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Experiences of continuous formative assessment in engineering mathematics

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The old model: exam-based assessment

- Traditionally a course is graded based on a few exam questions
  - All topics of the course can't be covered
  - Some question types are over-emphasized
  - Once the exam is over students can forget everything they've learned
  - Students often start studying seriously only just before exams
  - The examination creates anxiety

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The new model: continuous formative assessment

- Blended learning with face-to-face interaction and computer aided assignments
- Grading the course is based on a large amount of assignments
  - The topics of the course are better covered
  - The significance of one task is not emphasized
- Workload is (hopefully) distributed more evenly during the whole course
  - This encourages deep learning (Ramsden 1992)
- Freedom to choose the time and place to work

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Some results from course ”S1”

	0	1	2	3	4	5
2007	*11,60*	*17,97*	*33,02*	*31,19*	*64,04*	*79,68*
	3,78	7,77	20,19	9,40	26,84	61,61
2008	*13,20*	*23,62*	*36,55*	*49,56*	*65,60*	*74,89*
	4,79	13,56	16,15	28,85	56,81	58,44
2009	*14,62*	*23,28*	*38,78*	*49,53*	*51,16*	*78,32*
	3,77	10,00	29,20	50,48	68,22	92,48

The percentage of *automatically assessed* (above) and traditional (below) exercise assignments solved by students. Numbers are sorted presented by the grade given (0-5), where 0 means failing the course.

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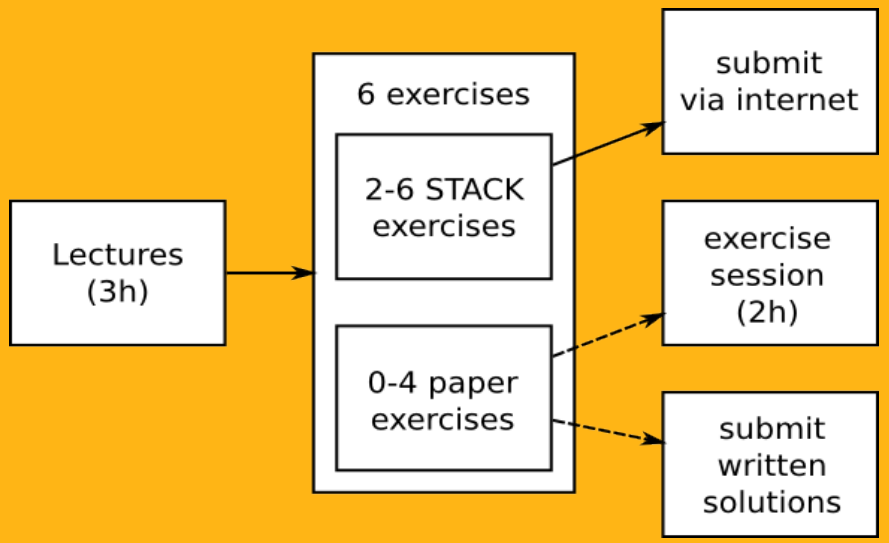
The experimental course: Discrete Mathematics



- 12×6 exercises in total, 2/3 of which were computer aided*
- 2 optional exams
- Graded from 0 to 5, where 0 is failed and 5 is highest

*Computer aided exercises were implemented using automatic assessment system STACK

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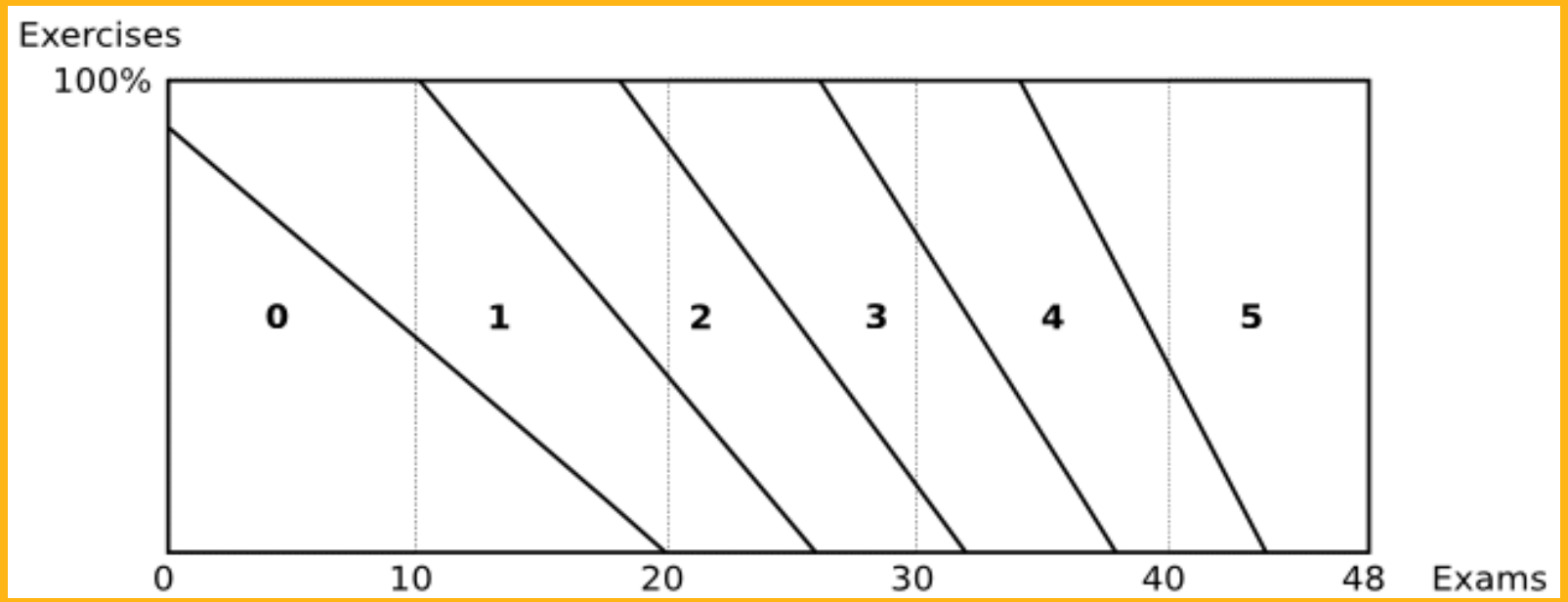
The experimental course: Discrete Mathematics

- 90% of exercises = grade 1 (pass)



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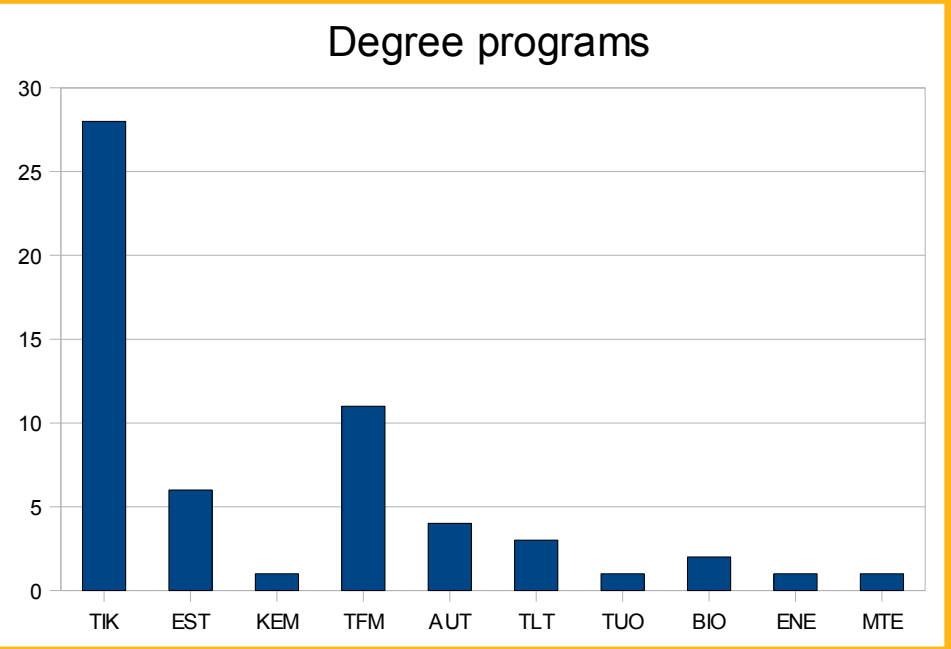
The experimental course: Discrete Mathematics

- 58 participants
- Mostly students from 2nd to 5th year



- TIK = Computer Science and Engineering
- TFM = Engineering Physics and Mathematics
- EST = Electronics and Electrical Engineering
- AUT = Automation and Systems Technology
- TLT = Communications Engineering

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Evaluation of results

- Comparing results with courses of 2008 and 2009
- Questionnaire of students' experiences (Ginns & Ellis, 2007)
  - Categories: quality of STACK exercises, clarity of goals and standards, appropriateness of assessment, appropriateness of workload, student engagement, practical arrangements and blended learning (Kivelä, 2002)
  - 30 items with five response possibilities on Likert scale: 1 = strongly disagree ... 5 = strongly agree
  - Number of responses depending on question 28 - 30

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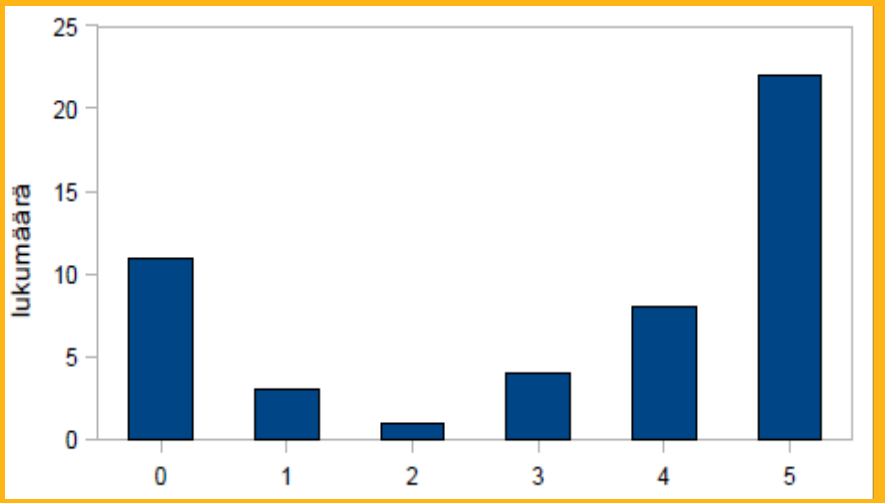
Results

- The percentage of grade 0 (failed)
  - 2008: 30%
  - 2009: 34%
  - 2010: 18%
- The percentage of grade 5
  - 2008: 27%
  - 2009: 15%
  - 2010: 45%
- Passing percentage increased noticeably

Grade distribution on 2010



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Results

- The percentage of failed students out of all participants
  - 2008: ?
  - 2009: 35%
  - 2010: 31%

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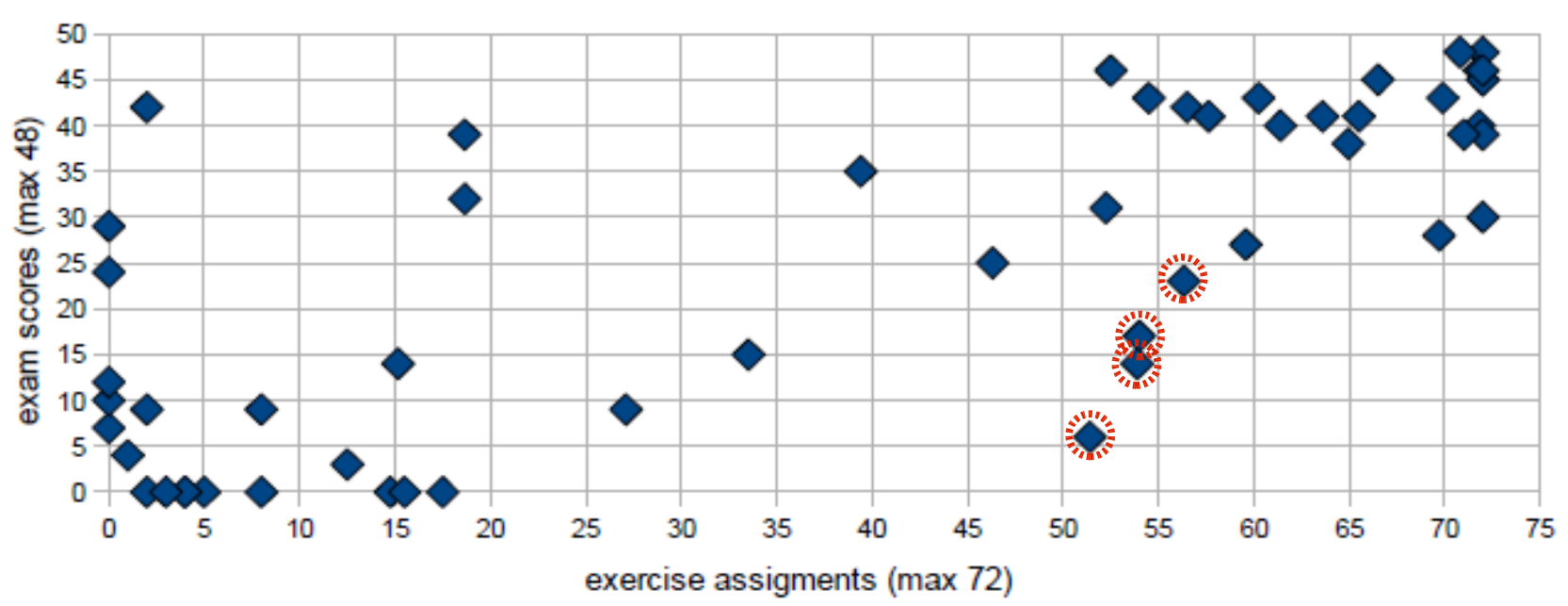
Results



Students' exam scores in relation with exercise assignments submitted

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Results

- Some students submitted a lot of exercises, but did not do well in the exams, but they were few.

Student	1st exam	2nd exam	paper exercises	STACK exercises
A	13	2	81%	72%
B	13	1	81%	72%
C	6	0	100%	55%
D	17	6	74%	80%

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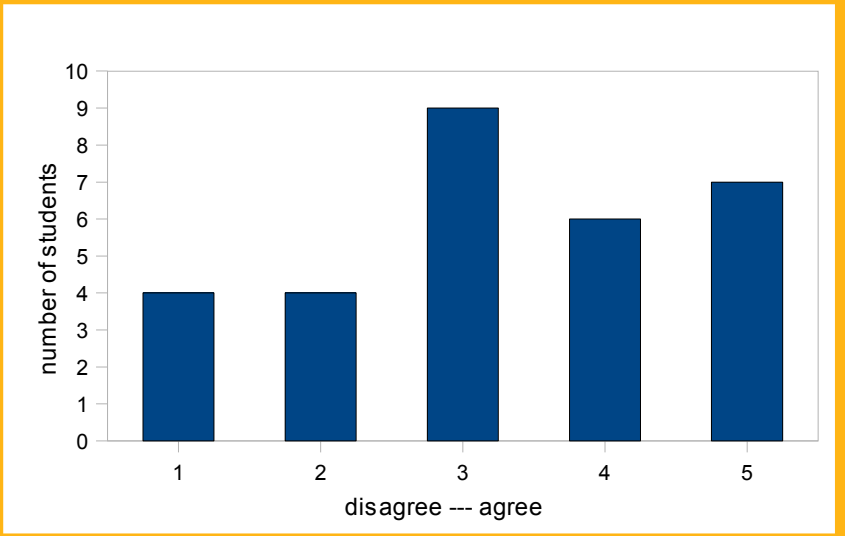
Results: questionnaire

- 43% of the respondents felt that they solved more exercises than normally
- Mean: 3,27 S.D: 1,34

- The percentage of participants, who had solved exercises (at least 1)
  - 2009: 70%
  - 2010: 91%.



20) I did more exercises on this course than I would normally do on a mathematics course.

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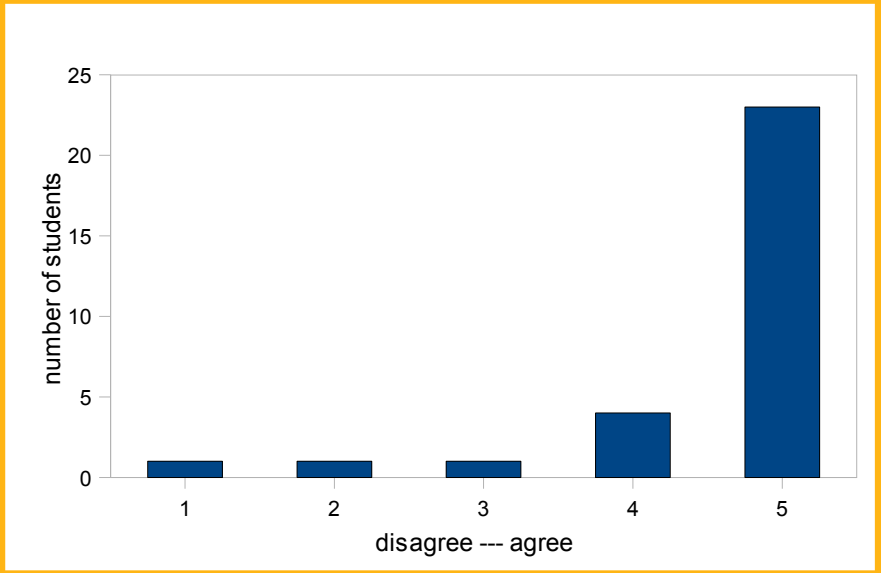
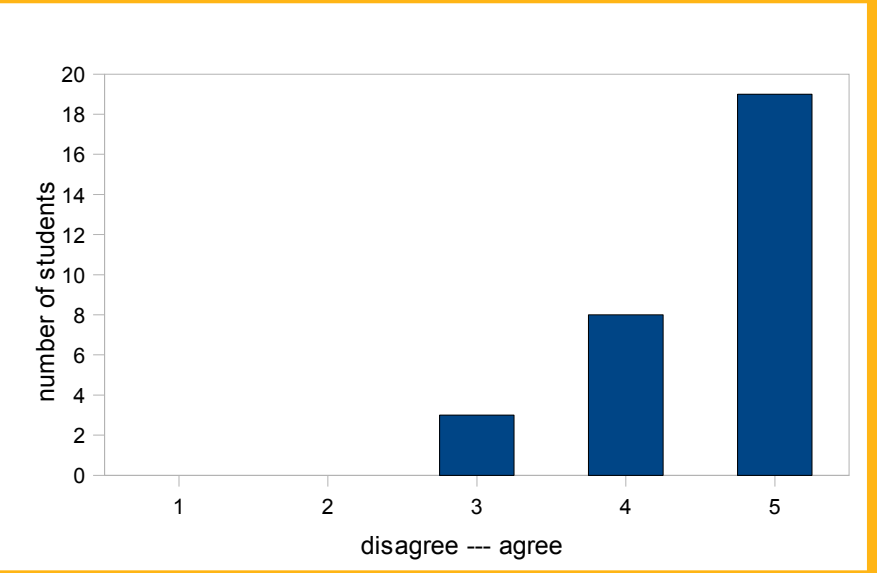
Results: questionnaire

- Students felt that solving exercises is important.



5) Solving the exercises helped me to learn things.



24) Solving the course exercises prepared well for the course exam.

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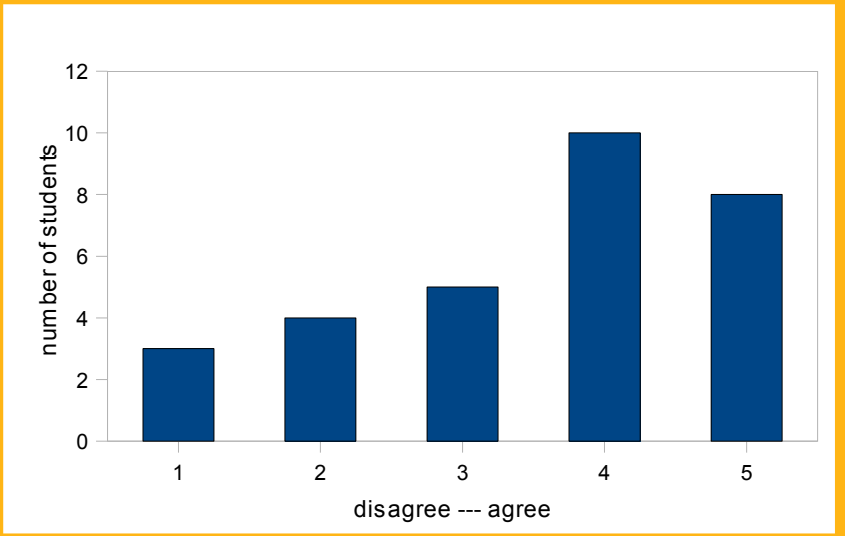
Results: questionnaire

- Most of the respondents (60%) said that they studied during the whole course
- Mean: 3,53 S.D:1,31

- All of the items concerning student engagement had a mean near to neutral and a high deviation



8) Instead of studying at the last minute (just before the exam) I studied during the entire course.

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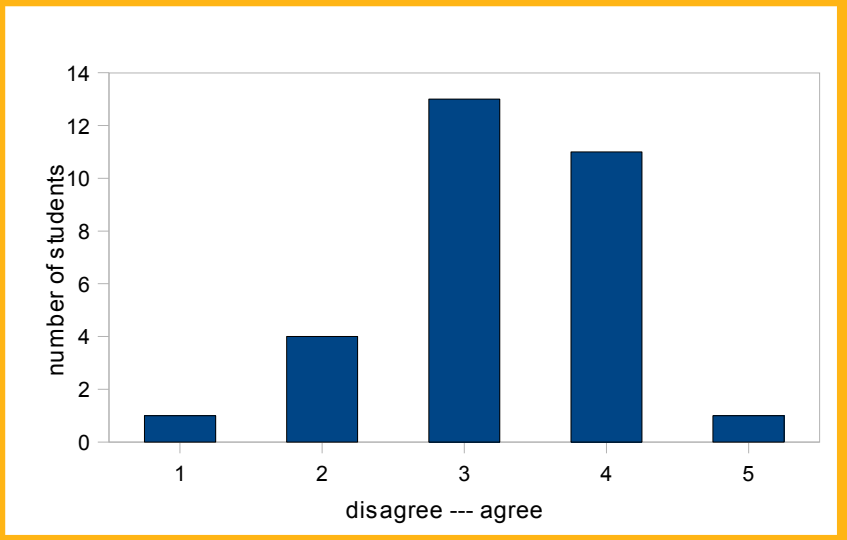
Results: questionnaire

- On the average, the tension of taking an exam did not ease
- Mean: 3,23 S.D:0,86

- Disagree: 17%
- Agree: 40%
- It seems that our arrangements did help some students



6) I was less tense about taking the course exam than normally.

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Ongoing projects

- Practices used on the experimental course are being tested on a larger engineering mathematics course S3
- New and improved practises are experimented on an entirely new engineering mathematics course BTT1 (for Bioproduct Technology students)
- Some support functions are being developed to evolve students' learning skills (OTE-project)
  - Customized guidelines for different learning styles

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Thank you!

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