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FORMATIVE ASSESSMENT METHODS IN BIOLOGY EDUCATION: PEDAGOGICAL STUDY AT PRIMARY SCHOOL IN THE CZECH REPUBLIC

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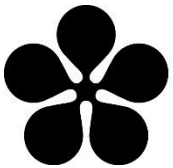

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Theoretical background

- increasing implementation of inquiry based tasks into science subjects reveals problem with assessing the students' performance during these activities
  - summative assessment is not appropriate method

Inquiry based tasks

- students take specific steps, from identifying the research question, formulating the hypothesis, planning and performing own experiments, analyzing and interpreting gained data to summary of results and using the models (Anderson, 2002)

Formative assessment

- process in which the information gained from the assessment is used for improvement of next steps in the teaching-learning process and to help pupils to reach the selected goals (Popham, 2006; 2008)
- includes various methods, from self-assessment, peer-assessment to teacher's assessment

Theoretical background

Peer-assessment

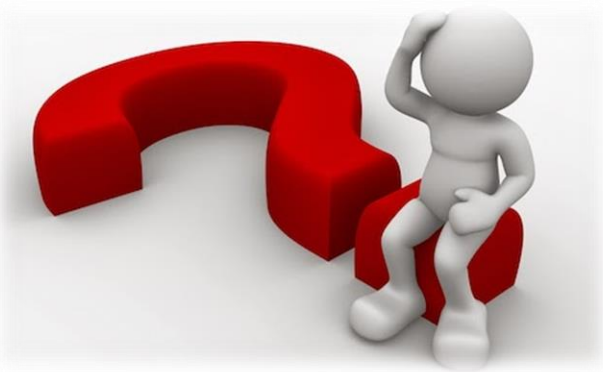
- students evaluate the quality of peer's work or level of his/her performance
  - they decide to which extent the peer has met set goals or criterions and guide him to improve his work and get closer to the criterions

- The positive correlation between students' achievement and peer-assessment as the formative assessment methods was found by Topping (2009, 2013):
  - Students involved in the peer-assessment process submitted better own works afterwards compared to students who received feedback from teacher and were not involved in the peer-assessment.

Research questions

Research questions

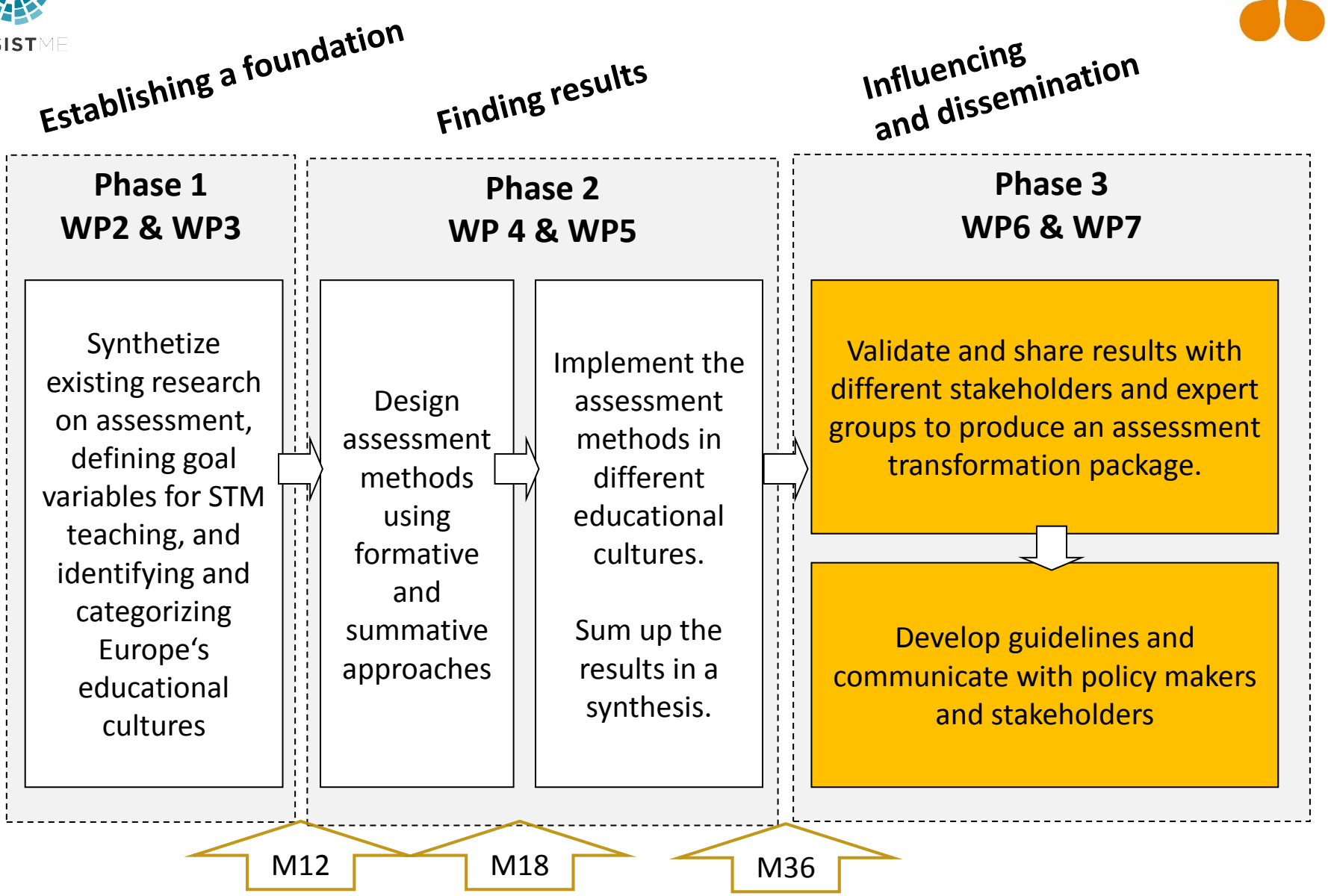
- 1) Do students accept peer assessment and use it for improvement of their products?
- 2) Do they take peer assessment seriously, ignore it, or direct boycott it?
- 3) How do students react to the assessment from classmates?
- 4) Do they prefer assessment from their peers to evaluating from teachers?



Project ASSIST-ME

- *Assess Inquiry in Science, Technology and Mathematics Education*
- international research project (European Union 7 FP)
- 8 European countries, 10 research and education institutions
  - England, Czech Republic, Denmark, Finland, France, Cyprus, Germany, Switzerland
- focused on formative assessment in the inquiry-based education
- the overall aim of ASSIST-ME project is to provide a research base on effective uptake of formative and summative assessment for inquiry-based, competence oriented Science, Technology and Mathematics (STM) education

SEVENTH FRAMEWORK PROGRAMME


Establishing a foundation
Finding results
Influencing and dissemination
Phase 1
WP2 & WP3
Phase 2
WP 4 & WP5
Phase 3
WP6 & WP7
Synthetize existing research on assessment, defining goal variables for STM teaching, and identifying and categorizing Europe‘s educational cultures
Design assessment methods using formative and summative approaches
Implement the assessment methods in different educational cultures.
Sum up the results in a synthesis.
Validate and share results with different stakeholders and expert groups to produce an assessment transformation package.
Develop guidelines and communicate with policy makers and stakeholders
M12
M18
M36

Implementation

LWG (*Local Working Group*)

- each LWG contains 6 teachers and 2 researchers

- in total 3 round of implementation
  - 1st round – November – December 2014
  - 2nd round – March – May 2015
  - 3rd round – October – December 2015

LWG	Subject	Level	Competence
1	Biology	Primary	Investigating in science
2	Biology	Lower-secondary	Investigating in science

Zdroj: ČSÚ, SLDB 2011

Research design

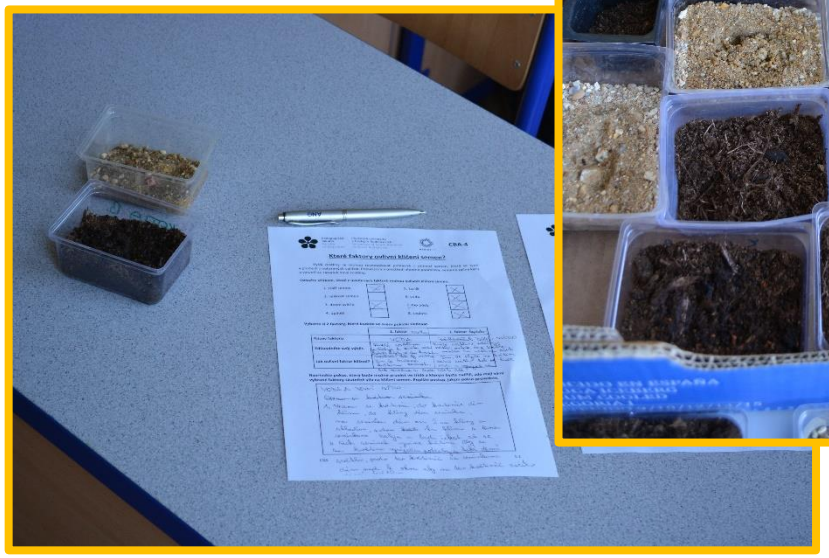
- **LWG1:**
  - Biology, primary level
- **LWG2:**
  - Biology, lower secondary level
- 3 rounds of implementation (different students and teachers)
  - different grades and schools
  - one long-term study (same students and same teacher)

- **Implementation**
  - topic of empirical investigation:
    - What factors can influence the breathing frequency? (*human physiology*)
    - What factors can influence the germination? (*plant physiology*)
  - **experimental group:** students assessed by their peers
  - **control group:** students assessed by their teacher

Inquiry activity 1	• Students design their experiment (containing hypothesis, tools, procedure and discussion of factors which have influence on the results) related to selected topic and practicable in school conditions.
Teacher's assessment	• The teacher assesses all students' protocols, assessment is written directly into the computer; researcher controls the protocols and makes copies.
Peer assessment	• Each student of experimental group receives protocol from his/her peer and writes assessment on his/her experiment design to the same kind of form as teacher wrote. Control group has different work not-related with the research
Correction & Evaluation	• Students get back their protocols and assessment form and based on it they correct their design of experiment. The teacher evaluate quality of peer feedback and level of acceptance of suggested changes.
Inquiry activity 2	• Students perform the experiment according to standardized methodology, then they fill in acquired data, interpret them and write a conclusion.
Teacher's assessment 2	• The teacher assesses all students' protocols, assessment is written direct into the computer; researcher controls the protocols and makes copies.
Peer assessment 2	• Each student of experimental group receives protocol from his/her peer and writes assessment on experiment performance to the same kind of form as teacher wrote.
Correction & Evaluation 2	• Students get back copy of their protocols and assessment form and based on it they correct their results and conclusions.
Final analysis	• The teacher and the researcher evaluate the whole process of peer assessment – level of acceptance of suggested changes, students' involvement in the process etc.

LWG1: Students‘ experiment

LWG2: Students‘ experiment

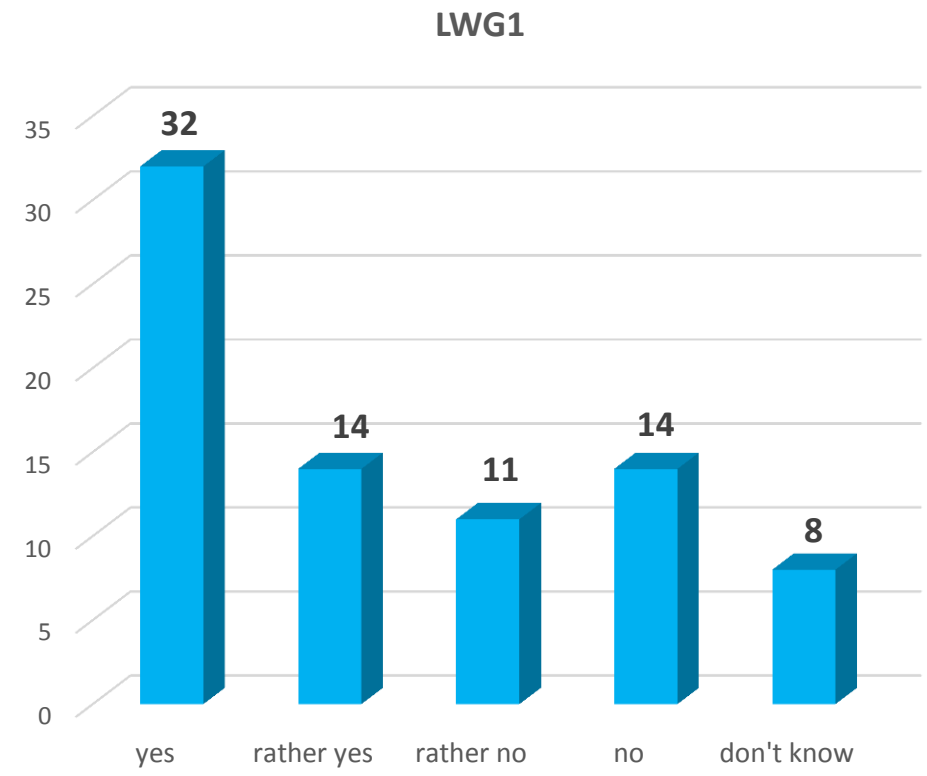


Data collection

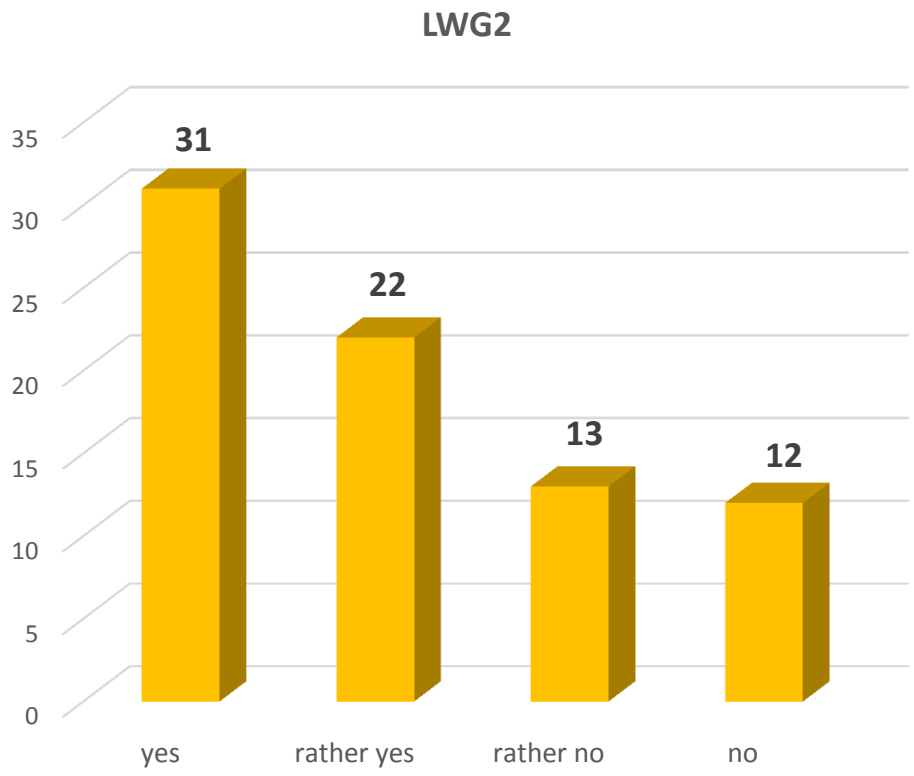
- **Semi-structured interviews with students**
  - **5 key questions**
    - each question had 4 to 6 sub-questions
    - related to 2 main fields:
      - 1) inquiry-based education in biology lessons
        - students' personal experience with this approach
        - students' opinion on inquiry and personal findings
      - 2) formative assessment (peer assessment)
        - personal opinion and experience with assessing process
        - difficulties with providing the feedback
        - acceptance of peer-assessment
        - students' preferences about the feedback

Results

- Students‘ opinion on their performing in assessment process
  - Did you do well in assessing your peers?



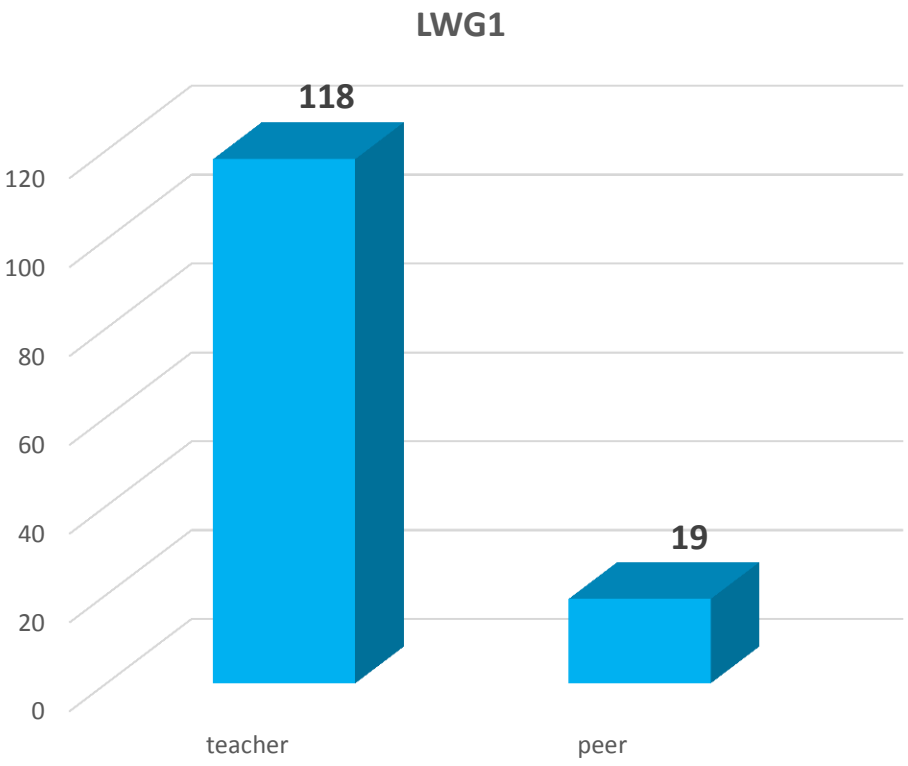
N = 79



N = 78

Results

- **Students' preference of assessing person**



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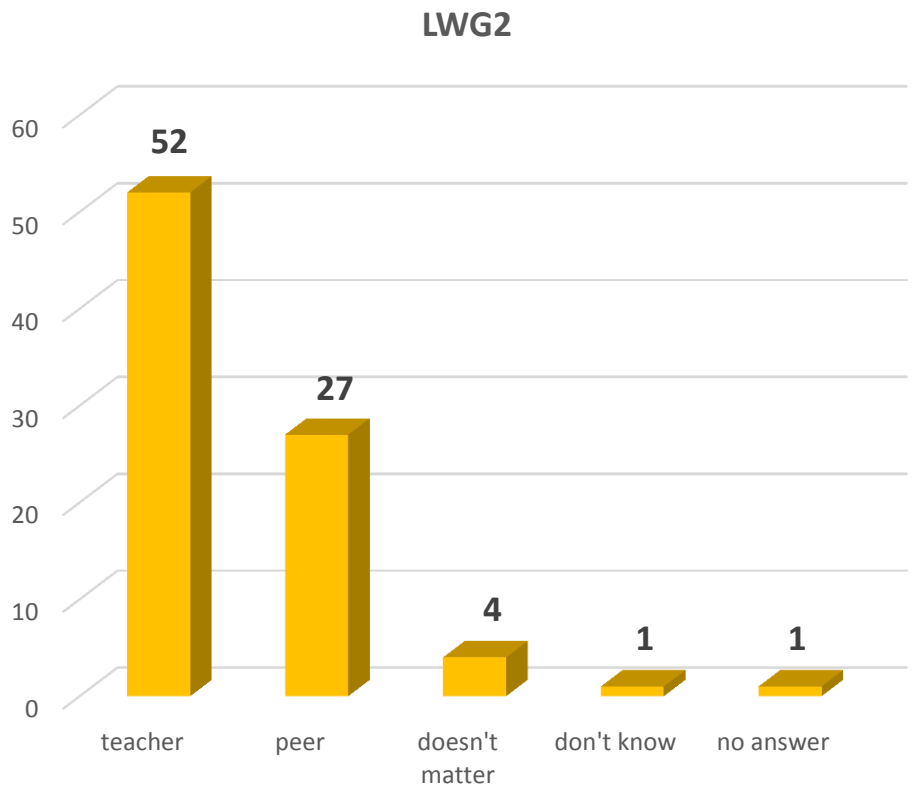
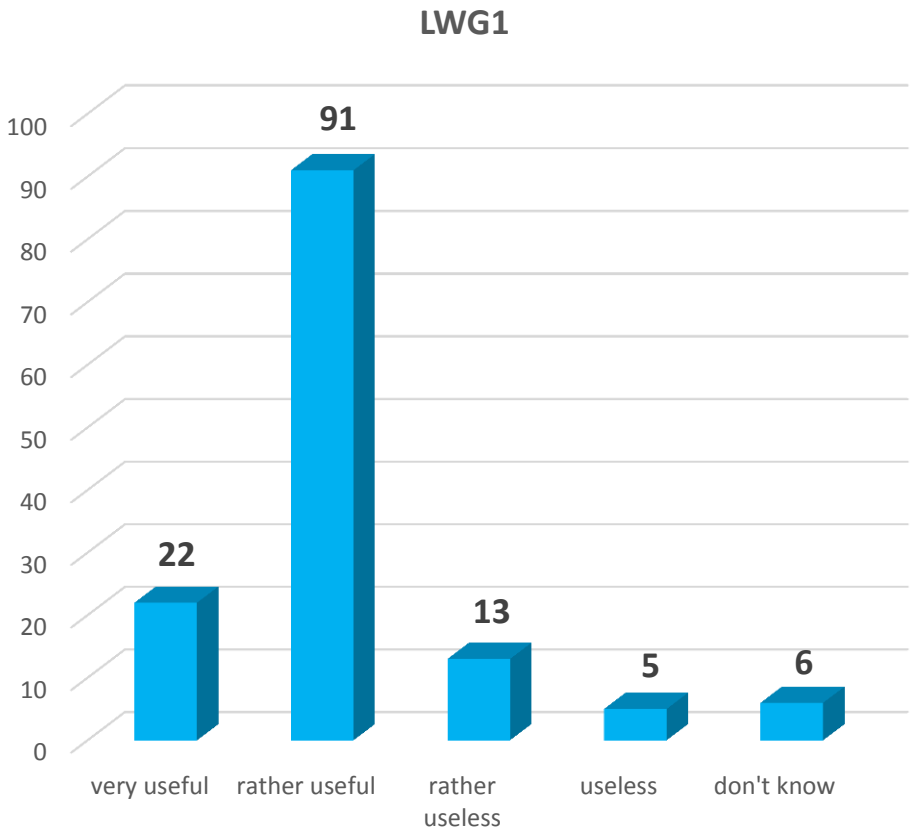
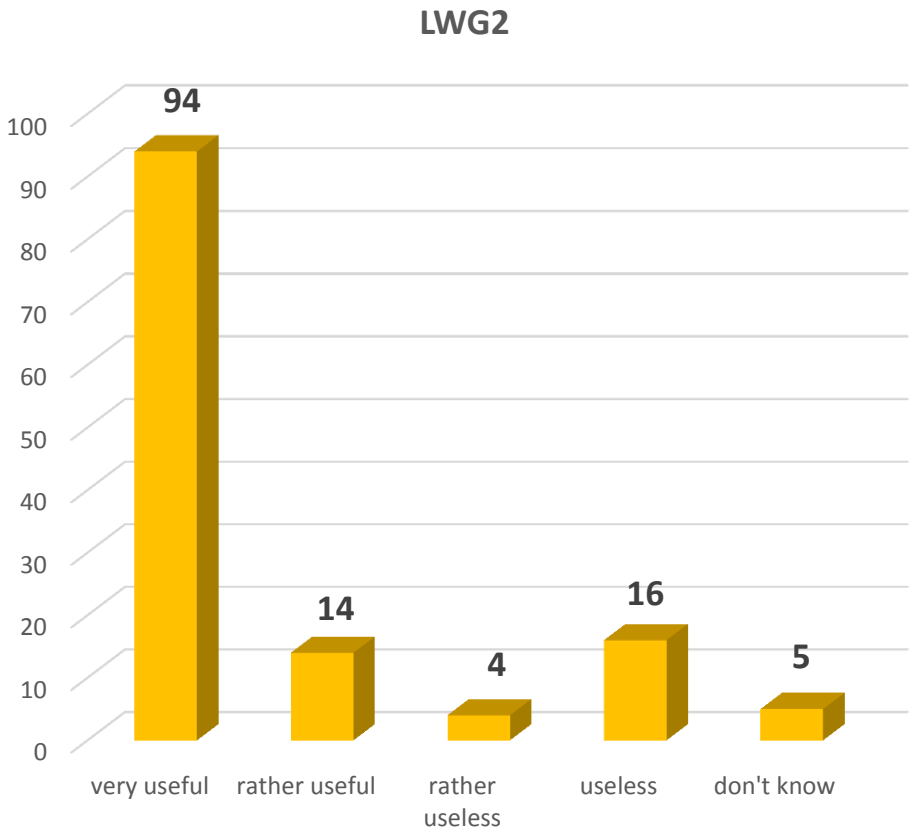


N = 85

Results

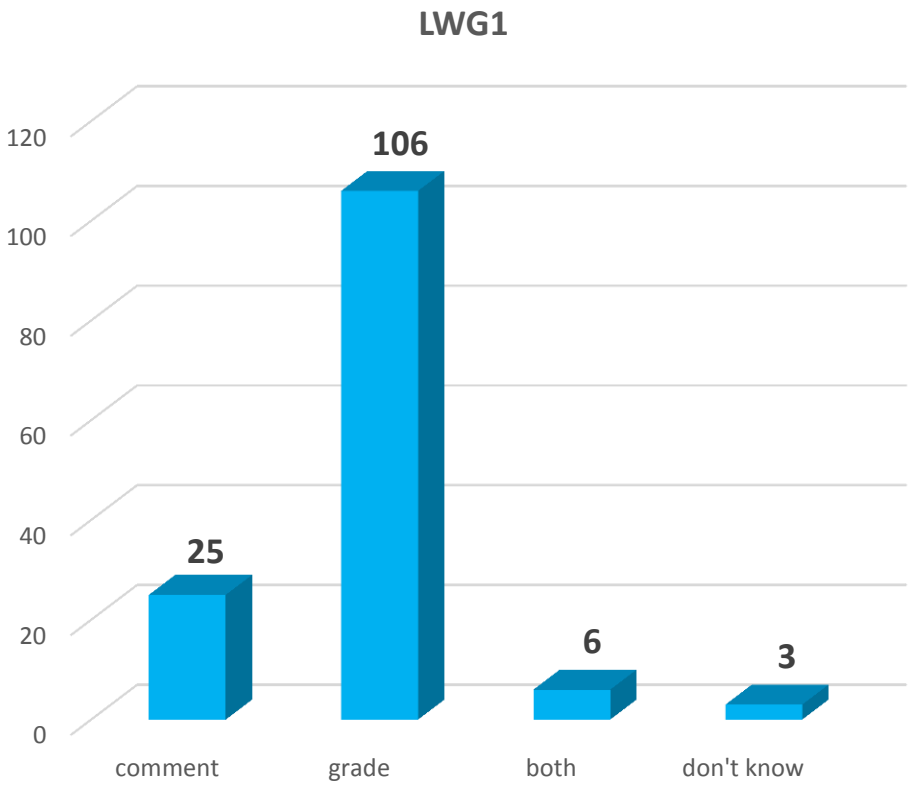
- **Students' opinion on usefulness of provided commentaries**

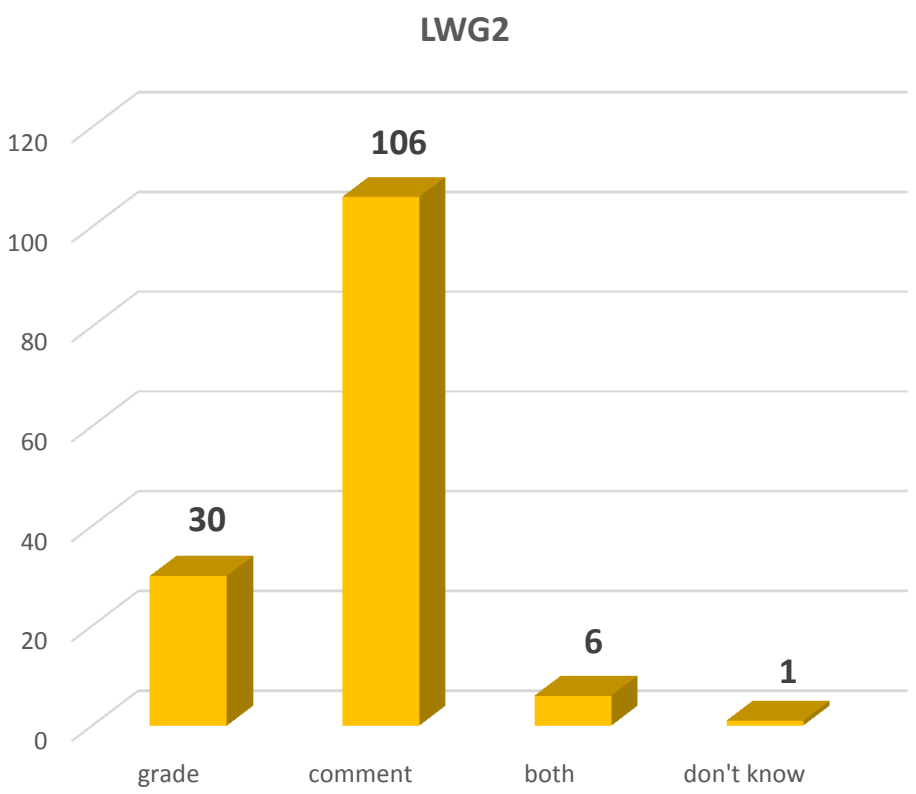




Results

- **Students' preference in the provided feedback**





Conclusions

- The peer-assessment seems to be a perspective method for assessing students in the inquiry based lessons in integrated science at primary level and biology at lower secondary level. This assessment method enables to express students' performance in all steps of inquiry tasks.

- Students preferred commentaries in the written feedback instead of the final grade. Three quarters of students chose the commentaries as most useful part of the feedback. After that they added these commentaries are better understandable for them and they know what to improve in their next work.

- They also stated that the feedback help them to improve their product (independently on the provider of feedback). Both groups, experimental and control, found the written commentaries more helpful than classical grades.

Conclusions

- During the experiment there were no boycotting of the peer feedback but most of students would prefer the teacher's assessment. In the additional question they quoted that their teachers are educated, more responsible, trustworthy so they trust them more than their peers.

- In the long-term study it was found that students are able to improve their assessing competences and provide better feedback when they got more experience with this formative assessment. After that they also trust more in the feedback from their peers.

- On the other hand, the main problems are still insufficient word power and low level of students‘ and teachers‘ personal experience with inquiry-based education.

Thank you for your attention.

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