

Conflict between calculations and underlying concepts: case of tertiary level students

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01 Methodology

Aim: To determine what would happen if we request students to perform calculations that do not make sense

1

Calculation of molar concentration if the given compound is insoluble in water

3

Calculations with molar volume if the given compound is in the solid state

2

Calculation of volume of the product if the reaction is impossible

4

Calculation of pH value of heterogeneous mixture

1: Paper and pencil test

2: Eye tracking

Paper and pencil test

Sample: students majoring in chemistry teaching (4th year)

Instrument: multiple choice test (declarative knowledge)

Which answer includes all the following that are insoluble in water?
Circle the letter of the correct answer.

- a) AgCl , NaNO_3 , $\text{Ba}(\text{NO}_3)_2$
- b) AgCl , BaSO_4 , $\text{Al}(\text{OH})_3$
- c) $\text{Ba}(\text{NO}_3)_2$, AgCl , KCl
- d) KCl , AgCl , $\text{Al}(\text{OH})_3$

Eye tracking

Sample: 12 students

Device: Gazepoint eyetracker (60 Hz)

Problem set: 5 tasks

01 Task

02 Task

03 Task

04 Task

05 Task

Calculate molar concentration of the solution obtained by adding 15 g of silver chloride into 50 cm³ of water.

Eye tracking

01

Reading phase

Eye movements were recorded while problems were displayed on the computer screen

02

Calculation phase

Students are requested to perform calculation

03

Difficulty evaluation

Students are requested to evaluate difficulty of task using Likert scale

04

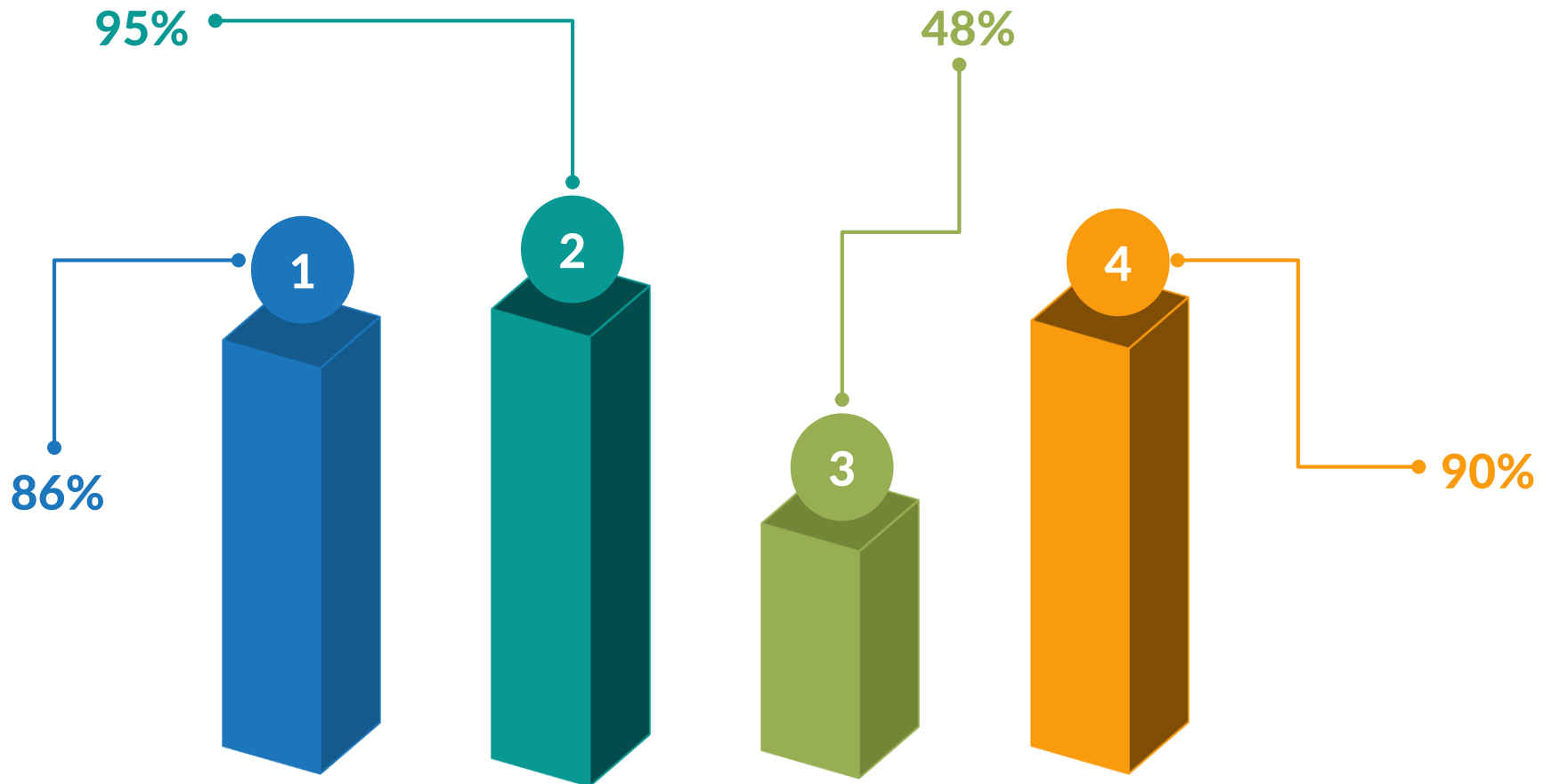
Making comments

Students are requested to make comments regarding calculation procedure

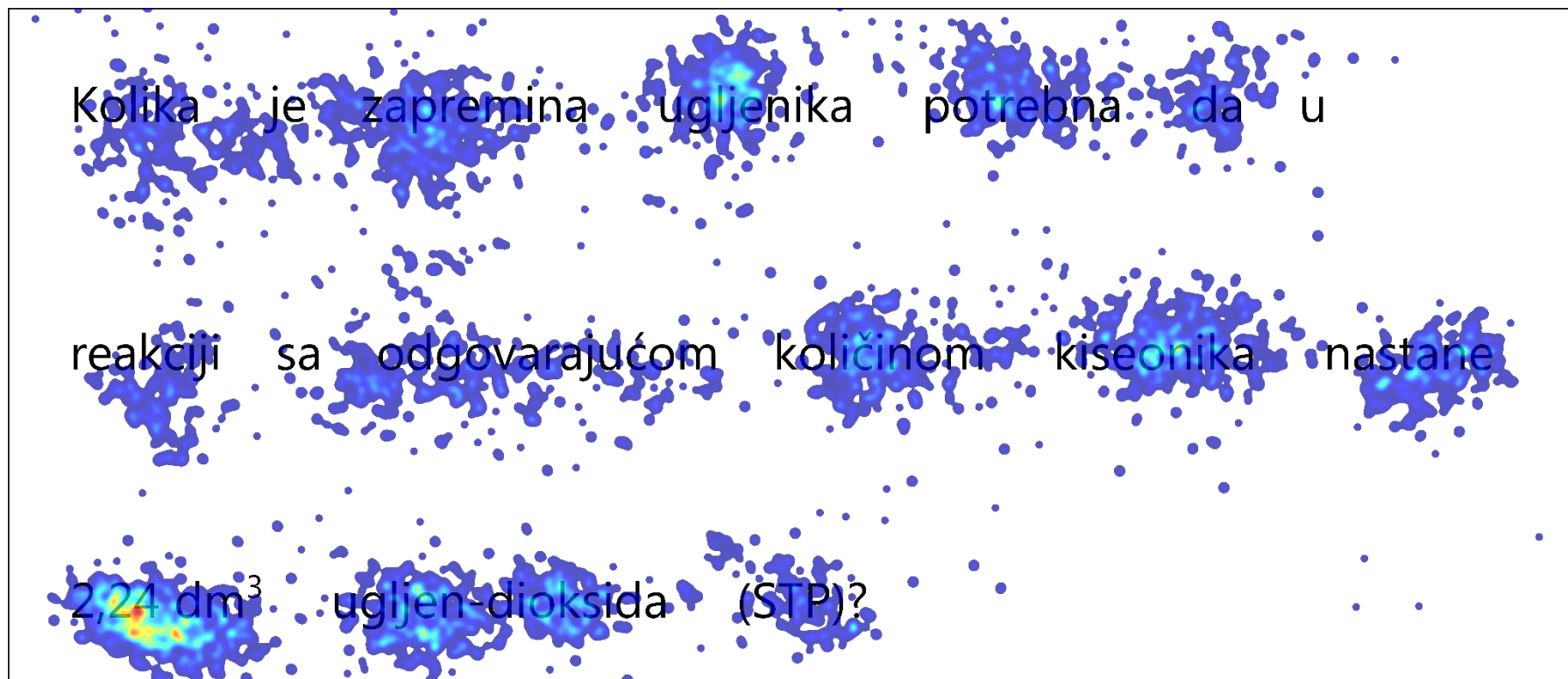
Data
Collection

02 Results & Discussion

Results of paper and pencil test



What is the volume of carbon necessary to produce 2.24 dm³ of carbon dioxide in the reaction with appropriate amount of oxygen? (STP)



A heat map for task 5 for selected student

Reading Phase

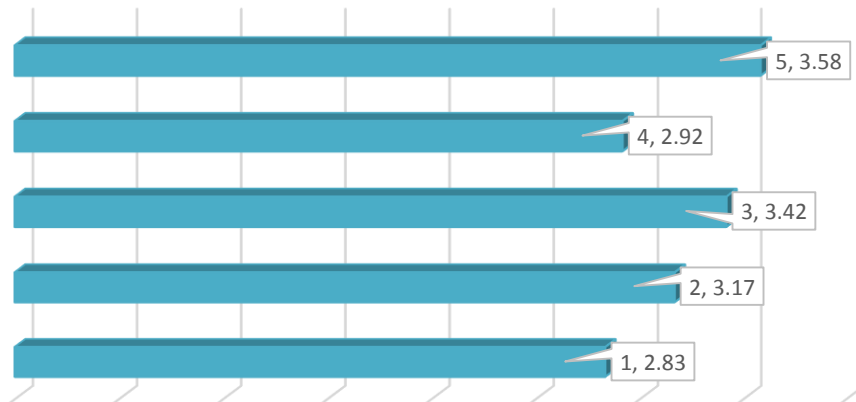
	AOI 1	AOI 2	AOI 3	AOI 4
TFD [s]	2.48	2.40	2.04	4.24
FC	12.67	11.82	10.45	13.33

 Volume  Carbon
 Oxygen  2.24dm³

Calculation Phase

- All students performed calculations by using common formulas, neglecting hindering factors

Difficulty Evaluation



- 1-4 easy
- 5 nor easy nor difficult

- It was easy, because one just needs to put numbers in the formula.
 - There is no problem if one knows formulas and value of molar volume.
 - The task is elementary.
 - The task is very easy.
 - I'm sure I did it correctly, it was very easy.
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- I can't remember the formula.
 - I'm not sure about this task. I do not know if I used the appropriate formula.

Thank You



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