



MatRIC Centre for Research,
Innovation and Coordination
of Mathematics Teaching

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Coordinator of MatRIC's

- Video network
- Digital assessment network

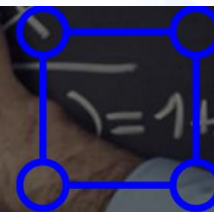


Centre of
Excellence in
Education



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).



Om Digital assessment Nettverket i MatRIC og egen erfaring med selvrettende tester i matematikk

Digital assessment network in MatRIC and my own experience using Computer aided assessment in my teaching.

Outline

Part 1 – Short presentation of MatRIC – Digital Assessment Network

Part 2 – Presentation of different Computer Aided Assessment (CAA) - tools I use

Part 3 – Using CAA in Mathematics, my own experience



MatRIC Centre for Research,
Innovation and Coordination
of Mathematics Teaching



Centre of
Excellence in
Education

MatRIC - www.matric.no

Centres of Excellence in Higher Education (SFU) in Norway

MatRIC's 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.

The overarching aim of the SFU-programme is to contribute to the development of excellent quality in higher education and to highlight the fact that education and research are equally important activities for higher education institutions. It is an important aim to stimulate excellent research and development informed education.

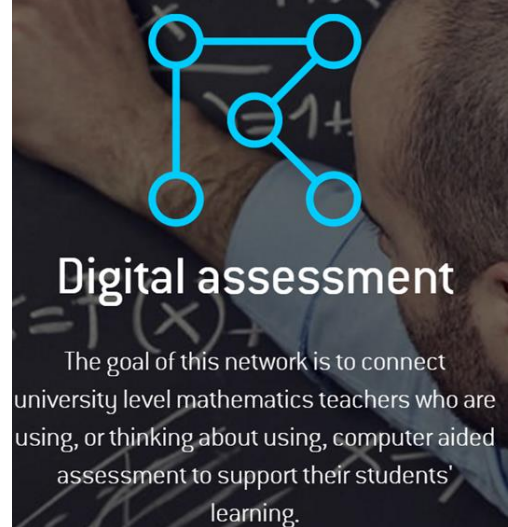
Digital Assessment network of MatRIC.

<http://www.matric.no/networks/5>

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.

The core interests and activities of this network are:

- Use and creation of digital assessments for teaching and learning mathematics.
- Computer aided assessment in compulsory testing and examinations in mathematics.
- Try to help teachers getting started using CAA.



Digital Assessment network of MatRIC.

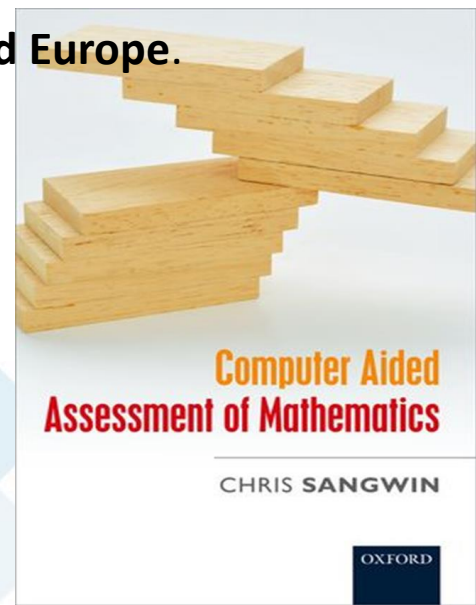
<http://www.matric.no/networks/5>

What we do:

- Setting up meetings, workshops etc, (1 – 2 each year).
- Spread the word at institutions, conferences etc.
- More?

The network consist of developers and users of CAA from Norway and Europe.

- STACK, Chris Sangwin, University of Edinburgh
- NUMBAS, University of Newcastle
- DEWIS, University of the West of England, Bristol (UWE)
- Sowiso, (Commercial, spin off Eindhoven University of Technology)
- DTU, SDU Denmark
- NTNU
- Artic University of Norway
- Abacus, Finland



WELCOME TO ABACUS

Abacus is a material bank for STEM education. We seek to produce, share and host high-quality educational material between collaborators. Our goal is to provide maintained and ready-to use material for lecturing and exercises. We specially focus on material utilizing the automatic assessment system **STACK**, but we are open to material making use of other formats and platforms as well.

The project was founded in early 2015 by the seven Finnish universities providing MSc education in engineering. Abacus was part of a pilot project concerning mathematical education, but has since grown in range of topics as well as partners. Interest towards the project has increased worldwide, and we look forward to including more collaborators.

Questions about the Abacus project or discussion about granting your institution membership should be directed at **Antti Rasila**, coordinator of the project.

Current partners:

- Aalto University, *Finland* Coordinator
- Åbo Akademi University, *Finland* Initial partner
- Lappeenranta University of Technology, *Finland* Initial partner
- Tampere University of Technology, *Finland* Initial partner
- University of Oulu, *Finland* Initial partner
- University of Turku, *Finland* Initial partner
- University of Vaasa, *Finland* Initial partner
- Häme University of Applied Sciences, *Finland*
- Lahti University of Applied Sciences, *Finland*
- Metropolia University of Applied Sciences, *Finland*
- Polytechnic Institute of Leiria, *Portugal*
- Ruhr Universität Bochum, *Germany*
- Tallinn University of Technology, *Estonia*
- Tampere University of Applied Sciences, *Finland*
- University of Eastern Finland, *Finland*
- University of Edinburgh, *United Kingdom*
- University of Helsinki, *Finland*
- University of Jyväskylä, *Finland*
- Vaasa University of Applied Sciences, *Finland*

Digital Assessment network of MatRIC.

<http://www.matric.no/networks/5>

What comes out of meetings?

Newcastle Colloquium April 2016

Participants from

University of Newcastle, University of Leeds,
The Open University, University of
Amsterdam, University of Manchester,
University of Edinburgh, DTU Copenhagen,
NTNU, UiB, UiT, HVL, UiA

Main Focus:

LTI Integration

Overleaf doc.

What comes out of meetings?

Gardermoen Colloquium October 2017

Participants from

University of Newcastle, University of Leeds,
University of Bristol, University of Amsterdam,
Oxford Brookes University, University of Glasgow,
University of Edinburgh, NTNU, UiT, UiA

Main Focus:

"Task design Framework"

LTI Integration - development



Institutional support for online assessment in mathematics: mathematics really is different

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<http://www.n>

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NTNU, UiB, UiT, H

Main Focus:

LTI Integration

Overleaf doc.

T. B. Confirmed

October 10, 2017

Abstract

Note: The original text is located in the appendices. CMG

Document written for senior management contemplating IT infrastructure decision making in institutions. Why is mathematics different for CAA? What do we need?

1 Executive summary

- Mathematics needs
- Specific tools for online assessment of mathematics have been developed for more than a quarter of a century.
- Individual members of staff need autonomy and agency to implement assessments appropriate to their discipline.
- Developing high-quality materials takes time, and institutional investment deserves ongoing support to ensure sustainable deployment.
- Institutionally provided central IT departments are ideally placed to provide infrastructure, such as single sign on, VLE and consistency of user experience. Large campus systems can be made flexible to support the needs of mathematics by allowing the inclusion of specific tools via web-services protocols such as LTI. Such protocols provide a balance between centrally supported tools, and the flexibility of individual needs.

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Task Design Framework

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LTI Integration

Overleaf doc.

This document records the issues raised at a meeting of MATRIC on 11 October 2017. The purpose of the meeting was to discuss priorities for the development of a task design framework for mathematics education, with the development of practical tools to support CAA in mind.

Who is this for?

There are various levels we might consider:

- Experts in the field of CAA
 - Benefit from developing the framework itself (stimulates conversation)
 - Sharing knowledge of different systems and what is possible
- Novices, giving them an introduction to authoring in CAA
 - Testimonials from people who have started using CAA
 - Examples of how it can be used in different ways, in different contexts
- Non-CAA expert colleagues who just want to make use of CAA items, e.g. by drawing on a library
 - Encouraging teachers to think about their intentions - push toward using to help students to learn

Goals

1. Challenging skepticism among mathematics educators about the capabilities of CAA, by (a) showing good examples of CAA, (b) encouraging them to think about the constraints of non-CAA tasks.
2. Providing tools to evaluate the quality of CAA tasks as they are developed. (Ultimately, we want good assessment tasks).

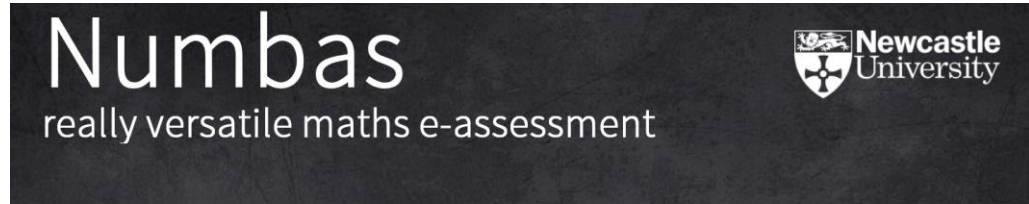
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Digital assessment-tools

Numbas – free

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



Numbas

mathcentre: Diagnostic test - Differentiation

1. Product rule Reveal Next

1. Product rule 3 marks.

2. Product rule 3 marks.

3. Product rule 3 marks.

4. Product rule 3 marks.

5. Product rule 3 marks.

6. Product rule 3 marks.

7. Product rule 3 marks.

8. Product rule 3 marks.

Total 0/78

Pause

End Exam

Submit answer Try another question like this one Next

Differentiate the following function $f(x)$ using the product rule.

$$f(x) = x^8(7x + 5)^8$$

$\frac{df}{dx} =$

Clicking on Show steps gives you more information, you will not lose any marks by doing so.

Show steps

Submit part 3 marks.

NMBAS

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

Numbas is a web-based e-assessment system, developed by the School of Mathematics & Statistics at Newcastle University.

<http://sowiso.nl/calculus/en/>

SOWISO was started in 2010 by Marc Habbema and Max Cohen as a spin off from the Eindhoven University of Technology.

Derivatives of trigonometric functions

Use the chain rule to determine the following derivative:

$$\frac{d}{dx} (\cos(x^2)) = 2x \sin(x^2) \quad \text{Wrong, you answer should contain the sine.}$$

Hint

The chain rule states that $(f \circ g)'(x) = f'(g(x))g'(x)$. Now choose f and g in such a way that you can write $f(g(x)) = \cos(x^2)$.

$$\frac{d}{dx} (\cos(x^2)) = 2x \sin(x^2) \quad \text{Wrong, you answer should contain the sine.}$$

$$\frac{d}{dx} (\cos(x^2)) = 2x \cdot \sin(x^2) \quad \text{Almost correct, you only forgot the minus sign.}$$

$$\frac{d}{dx} (\cos(x^2)) = (-2x) \cdot \sin(x^2) \quad \text{Great job}$$

continue >

✖ stop

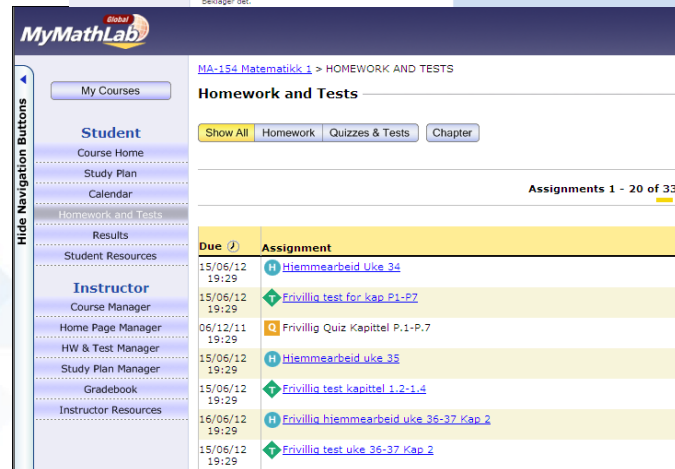
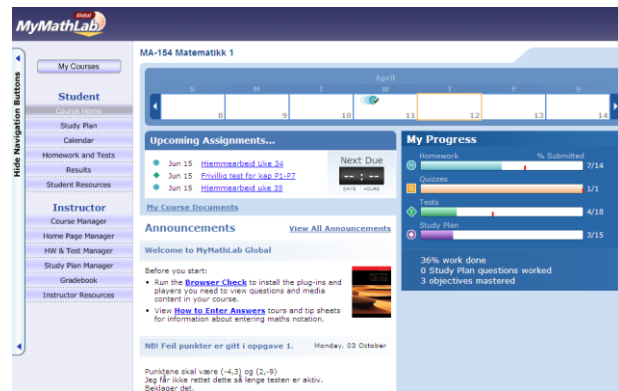
? ask question

Homework, testing and exams using MyMathLab

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



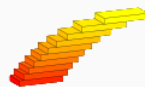
Digital assessment-tools

STACK

<http://www.stack.ed.ac.uk/stack/demo>

STACK - demonstration server

You are not logged in. ([Login](#))



System for
Teaching and
Assessment using a
Computer algebra
Kernel

STACK provides a question type for the Moodle quiz which is specifically designed to enable sophisticated computer-aided assessment in Mathematics and related disciplines, with emphasis on formative assessment.

- [More information about STACK](#)
- [STACK and the use of Computer Algebra](#)

To make use of the quizzes you must register as a user.

- [Documentation](#)
- [Installation instructions](#)
- [Code on github](#)

The lead developer of STACK is Chris Sangwin, based at the Loughborough University.

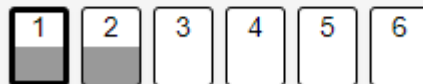
Many other colleagues have contributed, see [credits](#).

STACK demo

Line by line reasoning

[Home](#) ► [My courses](#) ► [Reasoning](#) ► [STACK and](#)

QUIZ NAVIGATION



[Finish attempt ...](#)

Demonstrating STACK

[Home](#) ► [STACK-demo](#) ► [Demonstration quizzes](#) ► [Find examples....](#)

Quiz navigation



7

[Finish attempt ...](#)

Question 1

Not complete

Marked out of 1.00



Flag question

Give an example of a quadratic with roots at $x = 3$ and $x = 2$

Your last answer was interpreted as follows: x^2

This answer is invalid.

You seem to be missing * characters. Perhaps you

[Check](#)

My experience in teaching Mathematics using CAA - tools.

Statements based on my experience – (this is my opinion).

- Digital assessment-tools make students work harder (and maybe better?)
- No more of copying answers.
- Immediate feedback - motivates
- Flexible teaching gives students opportunities
- Less failure.
- Together with video-lectures we are ready to meet the students of tomorrow.

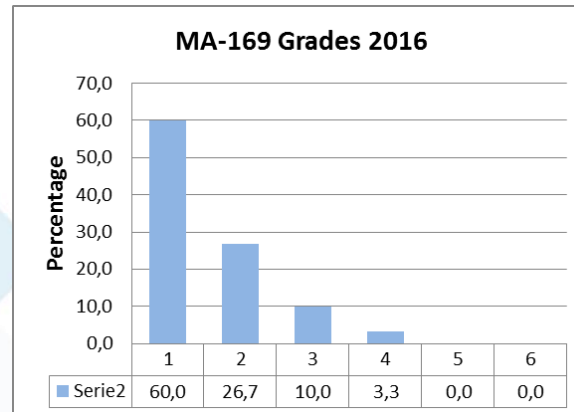
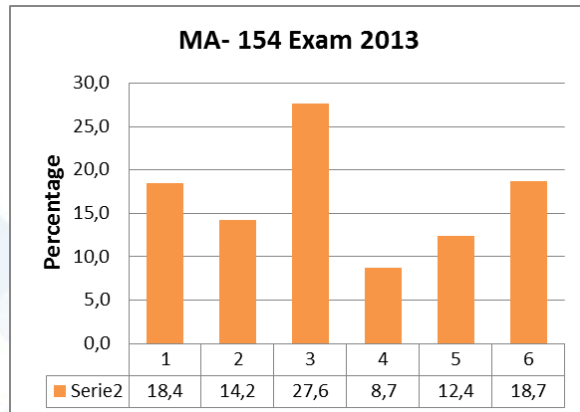


Teaching Mathematics within electronics engineering without ordinary lectures and using CAA - tools.

Performance on tests and exams:

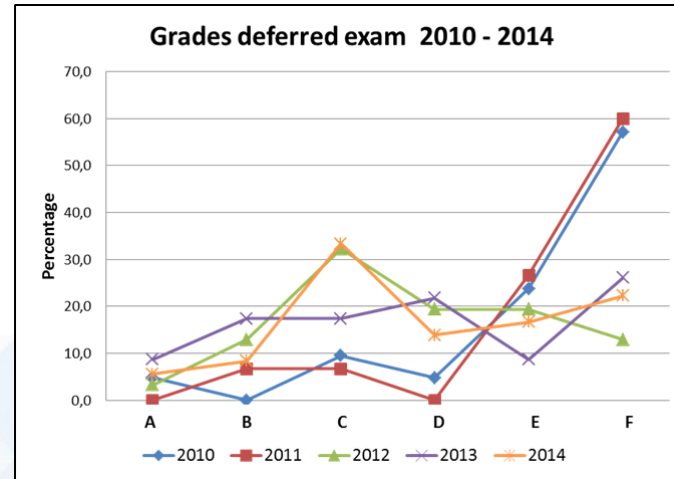
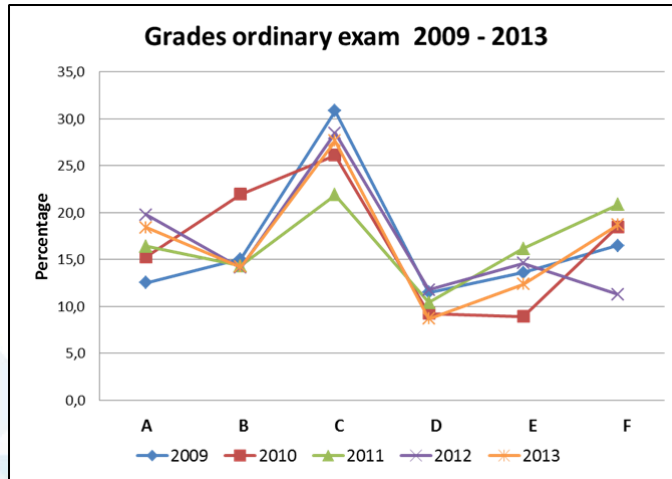
Test nr.	Date	Average score: (%)
1	17.09.15 – 22.09.15	92,8
2	15.10.15 – 20.10.15	92,3
3	12.11.15 – 17.11.15	94,2
4	02.02.16 – 08.02.16	87,5
5	23.03.16 – 04.04.16	83,8
6	20.04.16 – 02.05.16	92,4
Average score all 5 tests:		90,2
Midterm exam:	4 hours 03.12.15	86,9
Final exam:	4 hours 13.05.16	88,3

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



MA-154 Mathematics 1 for engineering

- Taught 5 times from 2009 to 2013.
- Introduced MyMathLab for a small group 2009.
- MyMathLab licence to all students from 2010.
- Tested e-Exam (digital exam) 2010 – 2012.
- Live streaming of lectures from 2011.



Teaching Mathematics within electronics engineering without ordinary lectures and using CAA - tools.

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.



Teaching Mathematics within electronics engineering without ordinary lectures and using CAA - tools.

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

- No “ordinary” 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 one digital exam (MA-169). Final paper 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.

Teaching Mathematics within electronics engineering without ordinary lectures.

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 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.

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.

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

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

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

Teaching Mathematics within electronics engineering without ordinary lectures.

What have I achieved? (This is my opinion):

- Positive feedback from students.
- High score on tests and exams.
- Students work throughout the semester.
- More motivated students.
- Students are able to work on their own.
- Math-courses are relevant for other courses in electronics and Physics.
- More involvement from students (I talk more with them).
- 3 students helps me improve courses.

Thank you for your attention!

