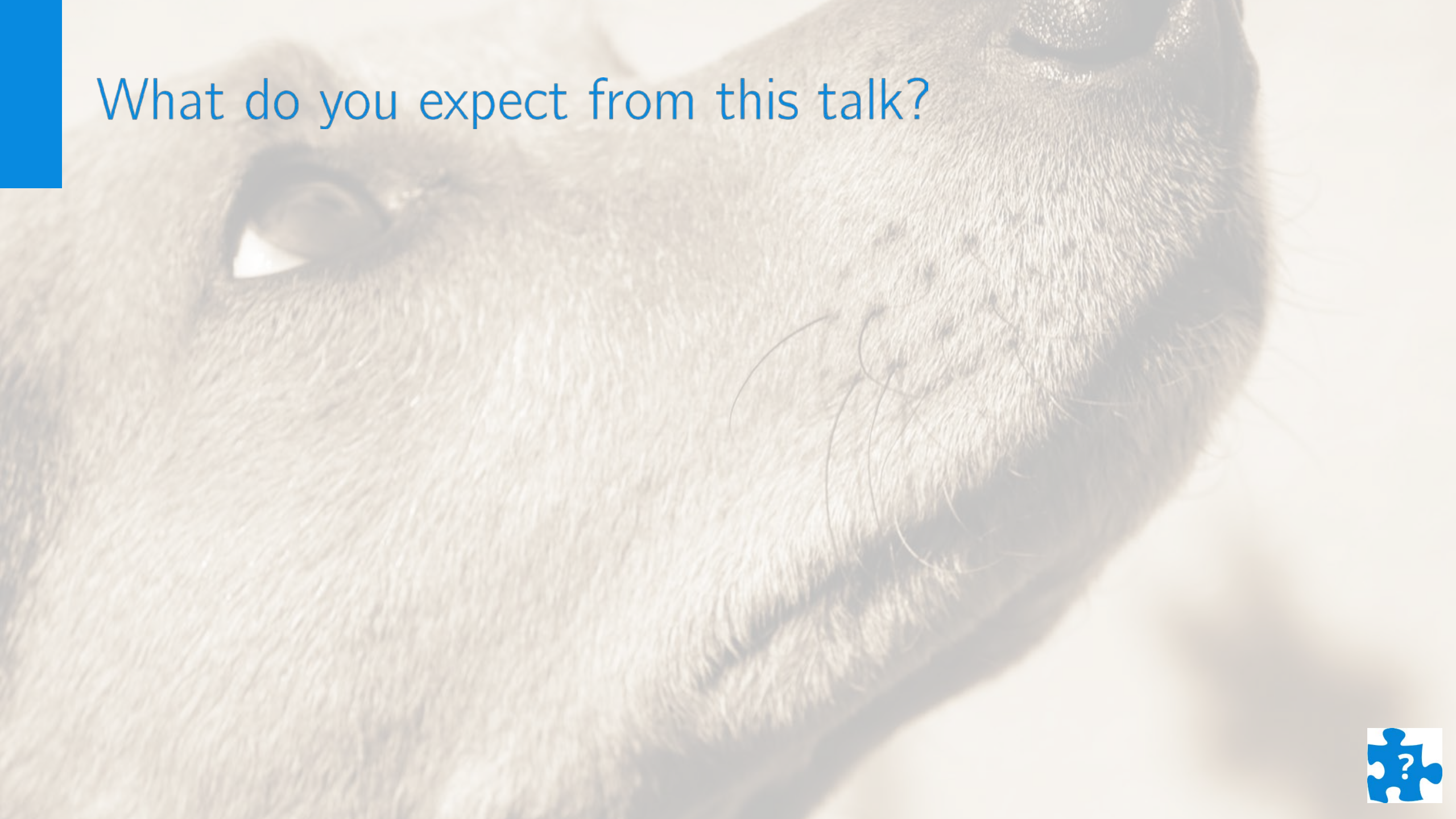


What is your main role?

A. Educational support
B. ICT support
C. Lecturer
D. Researcher
E. Student
F. Management
G. Other



What do you expect from this talk?



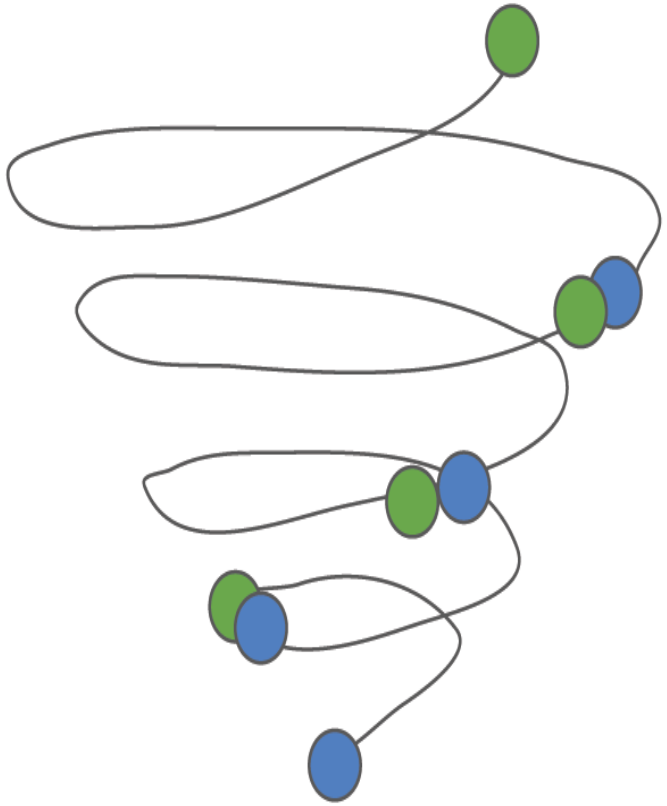
Programme

- The story of the lonely innovator
- PRIME
- Lessons learned

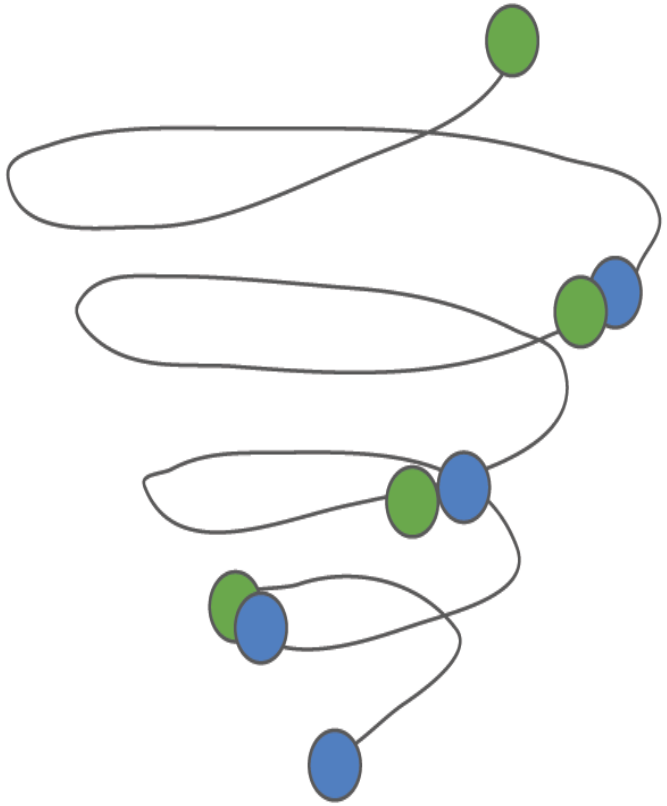
MIT report; www.math-explained.nl

The lonely innovator

Research



Research



Education

By Pim Bellinga@Grasple.com

PRIME

PRIME

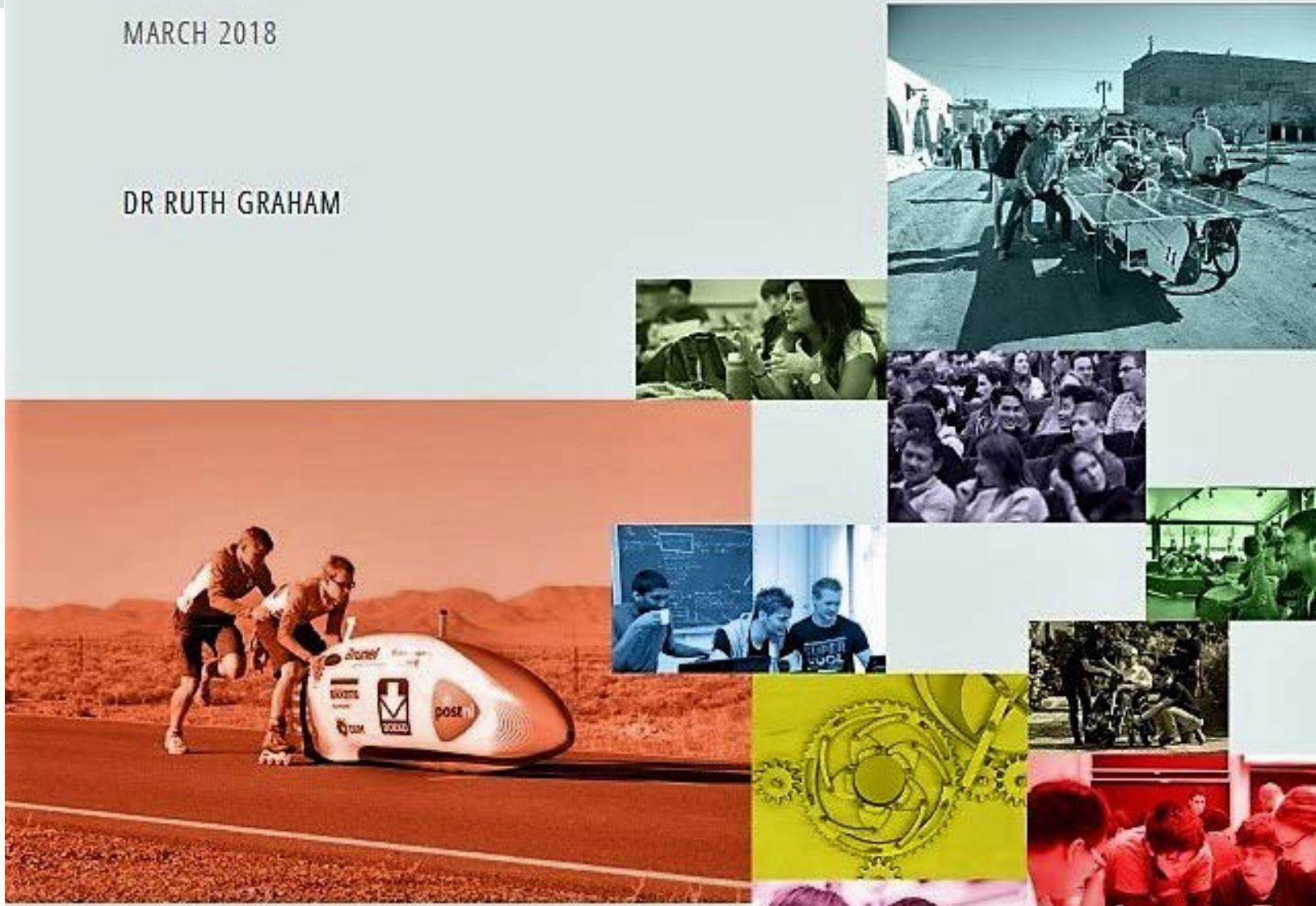
=

PRogramme Innovation Mathematics Education

School of Engineering

Identifies TU Delft
as a current and
emerging leader
in engineering education

(Case study PRIME in Box 27 p.148)



TU Delft

8 Faculties

25.000 students

1900 fte scientific staff

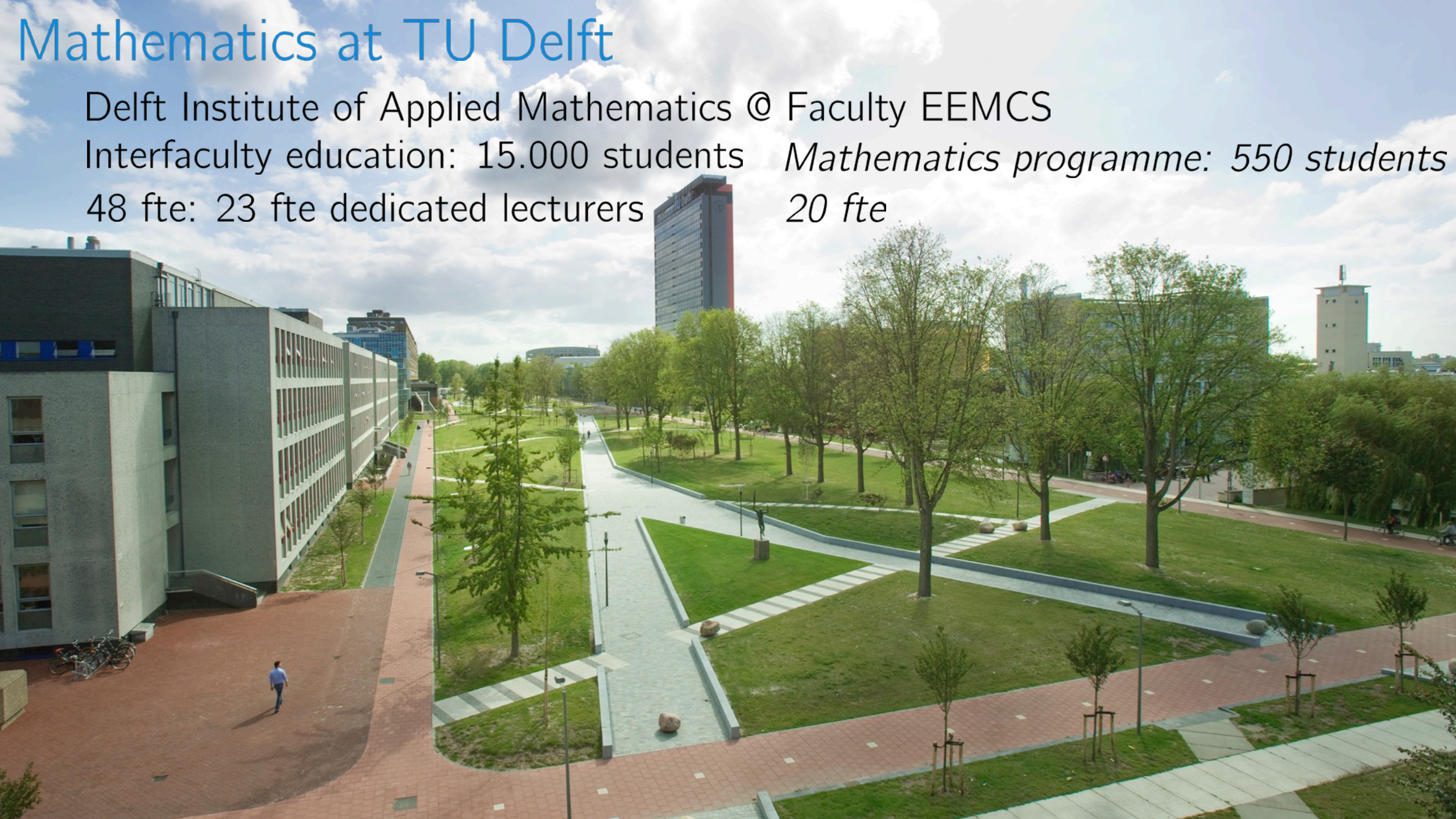
2000 fte PhD students

Mathematics at TU Delft

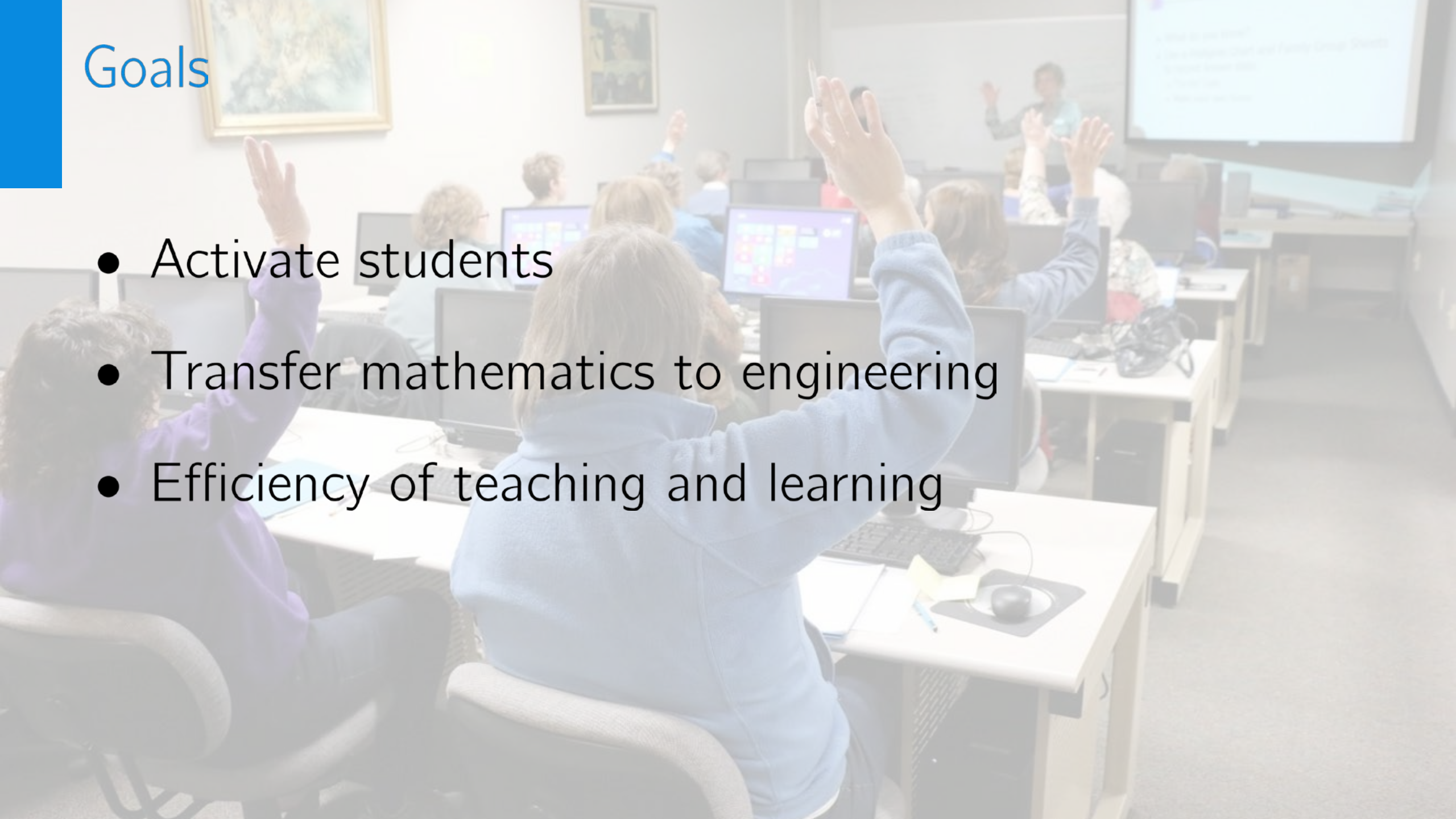
Delft Institute of Applied Mathematics @ Faculty EEMCS

Interfaculty education: 15.000 students — *Mathematics programme: 550 students*

48 fte: 23 fte dedicated lecturers — *20 fte*



Goals



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

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

Bachelor Programme	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
unique students involved : 3000+

Courses and faculties

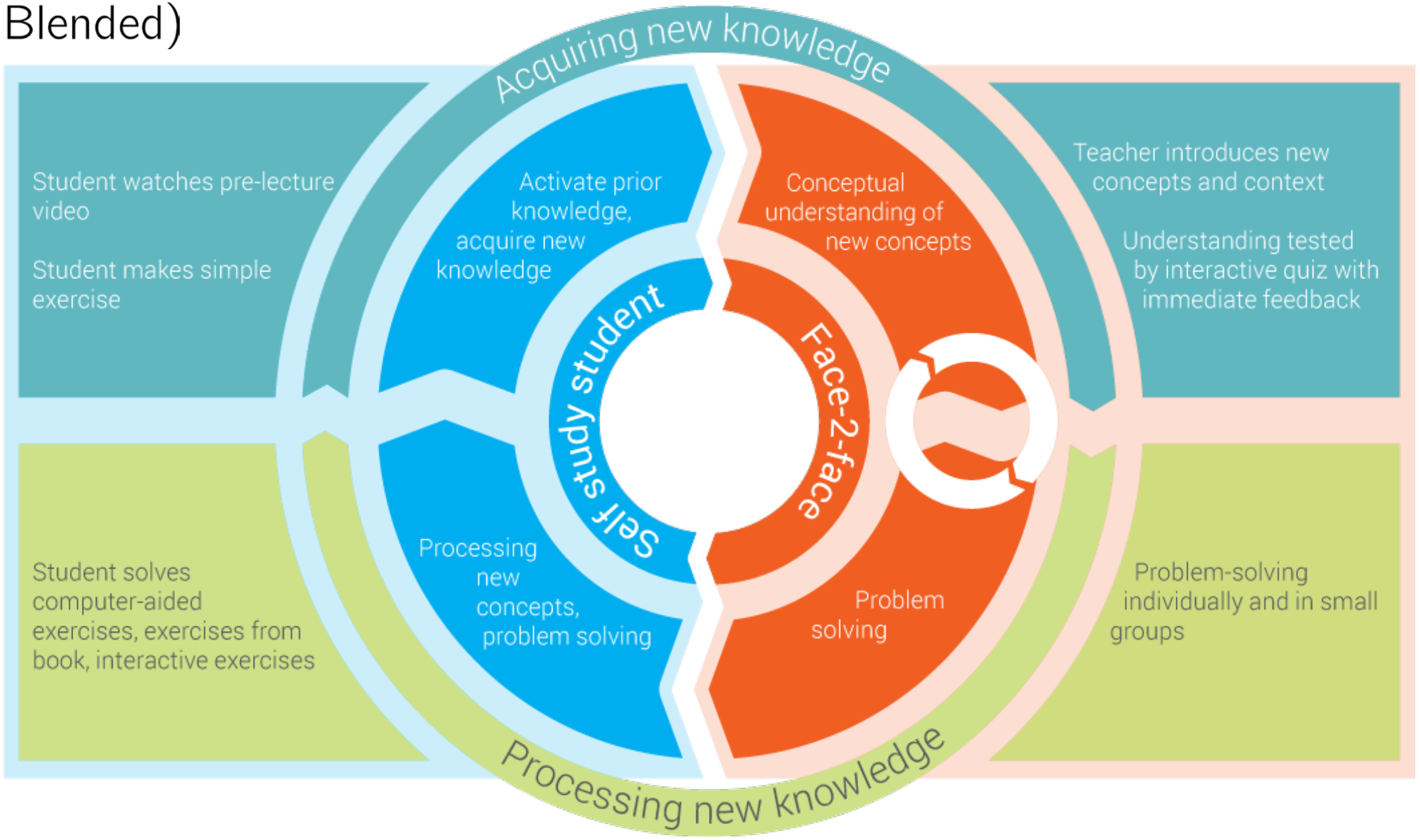
2019-2020

	Calculus 1, 2, 3	Linear Algebra 1, 2	Probability and Statistics	Differential equations
CE	XX	XX	Pilot Fall 2019	Pilot Fall 2019
EE			X	
AE	XXX	X	X	
3mE	XX	XX	X	
CS	X	X	X	
TPM	X	X	X	
AES	XX	X	X	

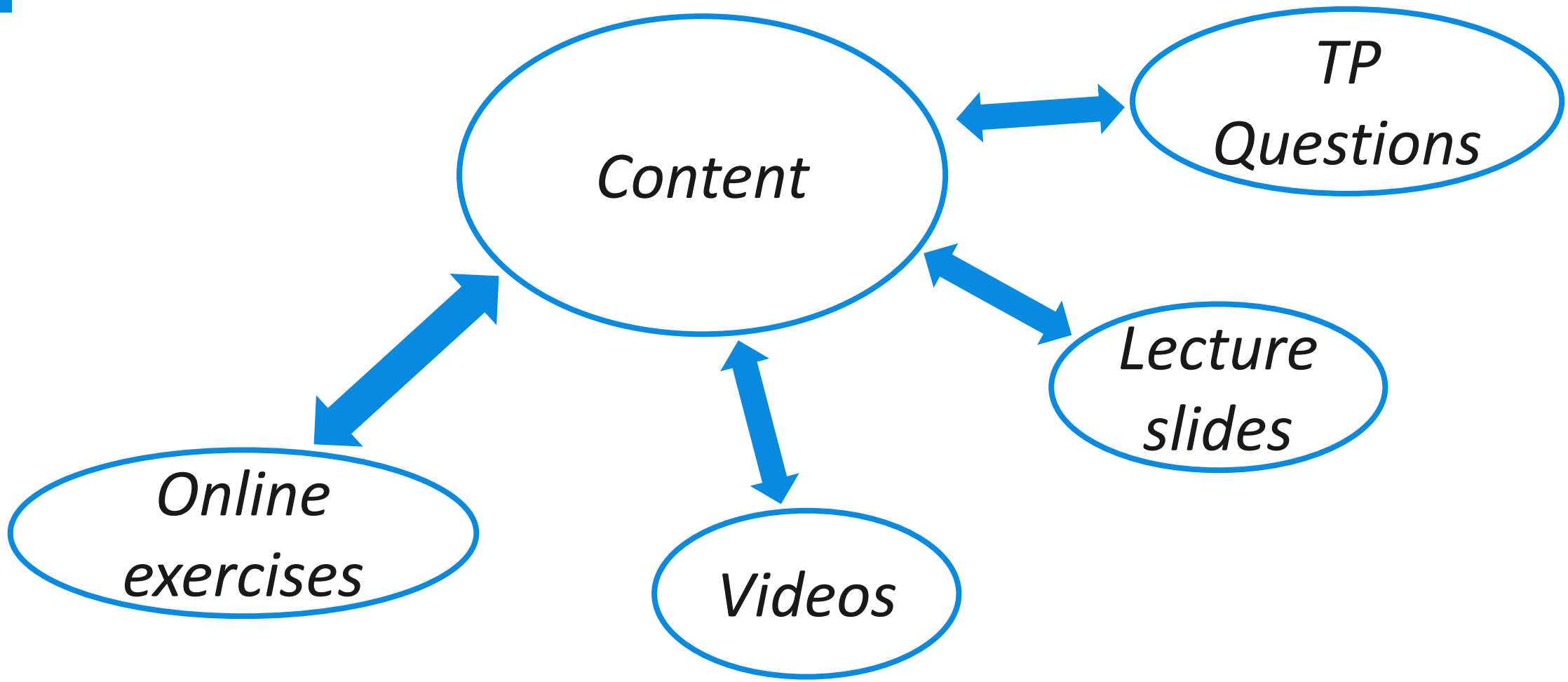
Outcomes

Didactical concept: Prepare, Participate, Practice

(Blended)



Content


Content
TP
Questions
Lecture
slides
Videos
Online
exercises

Innovate teaching and learning

- Constantly improving
- Evidence-based
- Student and teacher driven

Lessons learned

What are the success factors for this process?

DATA-DRIVEN COURSE DESIGN

ADOPTION IN OTHER DEPARTMENTS

SUSTAINED EFFORT

PREPARING STUDENTS FOR THE CHANGE AND …

SETTING EXPECTATIONS

ALIGNMENT

Funding → Team effort

Strong external project leader

↳Strong internal project leader

↳Coordinators and lecturers

Involvement of stakeholders

Evaluate and redesign

Provide training

Do research

Training the students: How to study in a blended course

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
- Uniformity among lecturers

Research

Statistics

For each course:

- Pre-lecture activities
- Attendance
- Participation in quizzes
- Participation online exercises
- Exam results

Research

with Renate Klaassen from 4TU.CEE*

Setting: 800 1st year students in ME and CE
Course: Calculus II - Functions of severable variables

Is self-reported engagement with the course material significantly enhanced by monitoring or scaffolding cues from the lecturers?

1. Attending classes
2. Scaffolding cues (from the lecturers)

- Online vs offline
- Gender effect

*accepted for CDIO 2019

Research*

with Martine Baars (Erasmus University Rotterdam), CEL

Setting: 900 1st year students in CSE
Course: Linear algebra

What is the effect of monitoring and controle prompts in a blended environment on the performance at the interactive quiz questions?

How do self regulating skills of students in the two groups develop during the course?

What role do metacognitive learning strategies play in the effect of monitoring and prompts on students' performance in the quizzes and in the exam?

*in progress

Future

Online exercises
Videos
Slides
TP Questions
?

Future

- Adaptive learning
- Learning analytics
- How to test
- Research
- What about Mathematics programme?

Summary

Innovation = success and fun IF AND ONLY IF

- Teamwork
- Support
- Training

Never ending story!!

200+ videos

www.math-explained.tudelft.nl

1000+ exercises

https://grasple.com/math/

Online Homework Platform
Grasple: open content

Basic math exercises have been created by OpenStax. The more advanced topics (Calculus) have been created by Delft University of Technology and adapted by Grasple. All materials are CC licensed! So feel free to reuse, remix and redistribute these exercises as long as you make a proper attribution.

Legend

Indicates whether a lesson/explanation is available per subject | 10 Indicates if and how many exercises are currently available per subject

Content has an open Creative Commons license | Author indicated that content is accessible upon request

Basis

- Algebraic expressions 5
- Exponents 5
- Square roots 5
- Polynomials and factoring polynomials 5
- Rational expressions 3
- Solving equations 3
- Inequalities 3

Functions and graphs

- Graphs 5
- Functions 10
- Transformation of functions 3
- Inverse functions 5
- Composition of functions 5

Select your Course

TUD - Probability & Statistics - EE1M31 - 1819Q3

Introduction

- Grasple introduction

Events and probability rules

- Events and probability rules - Basics
- Events and probability rules - Practice questions
- Events and probability rules - Challenging questions

Conditional probabilities

- Conditional probabilities - Basics
- Conditional probabilities - Practice questions
- Conditional probabilities - Challenging questions
- Law of total probability, Bayes' and independence - Basics

First distributions

- Discrete random variables and probability mass functions - Basics
- Discrete random variables and probability mass functions - Practice questions
- Discrete random variables and probability mass

powered by Grasp

Conditional probabilities - Practice questions

Start practicing!

It seems you don't fully understand this subject yet. Practice now and pass the exercises to show you do master this subject. Or take a lesson first. You can do it!

After lecture: exercises (online)

EXERCISE 0/5 edit Report mistake!

QUESTION 1 - TRY 1 OF 3

SKIP

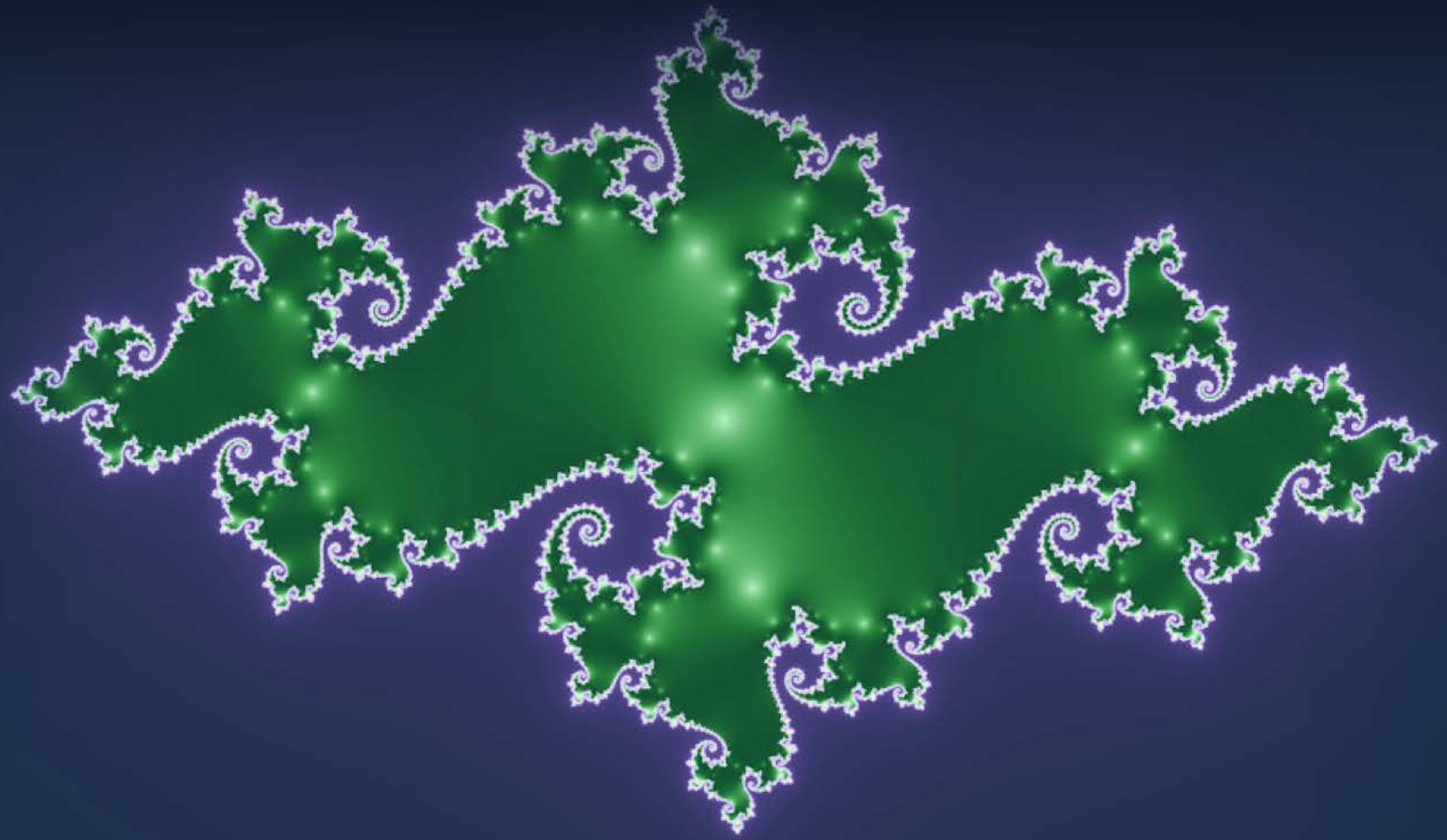
Suppose, $P(A) = 0.23$, $P(B) = 0.33$, $P(B \mid A) = 0.74$ and $P(A \cap B) = 0.17$.

What is the value of $P(A \cup B)$?

Check my answer

Questions?

TU Delft

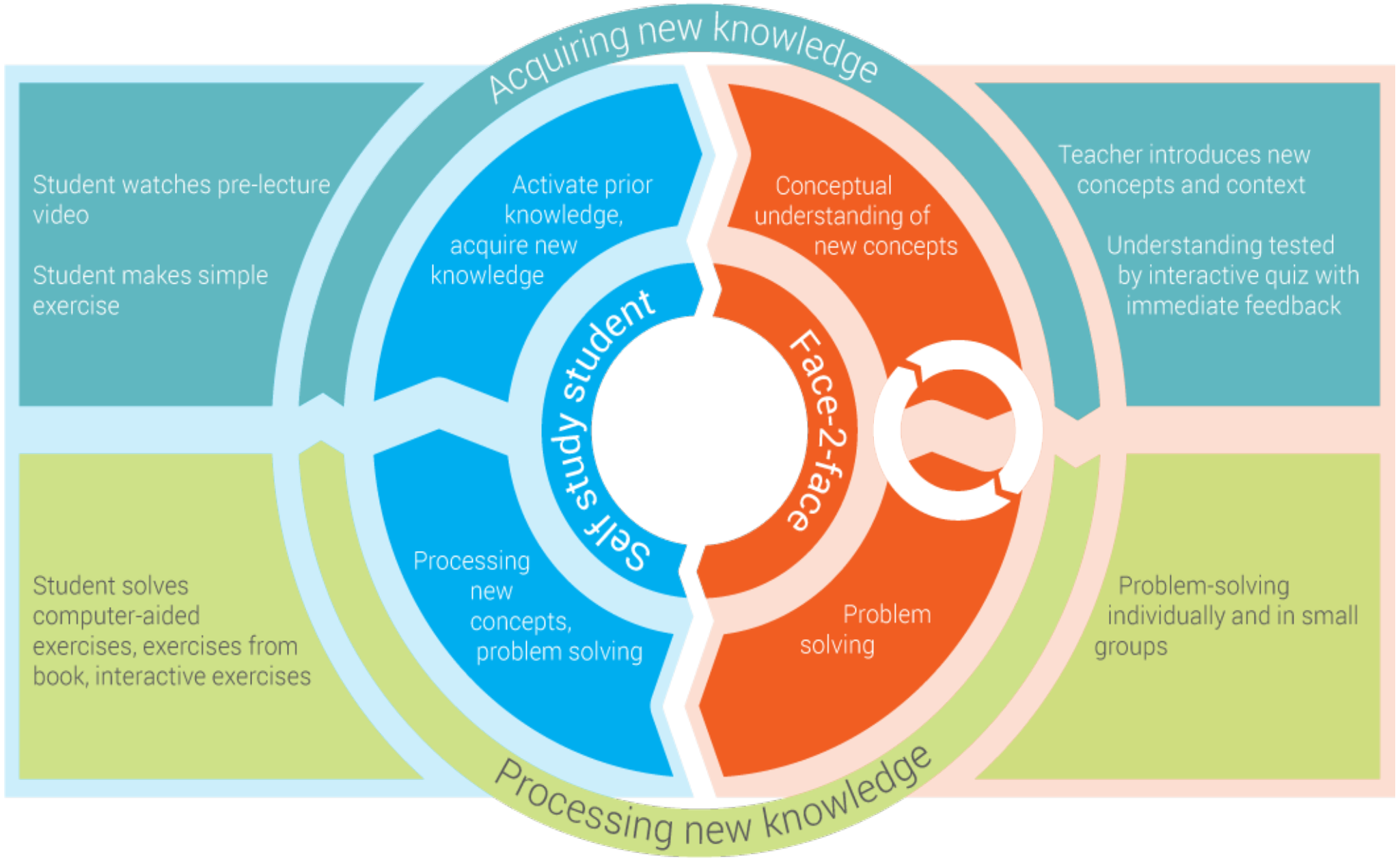


CC BY

PRIME Overview

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

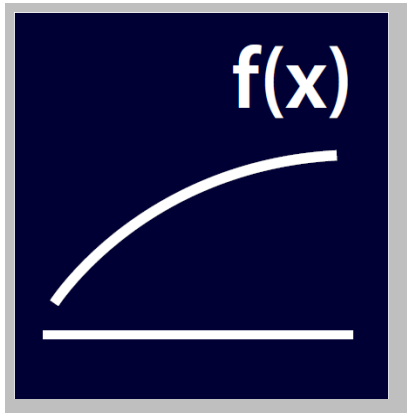
Didactical concept: Prepare, Participate, Practice



Mathematical modelling

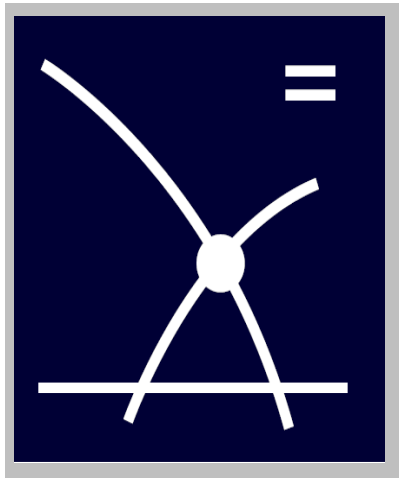
Real-world Problem

Formulate



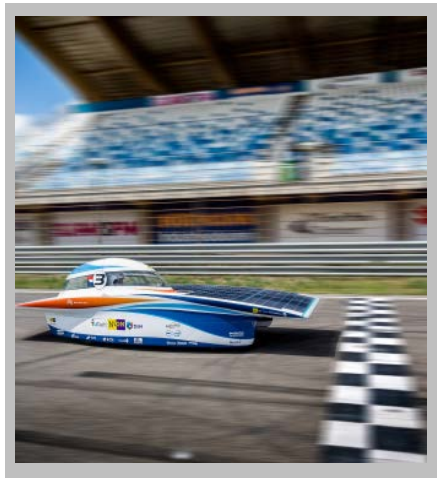
Mathematical Model

Solve



Mathematical Conclusions

Interpret

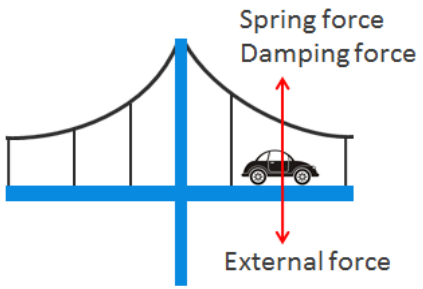


Real-world Predictions

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

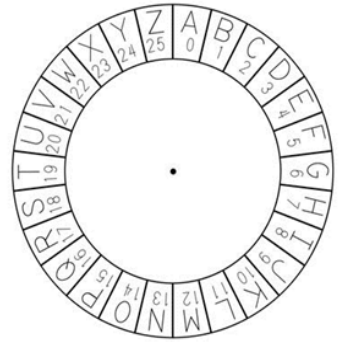
Mass cable: $m_c = 10$ ton

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

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
Image

View — 5 min

Here you can see how the topics of this lecture are related to each other and to other topics.

Before lecture: Study video (1/2)
Video

Watch — 15 min

In this video you will learn how to use Bayes' rule to determine conditional probabilities.

Before lecture: study video (2/2)
Video

Watch — 15 min

In this video you will learn when two events are independent.

Before lecture: exercises
Web Page

To do — 30 min

Lecture slides
PDF document

Starts 14 February, 2019 15:30

Study lecture slides — 15 min

After lecture: exercises (book)
Web Page

To do — 1h 30 min

After lecture: exercises (online)
External Learning Tool

Practice in Grasple