

Matematikk i ingeniørutdanningen – disiplin vs. program



Sammen om kunnskap

Morten Brekke

Dosent

Kort om meg:

- Viserektor for utdanning i perioden 1. August 2019 – 31. Juli 2023.
- 30 års erfaring med undervisning på ingeniørutdanning
- Meritert underviser.
- Leder av Rådet for kvalitetsprogrammene i HK-dir.
- Chair of EUA TPG group.
- Medlem i SEFI SIG Mathematics Steering Committee.
- Medlem Editorial Board TEAMAT – Teaching Mathematics and its applications – Institute of Mathematics - UK
- **Styreleder MatRIC**

<https://www.uia.no/senter-og-nettverk/matric>



MatRIC Centre for Research,
Innovation and Coordination
of Mathematics Teaching



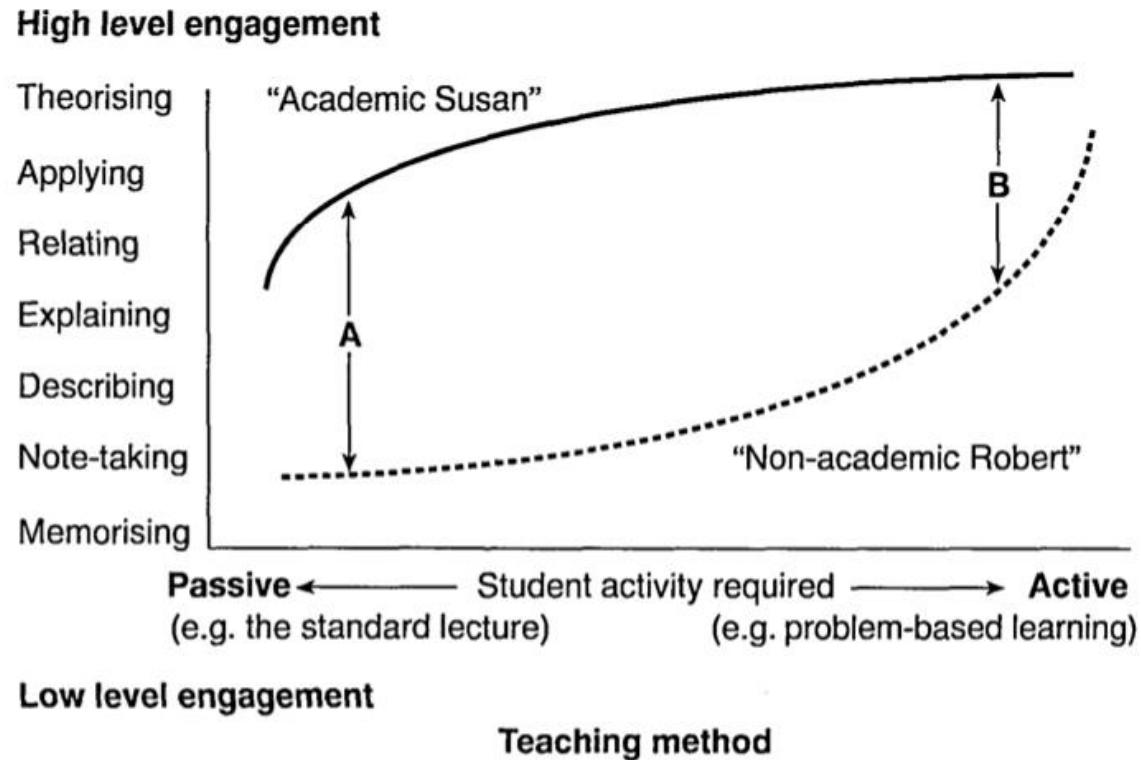
**SENTER FOR
FREM RAGENDE
UTDANNING**

MatRIC's vision:

«Students enjoying transformed and improved learning experiences of mathematics in higher education.»

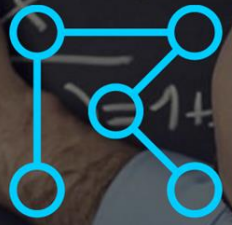
What the Student Does: teaching for enhanced learning, Biggs 1999

What the Student Does 59




1. Learning is primarily a direct result of individual differences between students.
2. Learning is primarily the result of appropriate teaching.
3. Learning is the result of students' learning-focused activities which are engaged by students as a result both of their own perceptions and inputs and of the total teaching context.

FIG. 1. Student orientation, teaching method, and level of engagement.

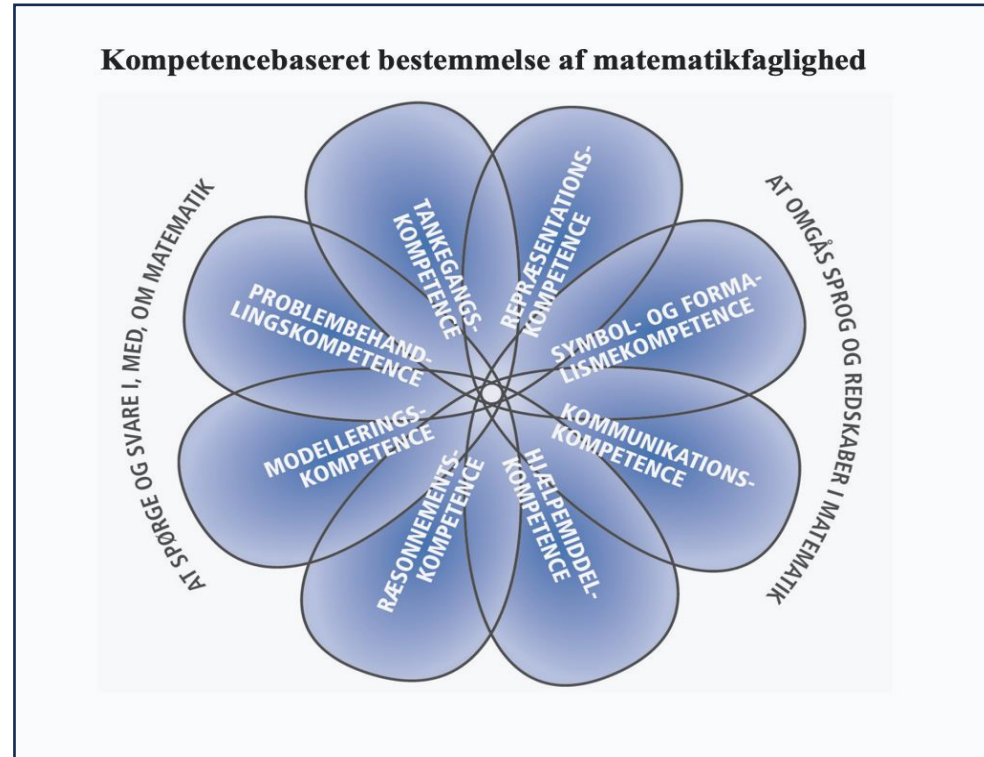
Digital assessment

The goal of this network is to connect university level mathematics teachers who are using, or thinking about using, computer aided assessment to support their students' learning.



Video

This network aims to connect university level mathematics teachers who are working on the production of video resources for teaching and learning mathematics (for streaming, tutorial support, flipped classroom approaches, blended learning and MOOCs).



Mogens Niss Flowerdiagram of the 8 competencies

European Society for Engineering Education (SEFI)

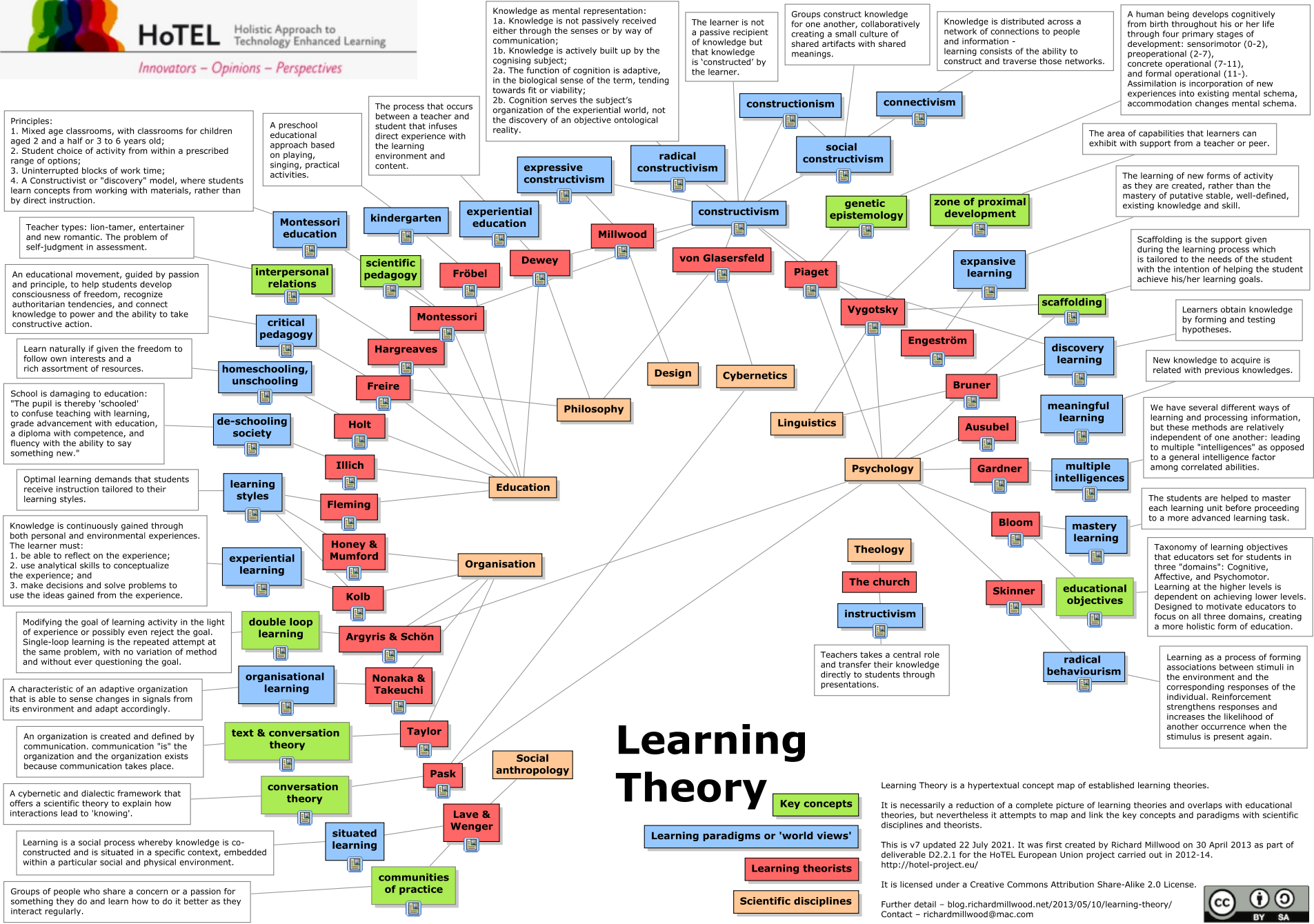
A Framework for Mathematics Curricula in Engineering Education

A Report of the Mathematics Working Group



Publisher: European Society for Engineering Education (SEFI), Brussels
ISBN: 978-2-87352-007-6

Principal Editor: Burkhard Alpers
Associate Editors: Marie Demlova, Carl-Henrik Fant, Tommy Gustafsson, Duncan Lawson, Leslie Mustoe, Brita Olsson-Lehtonen, Carol Robinson, Daniela Velichova
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Learning Theory

Key concepts

Learning paradigms or 'world views'

Learning theorists

Scientific disciplines

Learning Theory is a hypertextual concept map of established learning theories. It is necessarily a reduction of a complete picture of learning theories and overlaps with educational theories, but nevertheless it attempts to map and link the key concepts and paradigms with scientific disciplines and theorists.

This is v7 updated 22 July 2021. It was first created by Richard Millwood on 30 April 2013 as part of deliverable D2.2.1 for the HoTEL European Union project carried out in 2012-14. <http://hotel-project.eu/>

It is licensed under a Creative Commons Attribution Share-Alike 2.0 License.

Further detail - blog.richardmillwood.net/2013/05/10/learning-theory/
 Contact - richardmillwood@mac.com



MatRIC Drop-in



Nytt læringscenter for studenter og ansatte

Trenger du skriveveiledning eller mattehjelp, et rom for en workshop eller bare teste ut en teknisk løsning? Nå åpner det nye læringscenteret i biblioteket på Campus Kristiansand.



Human connection competences



MatricMentorer motiverer

Silje Hatlevik (23) blir oppriktig glad når hun ser andre blir trygge, får blomstre og får til faget. Hun har valgt å senke garden, og vil ikke bruke tid på å kritisere eller dømme andre, men heller åpne for å la dem skinne. Derfor finner hun det også meningsfullt og gøy å bidra til godt læringsmiljø ved å være studentmentor ved Drop in på UiA, campus Grimstad.



MatricMentor: – Vi gjør visst en forskjell

– Jeg visste ikke at jeg faktisk skulle være med å bety en forskjell for noen. Det sier student og mentor Preben Forsland (24) fra Harstad som holder på å ta bachelor i Fornybar energi ingeniør ved UiA, campus Grimstad.



UiA Faculty of Engineering
and Science

FYSE

- Mentor program for STEM
- Duration: 1. semester
- Weekly Peer Assisted Study Sessions

- Numbers:
 - 500 first year students
 - 33 mentors
 - 12 bachelor programs

ECTS vs. Admission score (high school grades)

Totalt	VGS Poeng		<35		<40		<45		<50		>=50	
	Høst semester		2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
	Snitt Stud poeng		19	20	21	18	20	23	23	23	17	24
FYSEOppmøte	0 %		11	11	10	11	7	13	13	20	10	13
	<=33%	>0%	18	17	21	19	20	20	19	19	23	27
	<=66%	>33%	22	20	24	18	27	24	28	25	25	23
		>66%	26	23	26	23	27	26	27	24	25	26



Diku is an agency under the Norwegian Ministry of Education and Research. In addition, Diku administers programmes for the Norwegian Ministry of Foreign Affairs, the European Commission, and the Nordic Council of Ministers.



Norwegian Directorate for Higher Education and Skills

National interest, «lifted» by Diku

From Diku news - Article:

– Use their free time to solve math problems

- Project reduced failrate from 40 – 11 %
- Higher average grade

Aktuelt 29.12.2020

– Bruker fritimene til å regne matteoppgaver

Et matte-prosjekt reduserte strykprosenten fra 40 til 11 prosent på kort tid. – Nå er karaktersnittet høyere og resultatet jevnere blant studentene.

→ [Les artikkelen](#)



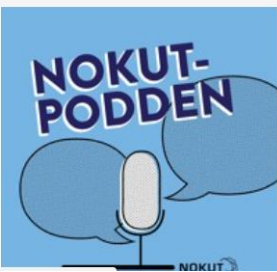
DEN OM FORKURS



MatRIC - Director
Thomas Gjesteland



NOKUT-podden. En podcast om h...
Den om forkurs

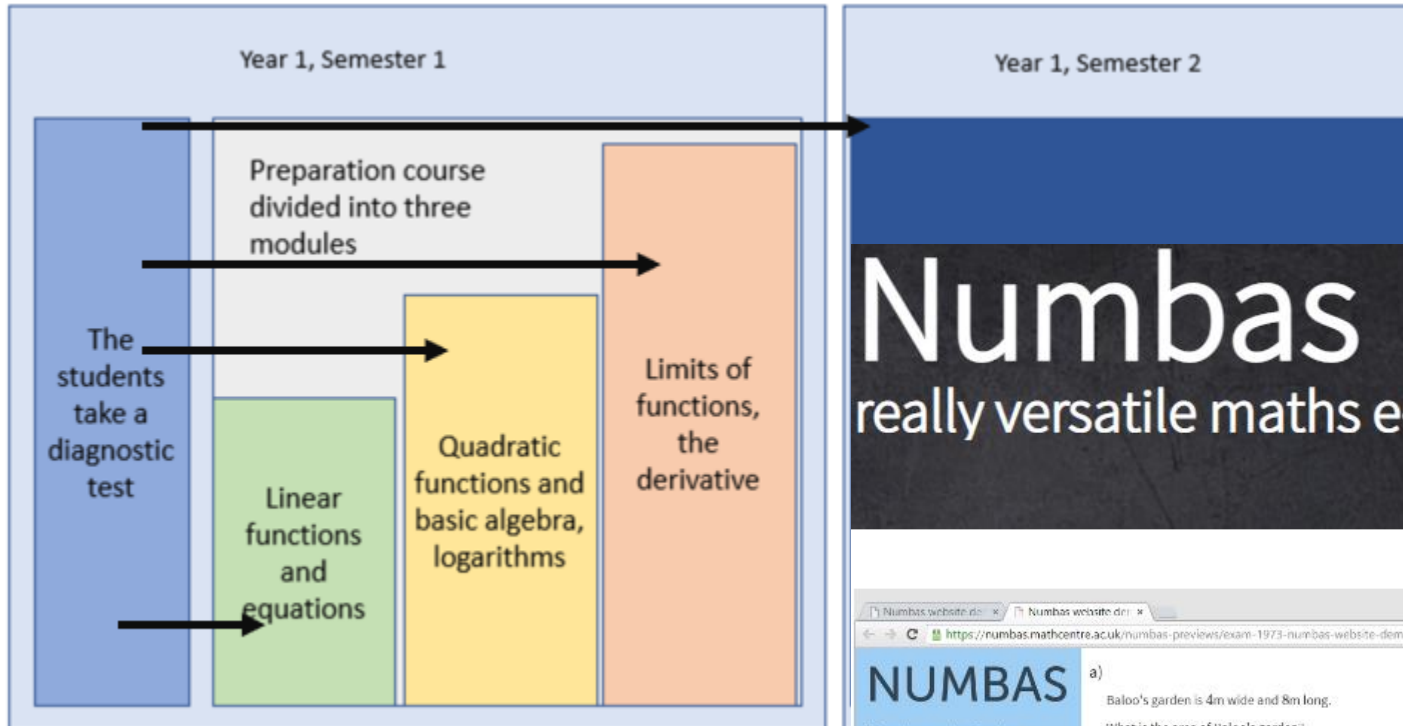


Preparation

Ida Maria Ländgards - Maths for Economy (with Numbas)

Ida Landgärds

PhD Research Fellow



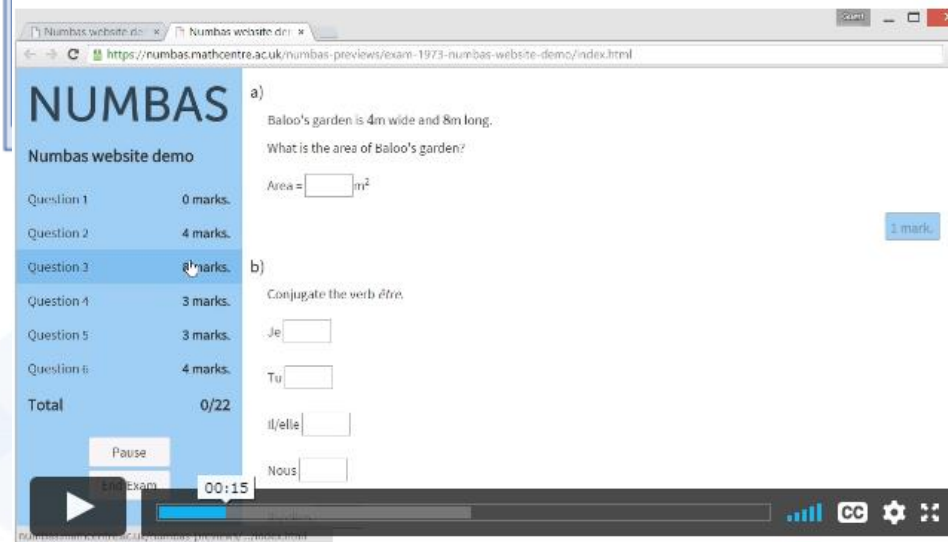
Numbas

really versatile maths e-assessment



“Institutional design”

<https://www.numbas.org.uk/>



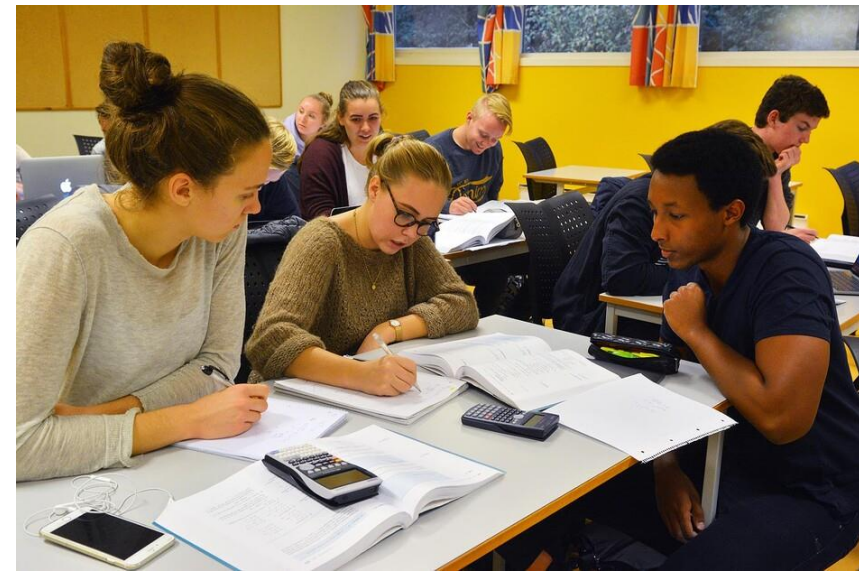
Numbas is an easy way to create online tests. Our free web-based system helps you build the exams you need to challenge your students, complete with videos and interactive diagrams.

See a demo

Get started!

2) Improvement of teaching

- On average 130 participants attended
- Failure rate down from 40% to 11%
- In General – grades gone up
- Evaluations show that 98 percent of the students will recommend the pre-course to others.
- Not dependent on Ida (teacher independent)



Reforming the Teaching and Learning of Foundational Mathematics Courses: An Investigation into the Status Quo of Teaching, Feedback Delivery, and Assessment in a First-Year Calculus Course

by  Yusuf F. Zakariya ^{1,*}  ,  Øystein Midttun ² ,  Svein Olav Glesaaen Nyberg ²  and  Thomas Gjesteland ² 

In this study, we draw on insights from this theoretical framework by involving *people* of varying *power* to make some effort in transforming the teaching and learning of a first-year calculus within the existing *structure* and the *symbols* of a Norwegian university. We identify teaching, feedback delivery, and assessment methods as prime areas of the first-year calculus course through which change efforts can be enacted. The teaching includes the learning outcomes, what is taught, and how it is taught. The feedback delivery includes the quality, quantity, accessibility, and utility of feedback by the students. The assessment methods include what is assessed, how it is assessed, and its flexibility. The interaction between and the alignment of these prime areas form another important focus of the change effort. We take the view that the first attempt in any change effort is to critically examine the status quo in the teaching and learning of the course. To this end, we present findings on the students' perceptions of teaching, feedback, and assessment in a first-year calculus course.

[S]tructures are the roles, routines, and practices of a department; their enactment and meaning are dependent on *symbols*, which are the norms, values, and ways of thinking in a department; changes are ultimately enacted by *people* whose individuality impacts their intentions and perceptions; and the distribution of *power* determines who makes certain decisions and influences interactions (p. 5, italics in the original).

Reforming the Teaching and Learning of Foundational Mathematics Courses: An Investigation into the Status Quo of Teaching, Feedback Delivery, and Assessment in a First-Year Calculus Course

With larger and fewer assignments, it was difficult to learn the material as it took longer each time I worked on the subject.

Another student wrote:

I did not get much feedback from the teacher. Had little compulsory and the obligatory was difficult (did not get much out of them). Better with small assignments.

Some of the students also suggested that the mandatory assignments should count towards the final grade in the course. For instance, one of the students wrote:

Have more obligations so you get feedback continuously. Should have graded scores on submissions that count toward the exam.

- Feedback
- Active learning
- High stake exam

“Institutional design”

Using “force” - Design sprint

MA-178 Mathematics 1



Course for engineers
6 study programmes
400 students
2 teachers



Written examination
40% failure rate

The Dean:

“Either you're in or you're out”

2) Improvement of teaching

Failure rate down from 44% to 12 %



EKSAMEN

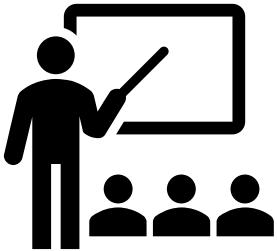
Fra 44 til 12 prosent stryk i matematikk

Strykprosenten i matematikk gikk kraftig ned etter at ingeniørutdanningen ved Universitetet i Agder endret eksamensform.



Design sprint

Key questions:



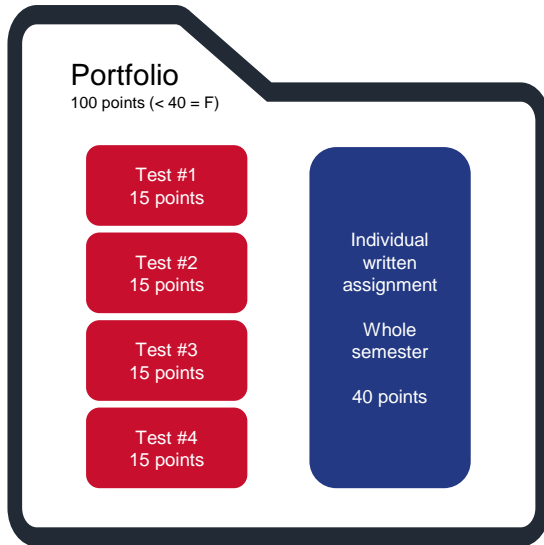
How can we get our students to work on mathematics earlier in the semester?



Can a new form of assessment reduce the high failure rate?

Will this affect the quality of teaching?

Can we decide who does what?

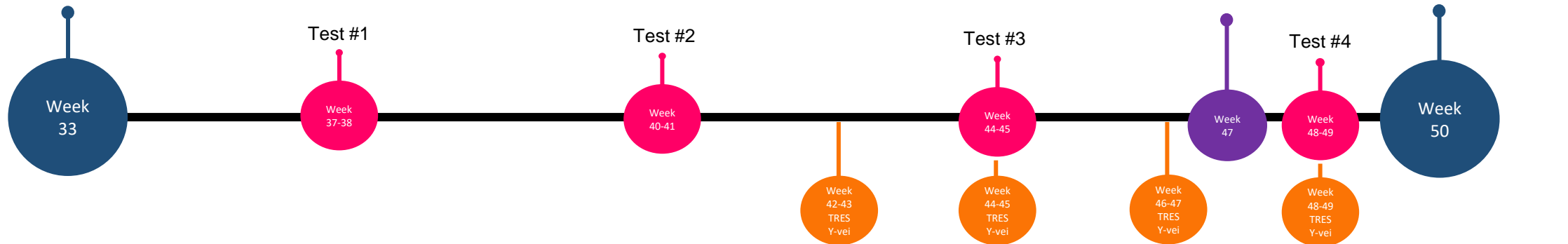


På forsøk #1 og forsøk #2 er det reservert plass til hver studieprogram. På disse to forsøkene trenger du ikke melde deg på. Du kan bare møte opp i C2 036. Hvis du ønsker flere enn 2 forsøk, kan du melde deg på de åpne forsøkene. Det er bare mulig å melde seg til et forsøk av gangen. Du velger selv hvilke tid og dag som passer best for deg. Påmeldingen blir tilgjengelig i Canvas 24 timer før hver prøve.

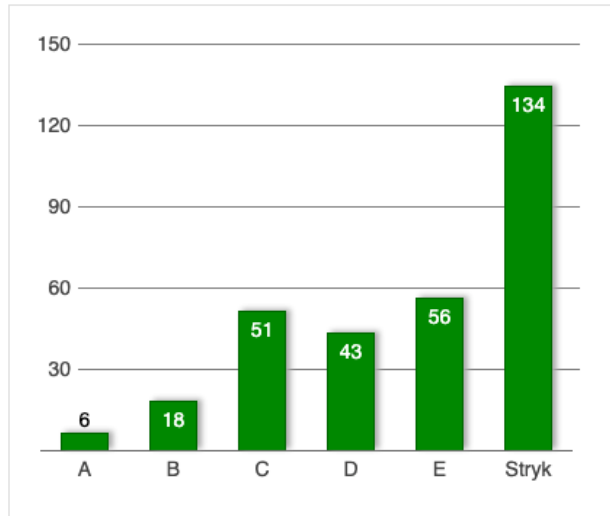
Timeplan for Samordna Opptak prøve #1				
Aud C2 036				
Uke 37	Man 12/9	Tirs 13/9	Ons 14/9	Tors 15/9
14:15 - 15:15		Forsøk #1 Data		
16:15 - 17:15	Forsøk #1 Mekatronikk	Forsøk #1 Elektronikk Fornybar energi	Forsøk #2 Elektronikk Fornybar energi	Forsøk #2 Bygg AI
18:15 - 19:15	Forsøk #1 Bygg AI		Forsøk #2 Mekatronikk	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas
Uke 38	Man 19/9	Tirs 20/9	Ons 21/9	Tors 22/9
14:15 - 15:15		Forsøk # 2 Data		
16:15 - 17:15	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas
18:15 - 19:15	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas		Forsøk #X Alle studieprogram Påmelding via lenke i Canvas	Forsøk #X Alle studieprogram Påmelding via lenke i Canvas



Start of semester



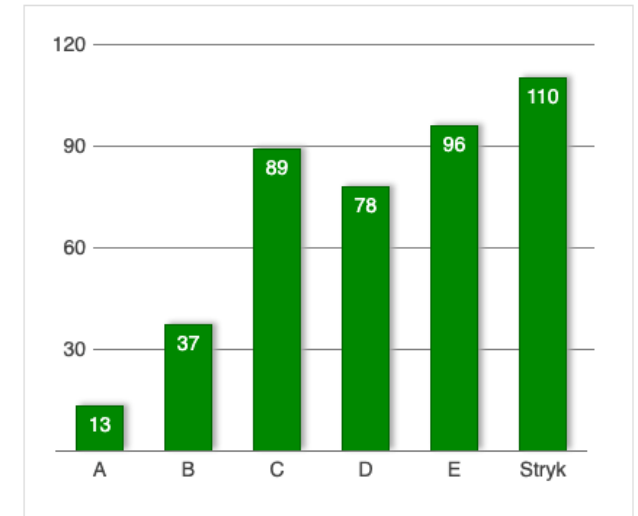
Statistics MA-178 Autumn 2019 – High stake exam **Results:**



44%

Average grade D

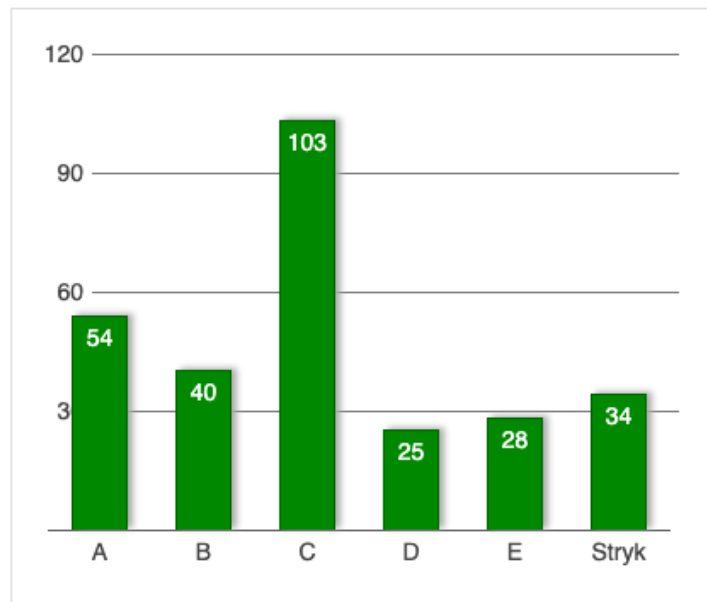
Statistics MA-178 Autumn 2020 – High stake exam



26%

Average grade D

Statistics MA-178 Autumn 2022 – Portfolio



12%

Average grade C

Pandemic – Home exam

24/7 COURSE HELP

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From first day to finals, get homework help, exam prep & writing support—tailored to your courses.

[Get started](#)

Lack of control

Reported time used on MA 178

18 - Anslå gjennomsnittlig tidsbruk per uke i emnet (inkludert undervisning):					
Svaralternativ	Vekt	Frekvens	Prosent	Prosent svar	
Mindre enn 3 timer	(1)	4	2,45%		
3 – 5 timer	(2)	4	2,45%		
5 – 9 timer	(3)	32	19,63%		
10 – 14 timer	(4)	50	30,67%		
15 – 19 timer	(5)	38	23,31%		
20 – 24 timer	(6)	22	13,50%		
25 – 29 timer	(7)	9	5,52%		
Mer enn 30 timer	(8)	4	2,45%		
				0 25 50 100	
Svarprosent					
163/374 (43,58%)					

Design sprint to find an alternative to the written examination

Participants: 25th – 29th of April 2022

Academic staff

- Øystein Midttun
- Sverre Lunøe-Nielsen
- Thomas Gjesteland
- Arne Wiklund

Administrative staff

- Geir Kløkstad (SAK / Eng.Science)
- Linda G. Bø (exam office)
- Grethe Ø. Fossnes (exam office)
- Siren Vegusdal (Canvas)

