



UNIVERSITY OF AGDER



Campus Kristiansand

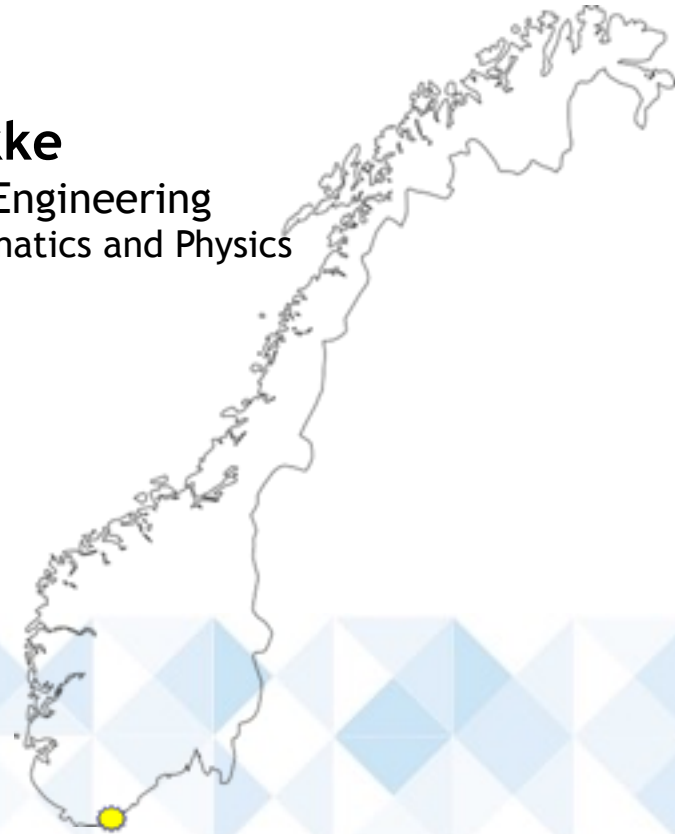


Campus Grimstad

Morten Brekke

Department of Engineering

Teacher in Mathematics and Physics





MatRIC Centre for Research,
Innovation and Coordination
of Mathematics Teaching



Centres of
Excellence in
Education

MatRIC - www.matric.no

Centre of Excellence in Higher Education (SFU) in
Norway vision is to be a national centre for better teaching and
learning of mathematics within natural sciences and professional
education at university/university college level.

Upcoming event:

3rd Annual conference , 19 - 20 October <http://www.matric.no/articles/62>

And please subscribe to our newsletter!



MatRIC Centre for Research,
Innovation and Coordination
of Mathematics Teaching

Morten Brekke

Department of Engineering
Teacher in Mathematics and Physics

Coordinator of MatRIC's
- Video network
- Digital assessment network



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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).



Using CAA to set grades in mathematics courses for engineering students in electronics

Why do this?

- At UiA Mathematics used to be taught in common courses for all engineering fields.
- Topics taught in the first semester may not be relevant at all or will not be applied until maybe the fourth or fifth semester.
- This can demotivate students since they struggle to see the relevance of the mathematics they study
- Breaking it down to teaching in smaller groups and try to make Mathematics relevant for each discipline.
- Improve students performance and understanding of Mathematics.

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This project has got a lot of attention from others:



UiA - Replaced lectures with videos and seminars.



NRK - Dropped the black-board

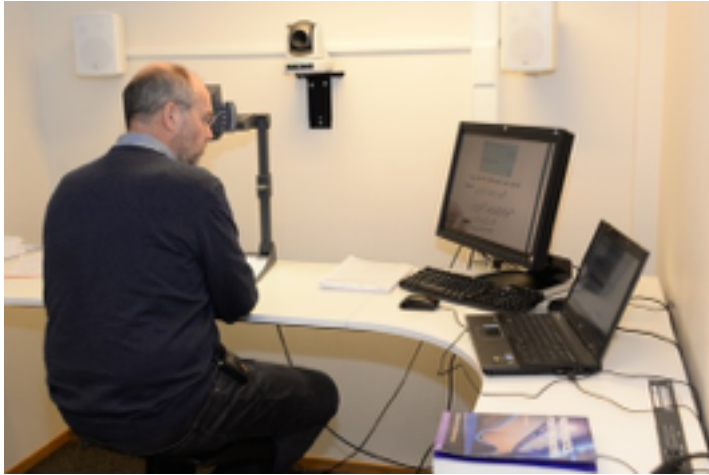
Using CAA to set grades in mathematics courses for engineering students in electronics

Three courses: Mathematics 1, Mathematics 2 and Statistics
Set up like this:

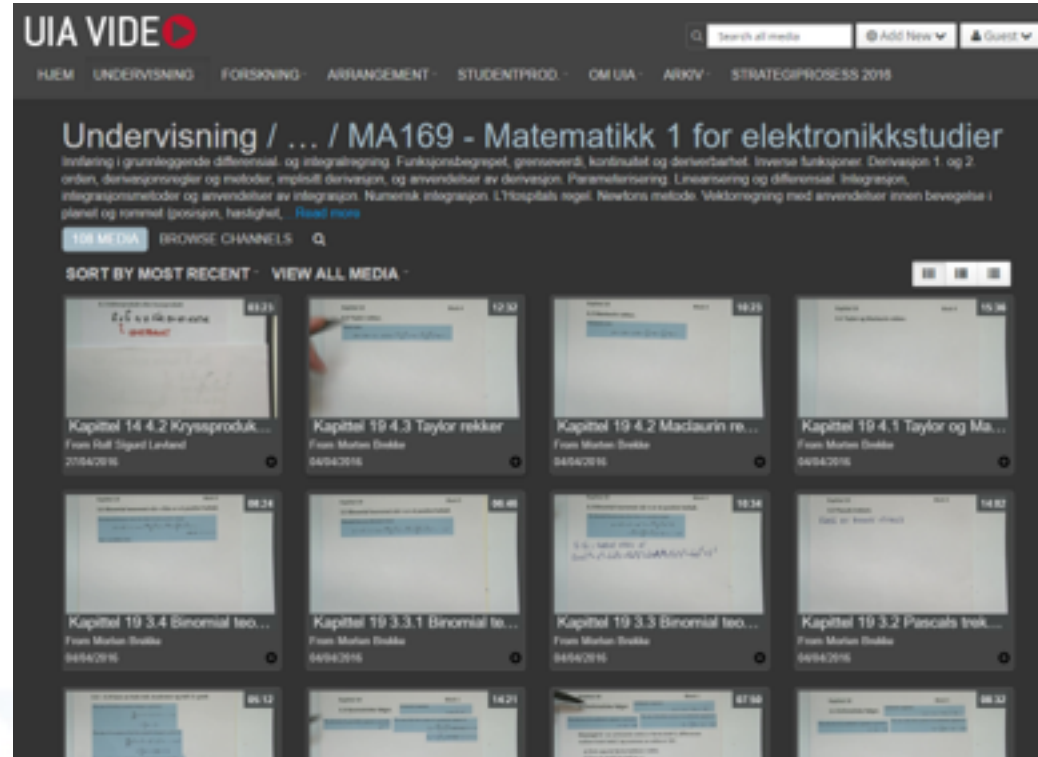
- No lectures, students watch prerecorded videos, and meet the teacher 4 to 6 hours weekly for seminars and practice.
- Grading through digital assessment throughout the courses and digital exams. Six (three) digital tests are set throughout the course, midterm exam and final exam contribute to the grade.
- Video resources are from MatRIC TV and short videos recorded by myself.
- Computer aided assessment tool MyMathLab (MML) from Pearson is used. Students do their homework, tests and exams with this tool.
- Interactive simulations using SimReal. Computational mathematics using different programs.

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Videos:



Recording in «selvstudio» in Grimstad. Using document-cam and PC.

The screenshot shows the UIA VIDE website interface. At the top, there is a search bar and navigation links for 'HJEM', 'UNDERVISNING', 'FORSKNING', 'ARRANGEMENT', 'STUDENTPROD.', 'OM UIA', 'ARKIV', and 'STRATEGIPROCESS 2015'. The main heading is 'Undervisning / ... / MA169 - Matematikk 1 for elektronikkstudier'. Below the heading is a brief description of the course content, including topics like differential equations, integration, and matrix algebra. There are buttons for '108 MEDIA' and 'BROWSE CHANNELS'. The content is sorted by 'MOST RECENT' and displays a grid of video thumbnails. Each thumbnail includes a title, a duration, and a 'From' field. The titles of the videos are: 'Kapittel 14 4.2 Kryssprodukt...', 'Kapittel 19 4.3 Taylor rekker', 'Kapittel 19 4.2 Maclaurin re...', 'Kapittel 19 4.1 Taylor og Ma...', 'Kapittel 19 3.4 Binomial teo...', 'Kapittel 19 3.3.1 Binomial te...', 'Kapittel 19 3.3 Binomial teo...', and 'Kapittel 19 3.2 Pascals trek...'. The thumbnails show various mathematical diagrams and equations.

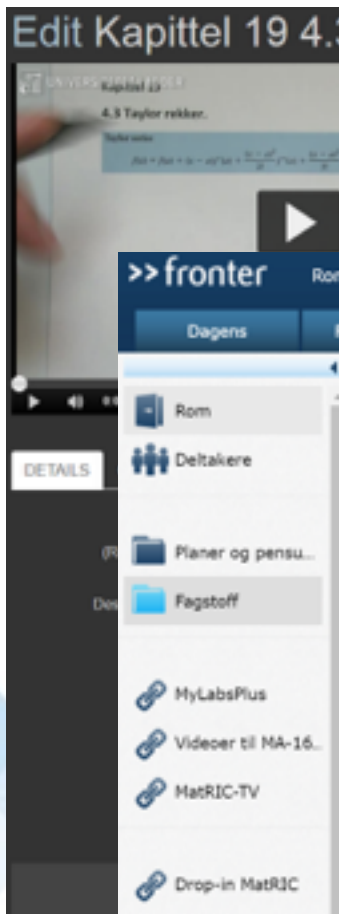
Published «directly» online to students at each course

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Videos:

Can do whatever editing

All notes from lectures can be found in Fronter.



Kapittel 19

Block 4

4.3 Taylor rekker.

Taylor series

$$f(x) = f(a) + (x-a)f'(a) + \frac{(x-a)^2}{2!}f''(a) + \frac{(x-a)^3}{3!}f'''(a) + \dots$$

EKSEMPEL; FINN TAYLOR-REKKA TIL $\sin(2x)$ OM $\frac{\pi}{2}$

$$f(x) = \sin(2x), \quad a = \frac{\pi}{2}$$

FORMEL; $f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3 + \dots$

"TABELL"

$f(x) = \sin(2x)$	$f\left(\frac{\pi}{2}\right) = \sin\left(2 \cdot \frac{\pi}{2}\right) = 0$	
$f'(x) = 2\cos(2x)$	$f'\left(\frac{\pi}{2}\right) = 2\cos\left(2 \cdot \frac{\pi}{2}\right) = -2$	$= -2^1$
$f''(x) = -4\sin(2x)$	$f''\left(\frac{\pi}{2}\right) = -4\sin\left(2 \cdot \frac{\pi}{2}\right) = 0$	
$f'''(x) = -8\cos(2x)$	$f'''\left(\frac{\pi}{2}\right) = -8\cos\left(2 \cdot \frac{\pi}{2}\right) = 8$	$= 2^3$
$f^{(4)}(x) = 16\sin(2x)$	$f^{(4)}\left(\frac{\pi}{2}\right) = 16\sin\left(2 \cdot \frac{\pi}{2}\right) = 0$	
$f^{(5)}(x) = 32\cos(2x)$	$f^{(5)}\left(\frac{\pi}{2}\right) = 32\cos\left(2 \cdot \frac{\pi}{2}\right) = -32$	$= -2^5$

$$\begin{aligned} f(x) &= 0 + (-2)\left(x - \frac{\pi}{2}\right) + 0 + \frac{8}{3!}\left(x - \frac{\pi}{2}\right)^3 + 0 + \frac{(-32)}{5!}\left(x - \frac{\pi}{2}\right)^5 + \dots \\ &= -2\left(x - \frac{\pi}{2}\right) + \frac{8}{6}\left(x - \frac{\pi}{2}\right)^3 - \frac{32}{120}\left(x - \frac{\pi}{2}\right)^5 + \dots \\ &= -2\left(x - \frac{\pi}{2}\right) + \frac{2^3}{3!}\left(x - \frac{\pi}{2}\right)^3 - \frac{2^5}{5!}\left(x - \frac{\pi}{2}\right)^5 + \dots \end{aligned}$$

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CAA:

MyMathLab (Pearson) - Digital Assessment tool

- Students get access through a Faculty License agreement with Pearson
- MyMathLab acts as an LMS (similar Fronter).
- I set up the course the way I want:
 - Add homework
 - Add tests, quizzes and tests
 - Create e-Examination
- The tool provides a complete overview of each student's results and progression.
- First used in 2009



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Using MyMathLab as a Learning tool:

- I want my students to be rewarded if they «hard work».
- I give «to many?» «Homework» exercises in MyMathLab. They have a «Help me solve this» option here.
- Exercises from «Homework» will appear in tests.
- Each tests are open 6 days and students get two tries.
- I encourage them to take the test early and then work on their errors before the second try.
- Exercises from tests will appear on Exams.
- With this my students work hard from day one.
- More drop-out early.

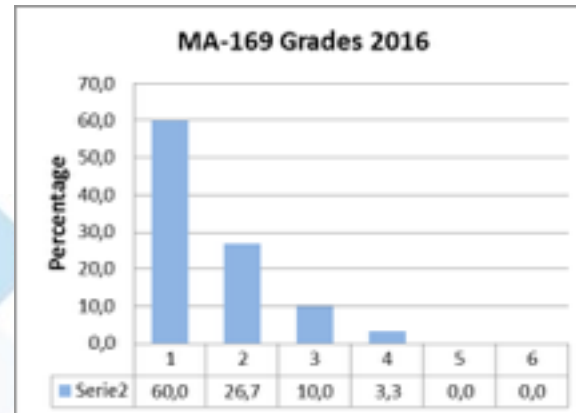
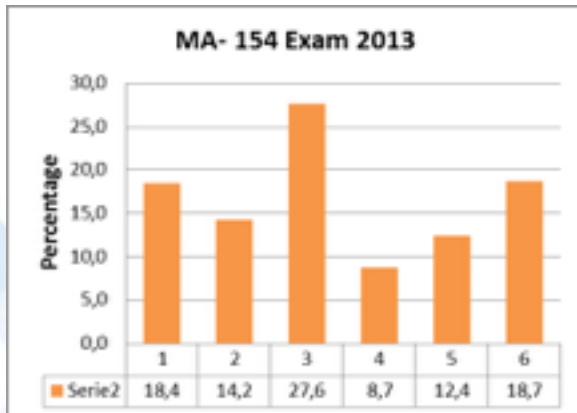


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Performance on tests and exams:

Test nr.	Date	Average score: (%)
1	17.09.15 – 22.09.15	92,8
2	15.10.15 – 20.10.15	92,3
3	12.11.15 – 17.11.15	94,2
4	02.02.16 – 08.02.16	87,5
5	23.03.16 – 04.04.16	83,8
6	20.04.16 – 02.05.16	92,4
Average score all 5 tests:		90,2
Midterm exam:	4 hours 03.12.15	86,9
Final exam:	4 hours 13.05.16	88,3

Grade	Test grades	Midterm exam	Final exam	Final course grade
A	21	19	15	18
B	6	8	7	8
C	3	5	6	3
D	1	0	1	1
E	1	0	1	0
F	0	0	0	0
Total	32	32	30	30



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Feedback:

Tests that give grades are really a dream for students. When we are presented with these tests we have a lot more respect for them. Since there are two attempts both me and many others in the class use the first attempt to see what we actually do know. After our first attempt we go through what was wrong together with others. With this we also ensure that all is doing well. This contributes to an environment where people work together to understand mathematics. Since test tasks are related to exam, students work harder to perform better. The thing with these tests is personally one of the best experiences I have seen.

The course requires that you work a lot with exercises, using MyMathLab works really nice getting immediate feedback if you done something wrong.

The last test was just incredible and I learned a lot from it. Without doubt the best test so far. 6 hours of maths can be tiring, but feels rewarding at the end of the day.

Using CAA to set grades in mathematics courses for engineering students in electronics

Other feedback:

Very happy about the new videos from the last Chapters. They are simple and thorough. Easy to rewind if you need to get things explained more times.

The subject is relevant and can be connected to the course in electronics and the course in Physics.

Morten Brekke's video-lectures saved my Math-grade, had never gone without them - THANKS!!!!

Video-teaching is a great opportunity. It is just fantastic to use videos as repetition before exam and just not textbook and notes.

Using CAA to set grades in mathematics courses for engineering students in electronics

Further development:

3 students working on further developing of courses .

- Creating a small «how to study» course for new students.
- Match MatRIC TV videos to content in Mathematics 1.
- Create an assignment in Computational Mathematics in all three courses.
- Using Numbas in Teacher Education. Testing with Masterstudents.
- Create a STACK assignment for Matematics 1.
- And more to come...



Using CAA to set grades in mathematics courses for engineering students in electronics

STACK student project - First draft:

Goal

Learning integration by creating CAA using STACK. If you are able to create problems/exercises for other students, you need to have some understanding of basic integration. Especially giving right feedback should make them reflect about what integration really is.

Group project Mathematics 1

- Create a test in integration using STACK for next year students in MA-169
- Problems/exercises must be relevant for the curriculum in MA-169 and should help new students to be able to solve and better understand integration.
- The group should think of common errors when solving tasks and give sensible feedback when wrong answers are given.

Try out Numbas – Master students in Teacher Education

Numbas student project - First draft:

Goal

Try out a Numbas assignment for Master students in Teacher Education to see if CAA can be useful for learning Mathematics in Primary School.

Group project Numbas - Teacher Education

- Create two tests, classes 1 - 7 and 5 - 10.

Master students should :

- Work through them.
- Comment on them.
- Try to put in common errors for classes 1 - 7 and 5 - 10.
- Comment on feedback when wrong answer.
- Suggest improvements on tasks and feedbacks.

Thank you for your attention!