

Effectiveness of Student Learning during Experimental Work in Primary School

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Appendix 1

Table A1: The rubric adopted for the data analysis regarding the effectiveness of experimental work level 2

A - The teacher's learning objectives - What the students were supposed to learn Source of information: <i>The teacher's unit-lesson plan</i>	D - What the students actually learn Source of information: <i>The interview with the students after the chemistry unit-lesson</i>
Objectives the teacher stated in her/his lesson plan and that are related to*: <ul style="list-style-type: none"> • Students' acquiring of content knowledge: <hr/> • Development of students' experimental skills and abilities: <hr/> • Students' development of natural science competences: <hr/> 	Objectives the teacher stated in the interview and that are related to*: <ul style="list-style-type: none"> • Students' acquiring of content knowledge: <hr/> • Development of students' experimental skills and abilities: <hr/> • Students' development of natural science competences: <hr/>
 <p>The efficiency of experimental work on level 2</p>	
Proportion of correct student's answers regarding chemistry unit-lesson related to: <ul style="list-style-type: none"> • Understanding of the content of the experimental work: <hr/> • Understanding of the laboratory equipment, safety issues, reagents, reaction conditions of the experimental work: <hr/> • Transferability of the knowledge gained in the experimental work to new situations: <hr/> 	
Findings about the efficiency of experimental work on level 2 (A vs. D): <hr/>	

* The objectives according to the National chemistry curriculum.²

Table A2: The rubric adopted for the data analysis regarding the effectiveness of experimental work level 1

B - The design or the selection of experimental tasks for the learners			C - Consideration about what students actually do	
Source of information: <i>Worksheets for students during the experimental work prepared by the teacher</i>	Source of information: <i>Analysis of the videotapes of the chemistry lessons by Flanders Interaction Analysis Chart</i>		Source of information: <i>Completed worksheets for students after their experimental work</i>	Source of information: <i>Analysis of the videotapes of the chemistry lessons by Flanders Interaction Analysis Chart</i>
<p>I. Tasks in relation to the curriculum objectives*:</p> <ul style="list-style-type: none"> • Students' acquiring of content knowledge: _____ • Development of students' experimental skills and abilities: _____ • Students' development of natural science competences: _____ <p>II. Taxonomic levels of tasks**:</p> <p>_____</p> <p>III. Structure of the worksheets involves***:</p> <ul style="list-style-type: none"> • Theoretical part: _____ • Reagents: _____ • Laboratory equipmet: _____ • Chemical safety protocol: _____ • Procedure: _____ <p>IV. Levels of the triple nature of chemical concepts****:</p> <p>_____</p>	<p>Treys with chemicals and laboratory equipment prepared for students' before the unit-lesson:</p> <p>Yes/No</p>	<p>↔</p> <p>The efficiency of experimental work on level 1</p>	<p>I. Worksheet completed: __%</p> <p>II. Correctly solved worksheet: __%</p> <p>III. Correctly solved tasks by taxonomic levels:***</p> <ul style="list-style-type: none"> • I. level: __% • II. level: __% • III. level: __% <p>IV. Feedback provided to students about the correct answers of the tasks:</p> <p>Yes/No</p>	<p>I. Teachers' activities during experimental work: __%</p> <ul style="list-style-type: none"> • The level of objects and observations****: __% • The level of ideas****: __% • Noise****: __% • Chemical safety during experimental work***: _____ • Environmental care***: _____ <p>II. Students' activities during experimental work: __%</p> <ul style="list-style-type: none"> • The level of objects and observations****: __% • The level of ideas****: __% • Noise****: __% • Chemical safety during experimental work***: _____ • Environmental care***: _____
<p>Findings about the efficiency of experimental work on level 1 (B vs. C):</p> <p>_____</p>				

* The objectives according to National Chemistry Curriculum;²

** The taxonomic levels of tasks were examined according to adopted³⁴ Bloom's cognitive domain taxonomy: I. – Remembering, II. – Comprehending and Applying, III. – Analysing, Synthesising and Evaluating;

*** The relevance was examined according to scale: E – Excellent, S – Somewhat, P –Poor;

**** The levels of the triple nature of chemical concepts were examined according to scale: M- Macroscopic, P- Particulate level, S - Symbolic level

***** Teacher's and students' activities have been examined based on analytical framework for evaluating of the efficiency of experimental tasks by Millar et al.⁶