Mathematical Competence Assessment and Work in Groups

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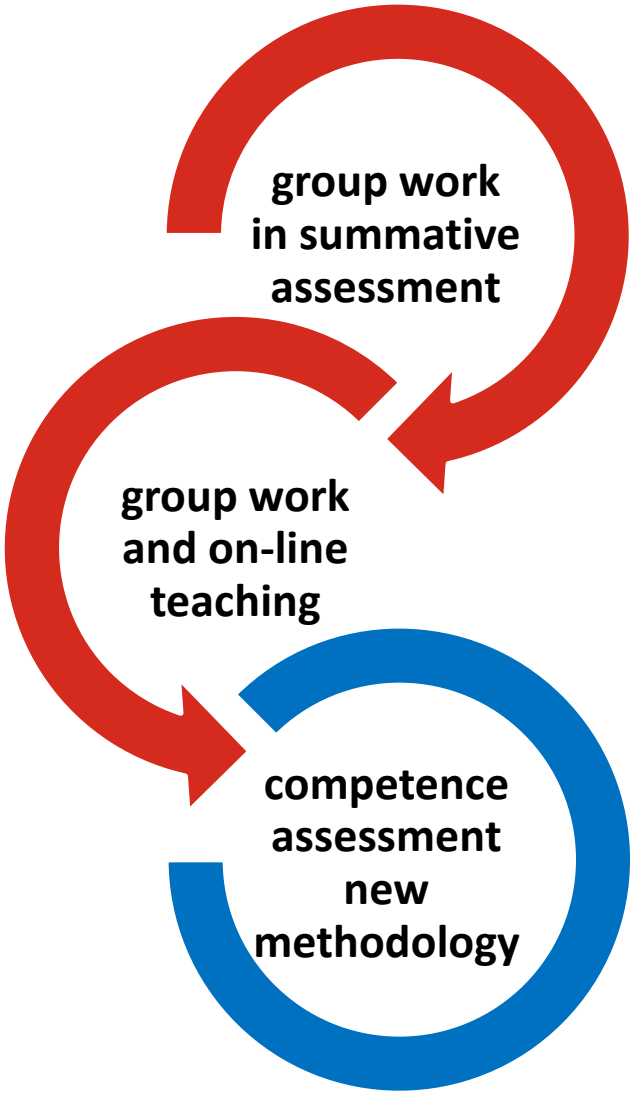
Outline


group work
in summative
assessment
group work
and on-line
teaching
competence
assessment
new
methodology

Group Work in Summative Assessment

Group Work

- not project work, but midterm summative test
- experimentally involved in exam
- groups - 4-5 members, members on students' will
- informed before, training before

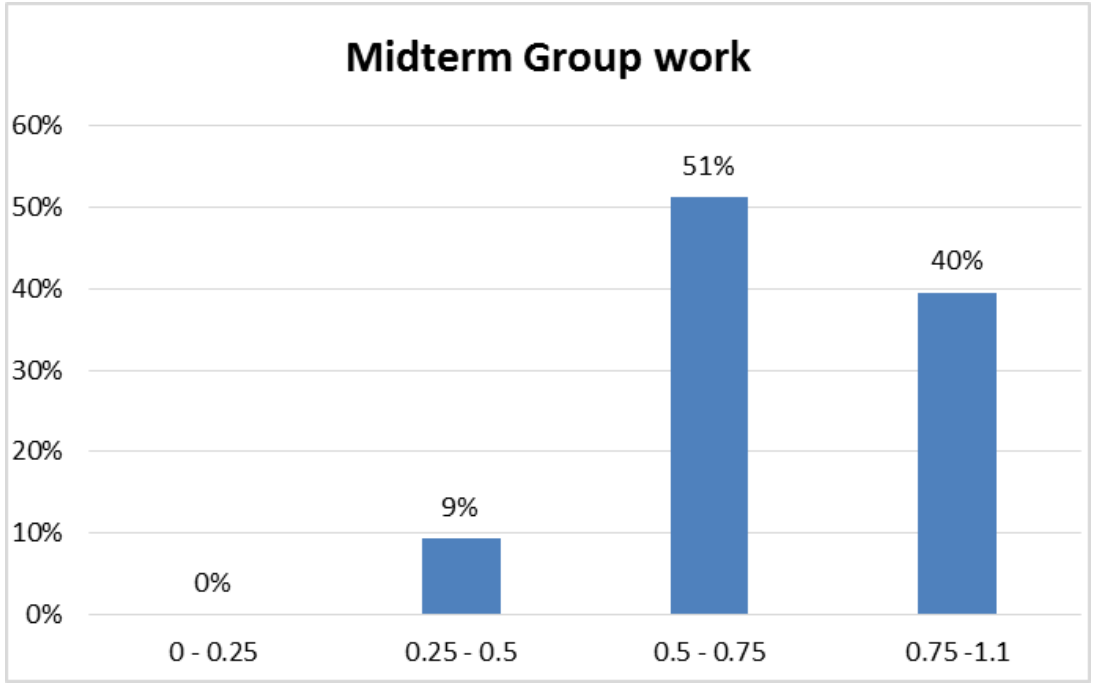
Midterm summative test

- course Mathematics I, daily schooling (autumn 2019):
  4 summative tests during semester + exam test
- topic: differentiation
  - Guide AC5
    New Rules for Assessing Mathematical Competencies – User Guide
    (http://fmi-plovdiv.org/GetResource?id=3569)

Group Work in Summative Assessment - Results

86 respondents in 17 groups

- simple scoring – all members in the group – same points
- high scores



Group Work in Summative Assessment - Results

Questions:

- How will the group work influence grading?
- Will the group work influence weak students, their performance?

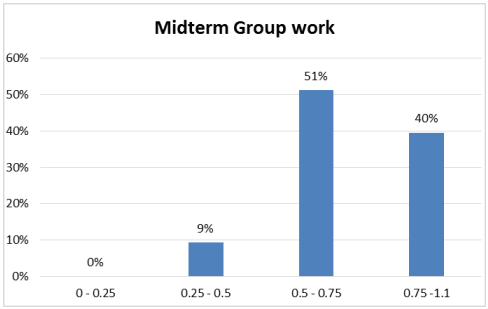
Group Work in Summative Assessment - Results

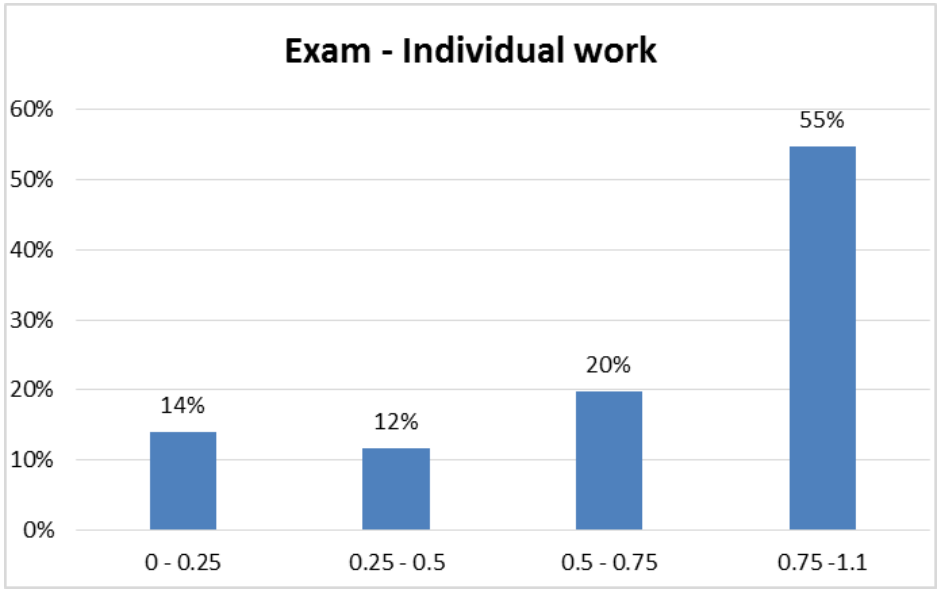
How will the group work influence grading?

Group Work in Summative Assessment - Results

comparison with results of the same students achieved in

“differentiation” problems of the **final individual exam part**



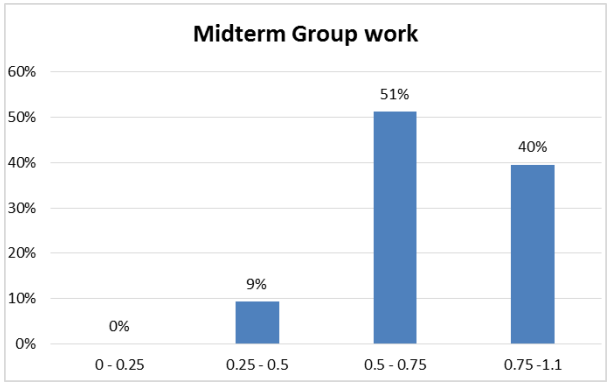


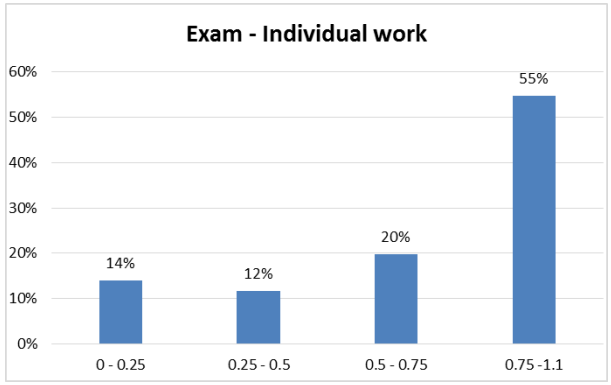
no statistically significant difference (Mann Whitney, Kruskal – Wallis)

Group Work in Summative Assessment - Results

the results in group work **were not higher** than results in individual mode

group work test	individual exam test
• basic problems on function behaviour • more complex applied problem	• basic problems on function behaviour





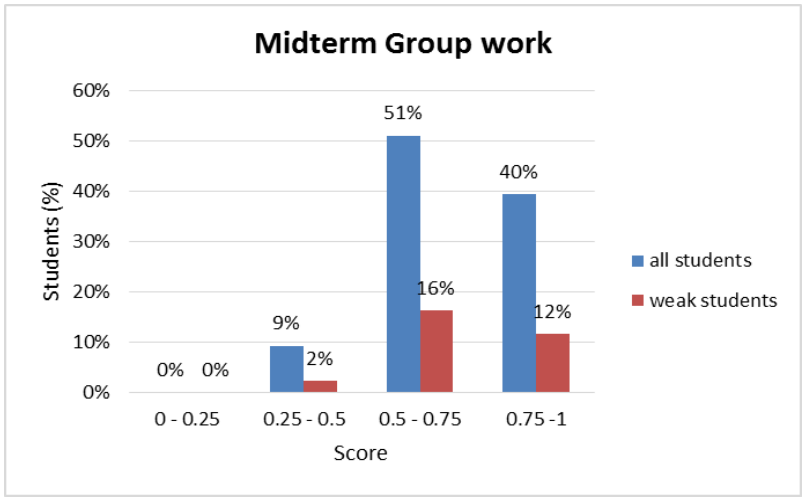
Group Work in Summative Assessment - Results

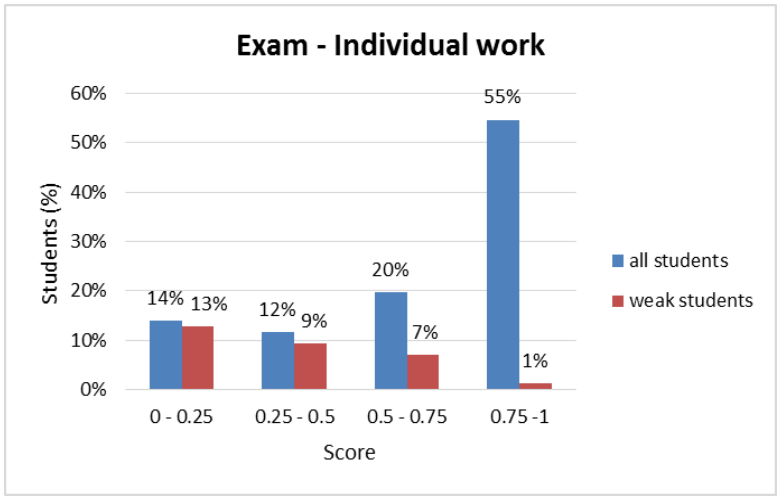
Will the group work influence weak students, their performance ?

Group Work in Summative Assessment - Results

category: “weak students”

- the score less than 50 % in the sum of other three midterm individual tests
- 30% of all students satisfied the rule



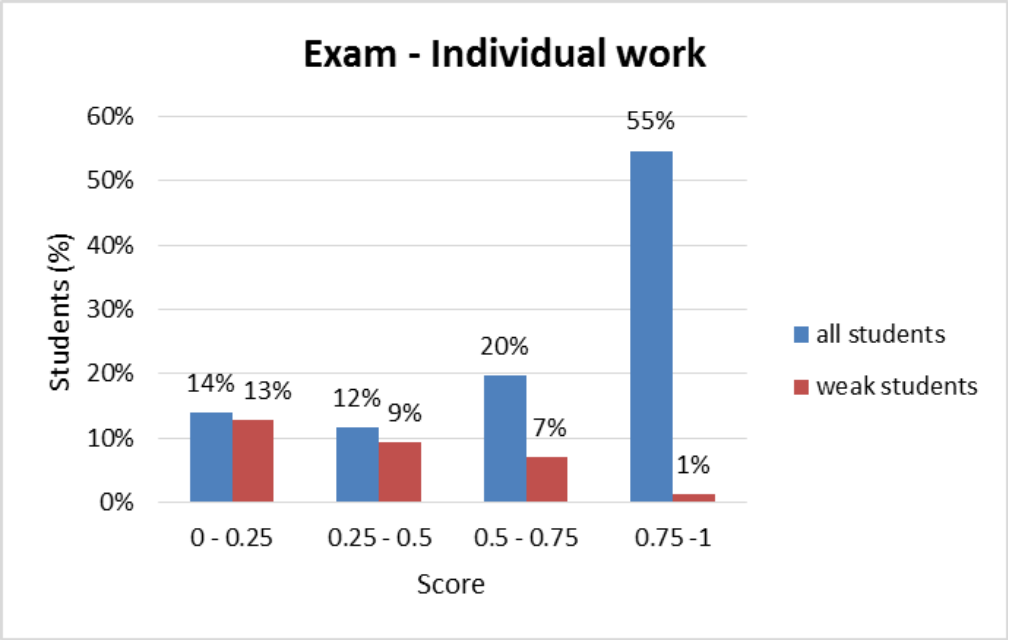


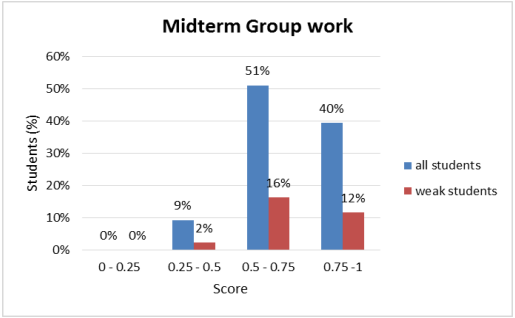
statistically significant difference (Mann Whitney, Kruskal – Wallis)

Group Work in Summative Assessment - Results

category: “weak students”

- 20% moved to score < 50%
- **score < 25%**
  - 13% out of all 14%
  - low interest in study, quitted
- **score > 50%**
  - (8% of all 75%)





Group Work in Summative Assessment - Results

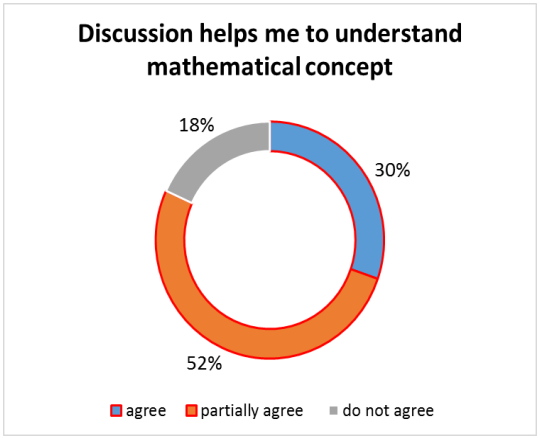
Conclusion

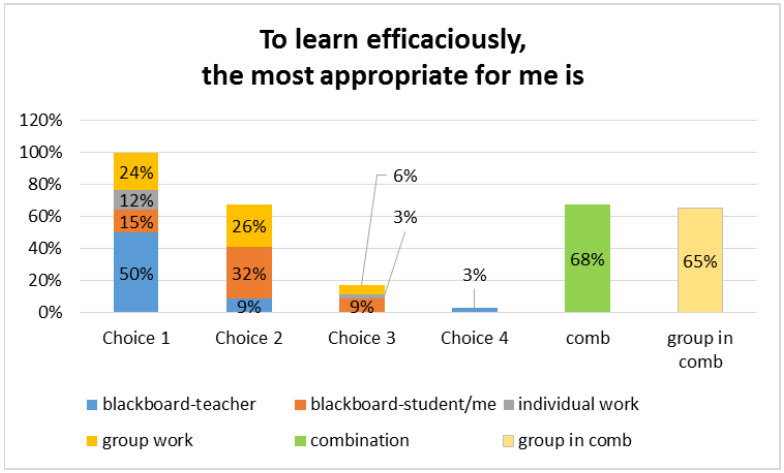
- Implementation of the group work did not negatively affect the assessment process.
- Students profited from the group work in cognitive as well as in social areas. Having team common target, they could freely discuss and argue on relationships, procedures or results developing their mathematical competencies, what for **75%** of all students implied **score better than 50** percent in the matching tasks of individual final exam test (even **55%** of all students had **score better than 75** percent; and 20% had score between 50 - 75 percent)
- GW provides space where competencies can be developed and assessed

Group Work in Summative Assessment

observations, opinions and attitudes

- students were surprised by integrating group work into midterm summative assessment
- students knew each other, and working in groups before the exam allowed them to divide the work with respect to their abilities
- lower performing students concentrated on basic tasks
- they felt very well and useful
- they appreciated: group work as an activity, possibility to discuss, comparison of various approaches and methods used in solutions

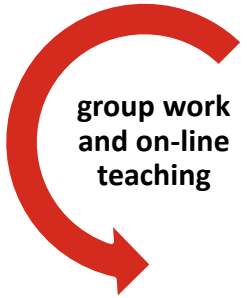




Group Work and on-line teaching & learning

Sudden switch to the distance form of education

- the great pressure on self-study arose, and communication was restricted
- the most limiting factor - quality of internet connection
- did not want to give up – 3 modes of group work, we brought to the action



Three modes of on-line Group Work

1st mode

did not depend on simultaneous internet connection

solve individually and share the record

mutual check, and comment

- each student was to check two other problems, to comment the procedure and the result

troubles

- arguing, justification or comments in written form

Three modes of on-line Group Work

2nd mode

depends on simultaneous internet connection

students use voice/video channel

- students together discuss and solve the task

record

- one participant makes record and shares the screen of notebook.
- at the end, the record document can be seen or downloaded by classmates.

Three modes of on-line Group Work

3rd mode

requires good internet connection

students use voice/video channel

they share interactive online whiteboard

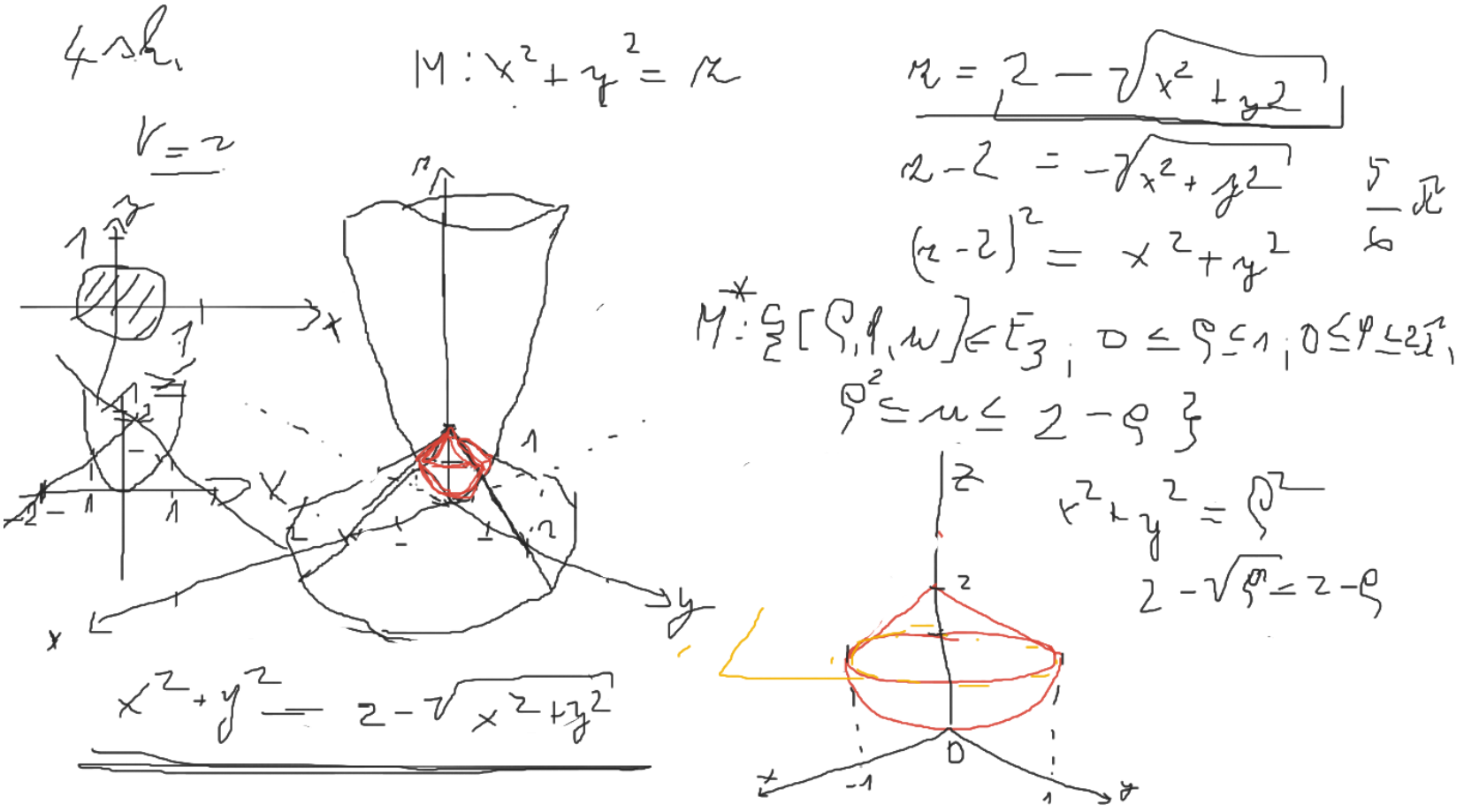
- **all participants can take a part in writing and discussing**
- **requires fine hand motor skills** to move the mouse (write and draw) s'times only most skilled student made notes
- **similar to normal full-time teaching**

record

- the record document can be seen or downloaded by classmates

Three modes of on-line Group Work

3rd mode – sample of performance



on-line Group Work - implementation

- **3rd (2nd) mode**
- **small groups of 2-3 students**
- **lesson organization**

1. Whole class introduction

2. Work in groups
    - completely under students' activity
    - lecturer visited sessions, watched the conversation and the whiteboard, in cases of need, one entered the action and provided necessary guidance
        - background – assessment of the degree of students involvement and competencies

3. Whole class summary
    - presentation of the group work (a presenter different from a writer)
    - lecturer's overall summary (goal, nice moments, important points, etc.)

on-line Group Work – observation and opinions

- **very attractive and popular**
  - students who did not have problem to demonstrate their work
- **out of comfort zone but activated**
  - introverts and students with lower performance
  - to minimize negative feelings – explanation in the beginning
- free friendly atmosphere appreciated
  - "no stupid question"
- lively creative enjoyable discussion
- 63% consider GW be the method which brings them the greatest benefit
- 75% felt well or very well
- one student was slightly dissatisfied, pointing out that not all members in the group were active, and they just took advantage from the work of others.

on-line education – opinions

- **the most valuable**
  - sharing documents and videos
  - saving time by not traveling

- **the biggest disadvantage**
  - lack of contacts with classmates and teachers,
  - technical problems with connection
  - perception of a barrier and delay in communication
  - no ability to separate study from other life activities
    - presence of many disturbing elements
  - many hours before computer, and
  - procrastination

Competence assessment – challenge

- curriculum is very strongly tied to content,
  it is very difficult to move from content to competencies assessment.
- usual assessment: content related tasks
- springboard: learning outcomes formulated in active verbs:
  - "As a result of learning this material you should be able to state, use, understand, describe, justify, calculate, draw, ...
  - since the middle of the 20th century
- learning outcomes are supplemented by degree of competence importance
  - outlined for technical tertiary education in the SEFI "Framework"
  - elaborated and enriched with collection of tests in "Guides" - New Rules for Assessing Mathematical Competencies – User Guide (Rules Math project)

Topic: Analysis and Calculus								
Learning unit: **Complex Numbers**								
Learning outputs	Competencies							
	C1	C2	C3	C4	C5	C6	C7	C8
State and use Euler's formula								
State and understand De Moivre's theorem for a rational index								
Find the roots of a complex number								
Link trigonometric and hyperbolic functions								
Describe regions in the plane by restricting the modulus and / or the argument of a complex								

Competence assessment – challenge

Question:

"How to assess competencies? "

Competence assessment – challenge

Competencies related content – content is evaluated

- the quality of student's competence is **presumed** from achieved score qualitatively,
  - in words, or
  - quantified through the conversion

- frequent
- similar and combinable with classical way of assessment

Competence assessment – new methodology

Content related competencies – competencies are evaluated

based on

- careful definition of the performance element representing quality of examined competence

Competence assessment – new methodology

content	Performance / Competence						max sum
	C1 think	C2 reason	C3 probl	C4 mod	C5 repr	C6 handl	
multiplication	choice of repr.	reason			repr.	calcul.	4
arg, abs	concept				repr.	calcul.	3
gon. form, power			graph interpret		repr.	calcul.	3
roots cubic eq	how to grasp	reason	find the way	way	repr.		5
graph of a region	concept				repr.		2
max sum	4	2	2	1	5	3	17

Competence assessment – new methodology

Student

content	Competence						task score	relative task score
	C1 think	C2 reason	C3 probl	C4 mod	C5 repr	C6 handl		
multiplication	1	0			0.5	0	1.5	0.38
arg, abs	0				0	0	0	0.00
gon. form, power			1		1	1	3	1.00
roots cubic eq.	0.25	0	0.5	1	0.5		2.25	0.45
graph of a region	1				1		2	1.00
competence score	2.25	0	1.5	1	3	1	8.75	
relative competence	0.56	0.00	0.75	1.00	0.60	0.33		**0.51**

Analysing the results of all students in a class, the teacher can efficiently reveal particular competence shortcomings and the appropriate activities could be operationally included in following curricula topics.

Thank you

- Questions?