DIGITAL TOOLS TO SUPPORT FIRST YEAR STUDENTS' MATHEMATICAL THINKING

Øresundsdagen 3

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Year 2015:

Teaching Calculus I for Engineering students

Many students fail in my course

Yes, let's give it a try!

Mirela

Perhaps the ideas could be adapted to your course?

Mats

We have good experiences from students working on inquire-based tasks in DMS

Doing research on dynamic mathematics software at upper secondary school

Maria

Year 2020:

Let's give it a try!

Mirela

The DMS activities are really working well BUT with so many students, the correction work is demanding.

The risk then is that the focus will be on procedural knowledge.

Mats

Maria

Yes, we'll have to be careful in the task design.

Teacher with experiences using CAA system

Yosief

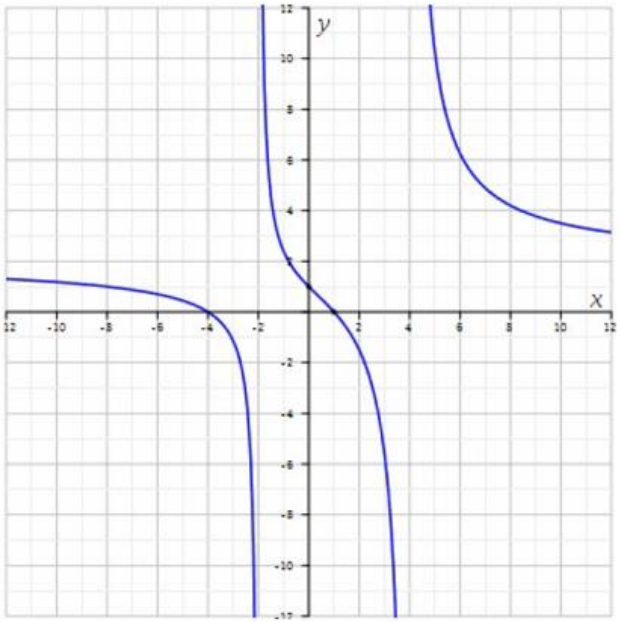
Perhaps some of the tasks could be automatically corrected?

An ongoing project

- A combined development and research project
- As part of the course assignment: two computer-based mandatory small group activities (designed for combined use of a DMS environment and a CAA system)
- Each activity consists of a task sequences (focusing on function understanding), where the tasks:
  - Require either a group answer or an individual answer
  - Are of mainly three different non-traditional types:
    - Exploration tasks (describe/explain)
    - 'Translation' tasks (from graph to formula)
    - Example-generating tasks

An example of a translation task

Below is the graph of the function g.



Use the graph to determine the function formula.

Check your suggestion in GeoGebra before submitting it as an answer to the task.

Group answer:

$g(x) =$ _____

Students are expected to…

- realize that it must be a rational function with one horizontal and two vertical asymptotes
- utilize the vertical asymptotes to construct the (factorized) denominator
- utilize the horizontal asymptote to conclude that the nominator should be of degree two with the coefficient 2 in front the x^2 term
- realize that they could utilize the zeros or two other points to finalize the function formula

An example of a example-generating task

Give examples of two different functions, f and g, both of which have

- two vertical asymptotes, $x = -6$ and $x = 3$, as well as
- a horizontal asymptote, $y = 2$.

Note:

- Group members may have received different asymptotes.
- Check in GeoGebra if your suggested functions really have the given asymptotes.

Individual response:

$f(x) =$

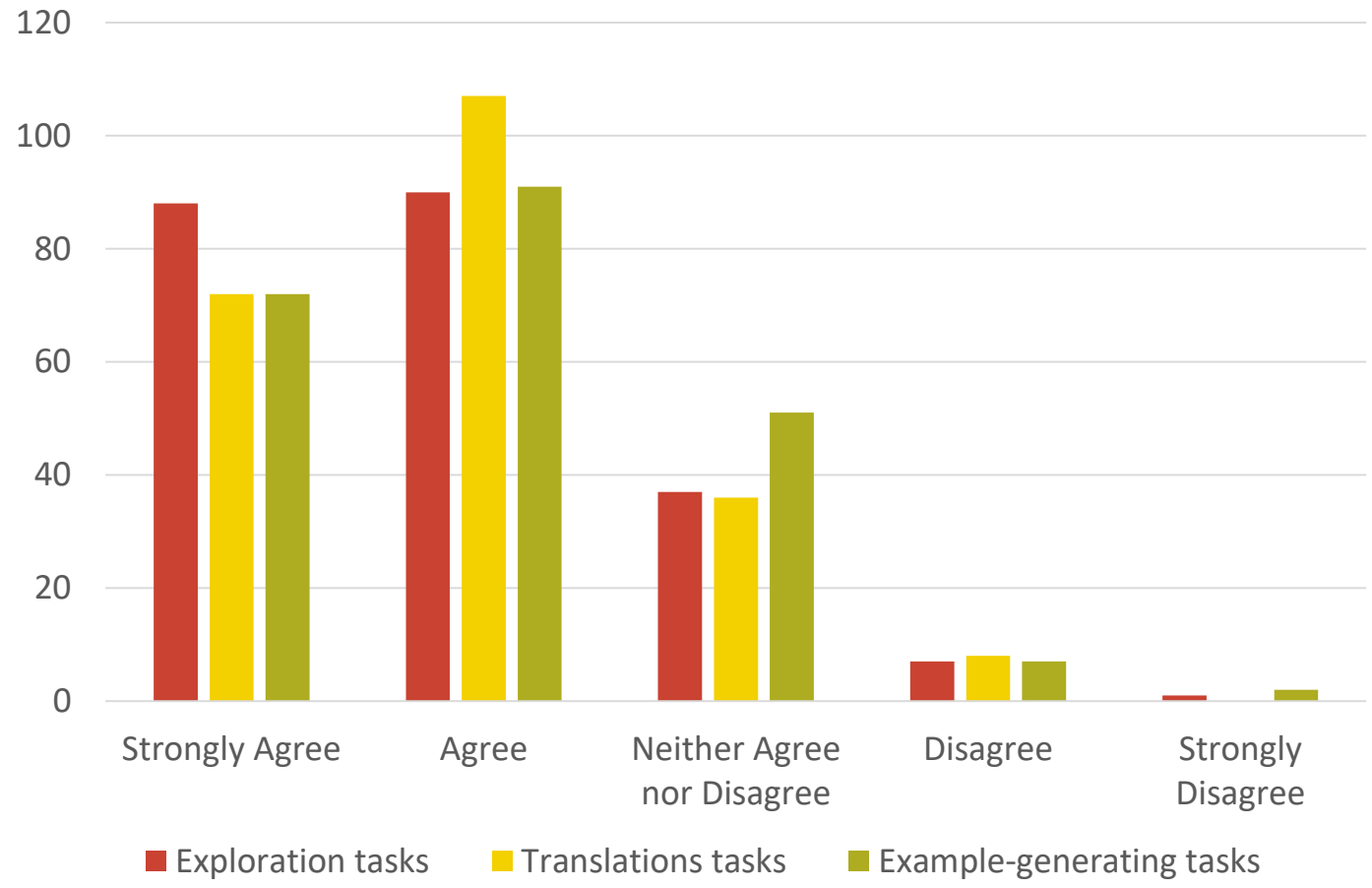
$g(x) =$

What do the students think about the activities?

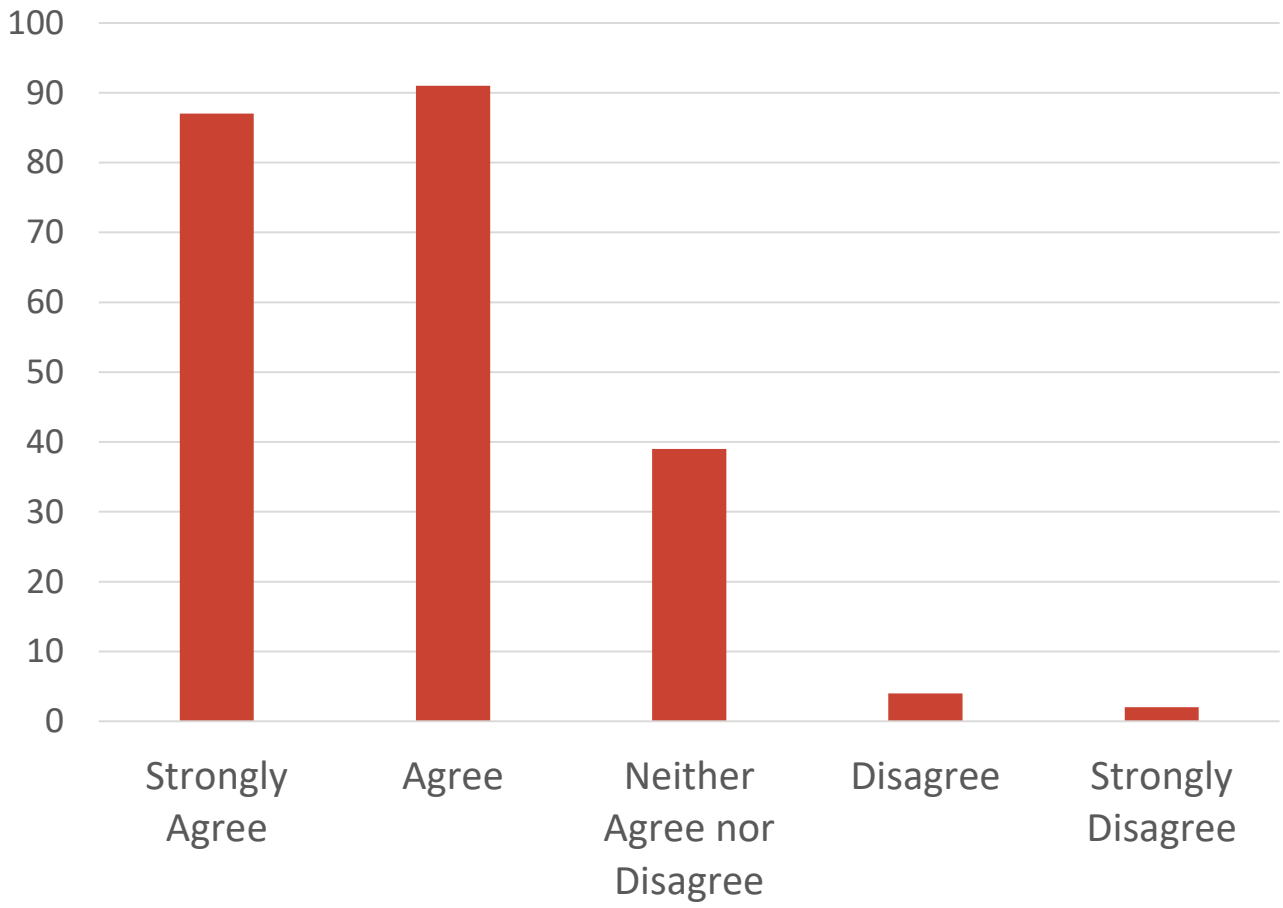
A voluntary questionnaire at the end of the course

- **2020: 84 out of 256 -> percentage of answers: 32,8%**
- **2021: 139 out of 235 -> percentage of answers: 59,1%**

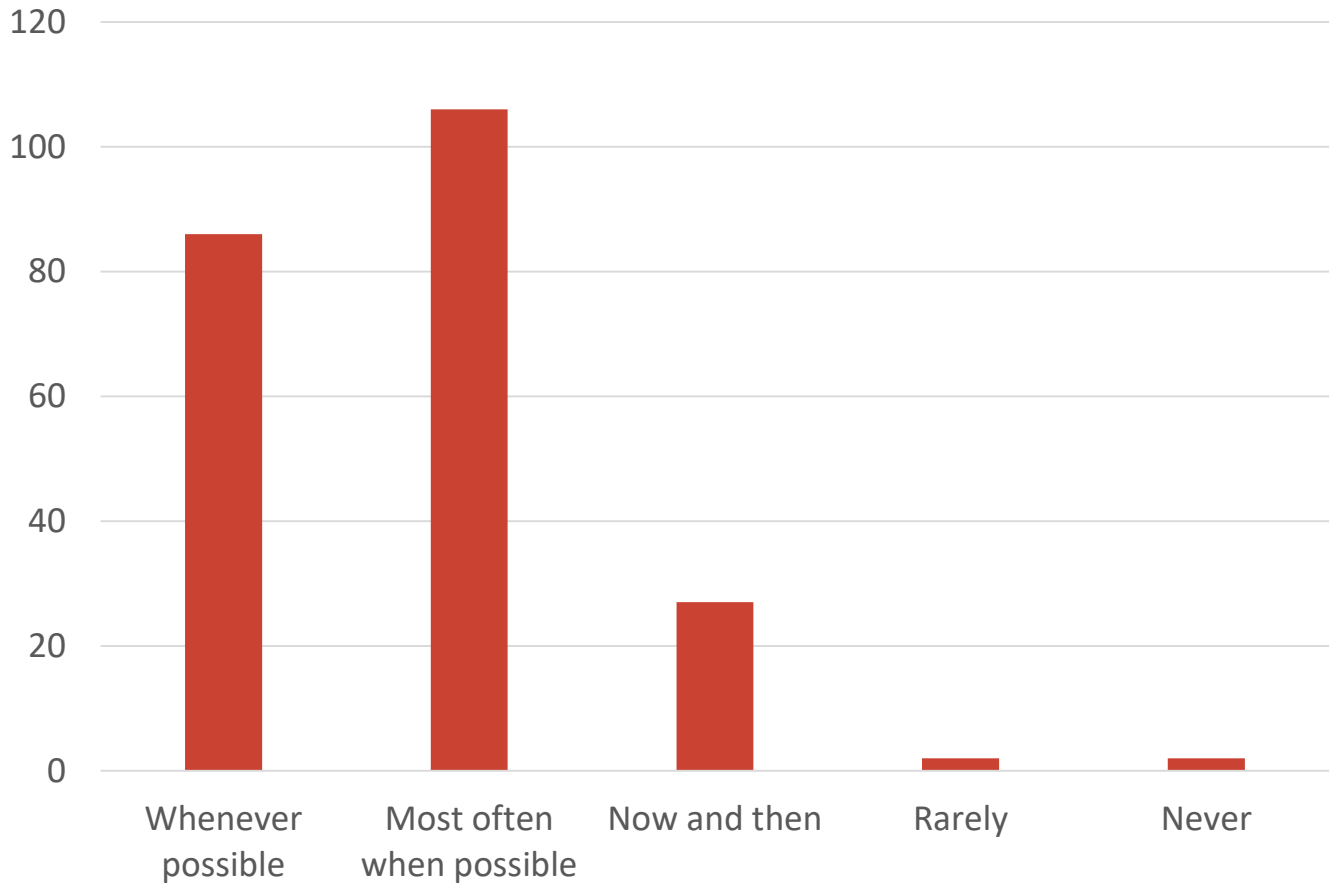
To what extent do you agree with the statement that the tasks provided increased understanding?



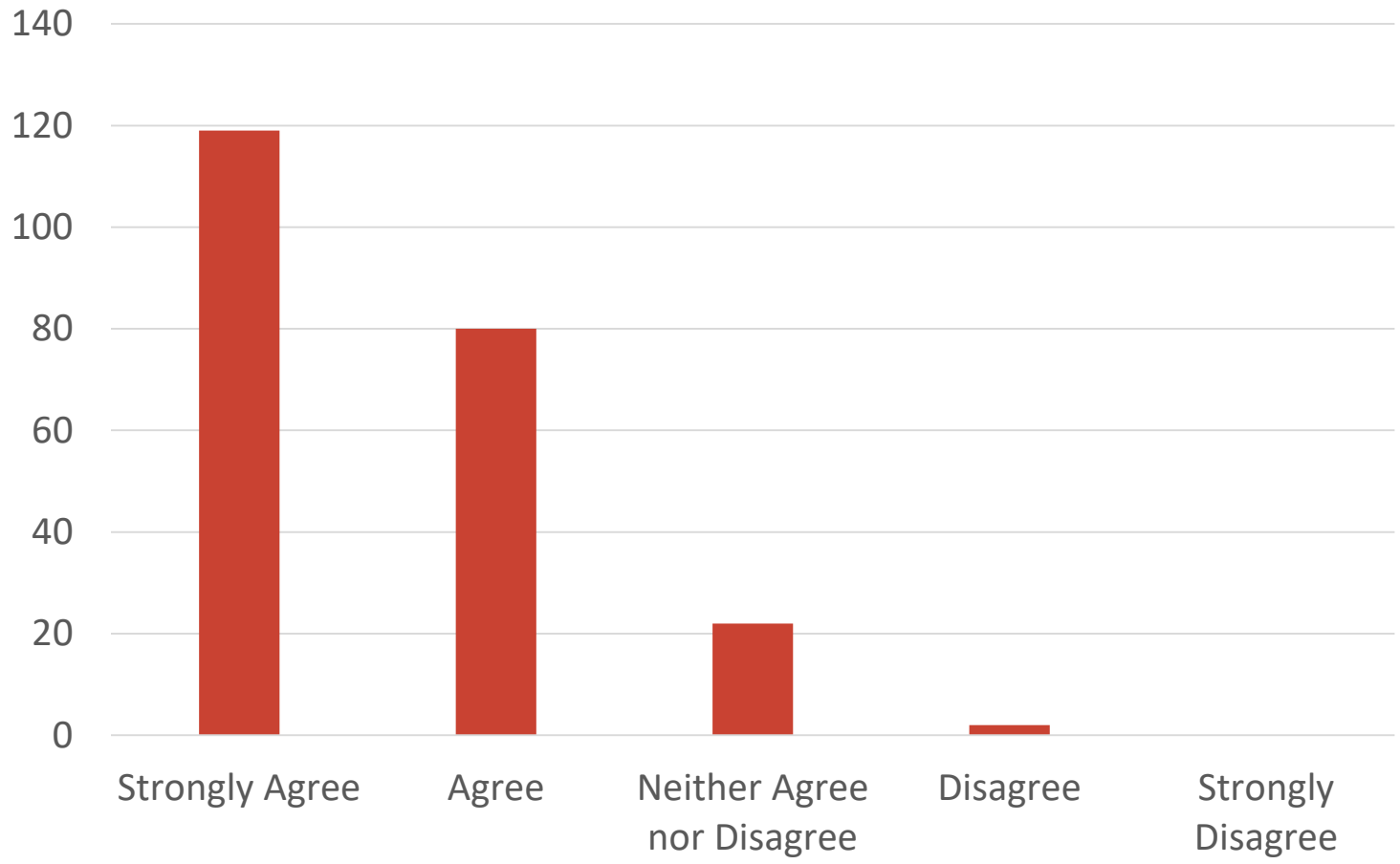
To what extent do you agree with the statement? It is good to have compulsory parts early in the course



To what extent did you use GeoGebra to check your answer before entering it in Möbius?



To what extent do you agree with the statement?
Working in GeoGebra provides an increased understanding



Ongoing collaboration

- *DELTA* (*Digital Education for Learning and Teaching Advances*) at University of Turin
- Erasmus+ Cooperation in Higher Education, *PYTHAGORAS* (spin-off from *iTEM*)

Many thanks for your attention!

We are happy to discuss our work with you!