WHAT LESSON OBSERVATION DATA REVEAL ABOUT THE CHANGES IN TEACHING SCIENCE: CASE STUDY FROM LATVIA

Liga Cakane, Jelena Volkinsteine, Dace Namsone, Ilze France,
University of Latvia, Riga, Latvia

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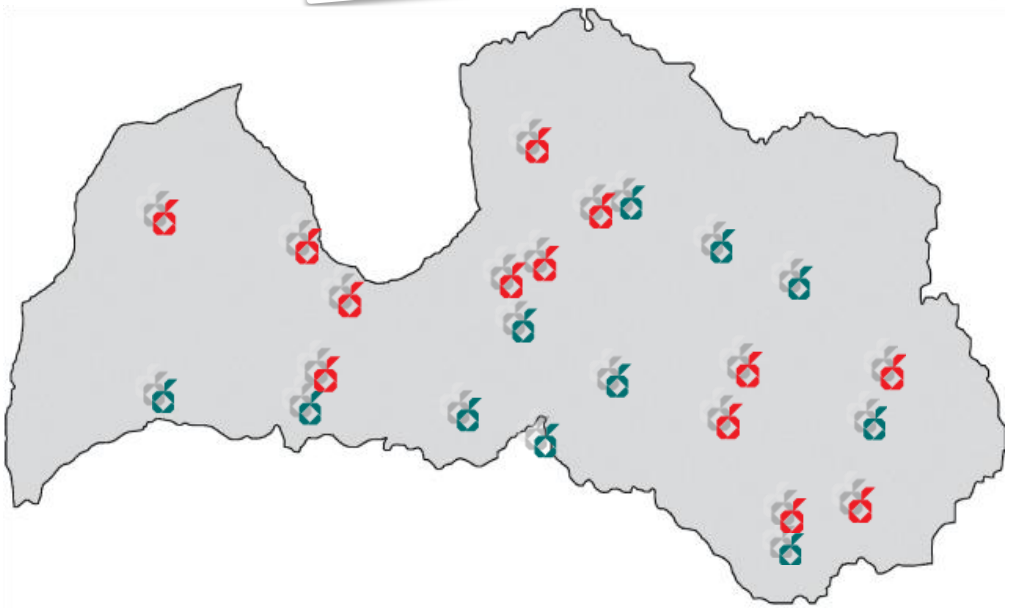
Educational Reforms in Science and Mathematics in Latvia

2005

2008

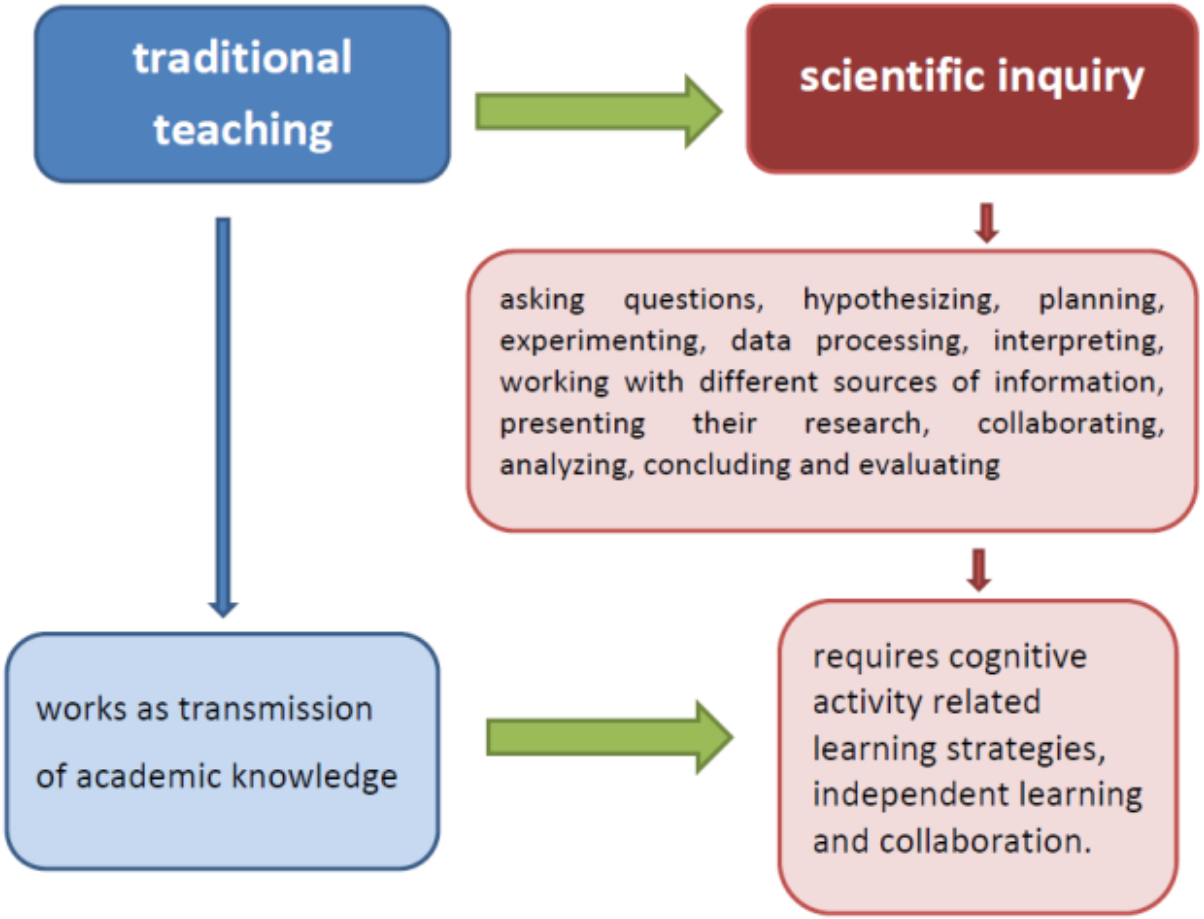
2012…



Priorities of Contemporary Teaching and Learning Process in Science

- Students understanding about science
- **Scientific inquiry**
- Link with real life
- Contemporary teaching and learning strategies
- ICT usage

Essence of the changes have begun



- (OECD) Program for International Student Assessment (PISA) outcomes related reforms that call for the need to improve learners‘ progress.

- OECD PISA research shows a gradual increase in students’ output in science subjects (490 points (2006) and 502 points (2012)), the number of students showing high level output and higher order cognitive skills is insufficient.

Constructivist-oriented instruction in the classroom emphasizes

- inquiry based learning,
- collaborative support,
- improvement of problem-solving and critical thinking,
- support to help students to construct mental models and experience conceptual change,
- use of technology,
- impact of students and teachers' beliefs

(Schraw et al., 2006).

On the lesson level it means

- to set learning outcomes,
- to refresh students' experiences,
- to hook and to interest them,
- to offer cognitive and metacognitive strategies that are helpful for knowledge construction,
- to provide feedback, strategies with high effect size, etc.

Impact on students' progress

Teachers - effect size is 0,47

Teaching - effect size is 0,43

(Hattie, 2012)

What learning reforms demand from the teacher

- Academic knowledge alone is not enough, and in order to master the necessary competencies, teaching and collaboration skills as well as different teaching techniques are gaining increasing importance

  Cordingley et al., 2003; Baumfield and Butterworth, 2007

- Education researchers, whose research based approach to learning process is relatively new, write about the difficulties encountered by teachers when they organize students' scientific inquiry.

  Bybee, R., & Fuchs, B. 2006, etc.

- The contents of teachers' curricula for example, chemistry (Latvijas Universitāte, n.d.b) reveal the traditional focus on acquiring academic knowledge in physics, chemistry, biology and mathematics.
- Today teachers can learn how to plan, organize and analyze a chemistry lesson by practicing to structure, model and analyze learning classes (Latvijas Universitāte, n.d.a; Daugavpils universitāte, n.d.)
- Based on the Education Act of Latvia, practicing teachers are entitled to professional development programs of 36 hours over three years.

Choosing lesson observation as a research tool

To clarify how some aspects of reforms set in governmental resolutions are actually implemented in the science subjects' classroom, this research used lesson observation and analysis.

Categories (education aspects) and chosen criteria

Categories (Educational components) – 2006	**Competencies – 2015**	**Criteria of how students' learning is organized**
Analytical and critical thinking skills	Analytical and critical thinking tools (Knowledge construction)	• What is the level of cognitive activity?
Learning skills	Self-directed learning	• Are learning outcomes clear to students?
		• Do students receive feedback on their learning?
Cooperative skills	Collaboration	• Does the lesson have student collaboration?

The following criteria were chosen to evaluate teachers' performance:

- teachers' usage of appropriate teaching and learning strategies to achieve the set learning goals;

- teachers' knowledge of the techniques of the chosen teaching methods;

- teachers' performance teaching collaboration strategies.

Research questions

- What do lesson observations reveal about the students' higher order cognitive activity, development of learning skills and collaboration in science subject lessons?

- What information does lesson observation reveal about teachers' skills to organize learning according to the criteria selected?

Methodology of research

- In 2013 a total of 53 physics, chemistry, biology and science lessons were observed and analyzed.

- 9 schools representing all school types - primary schools, secondary schools, gymnasiums, evening schools.

- Science classes were observed in grades 5 and 6; biology and chemistry in grades 7-12.

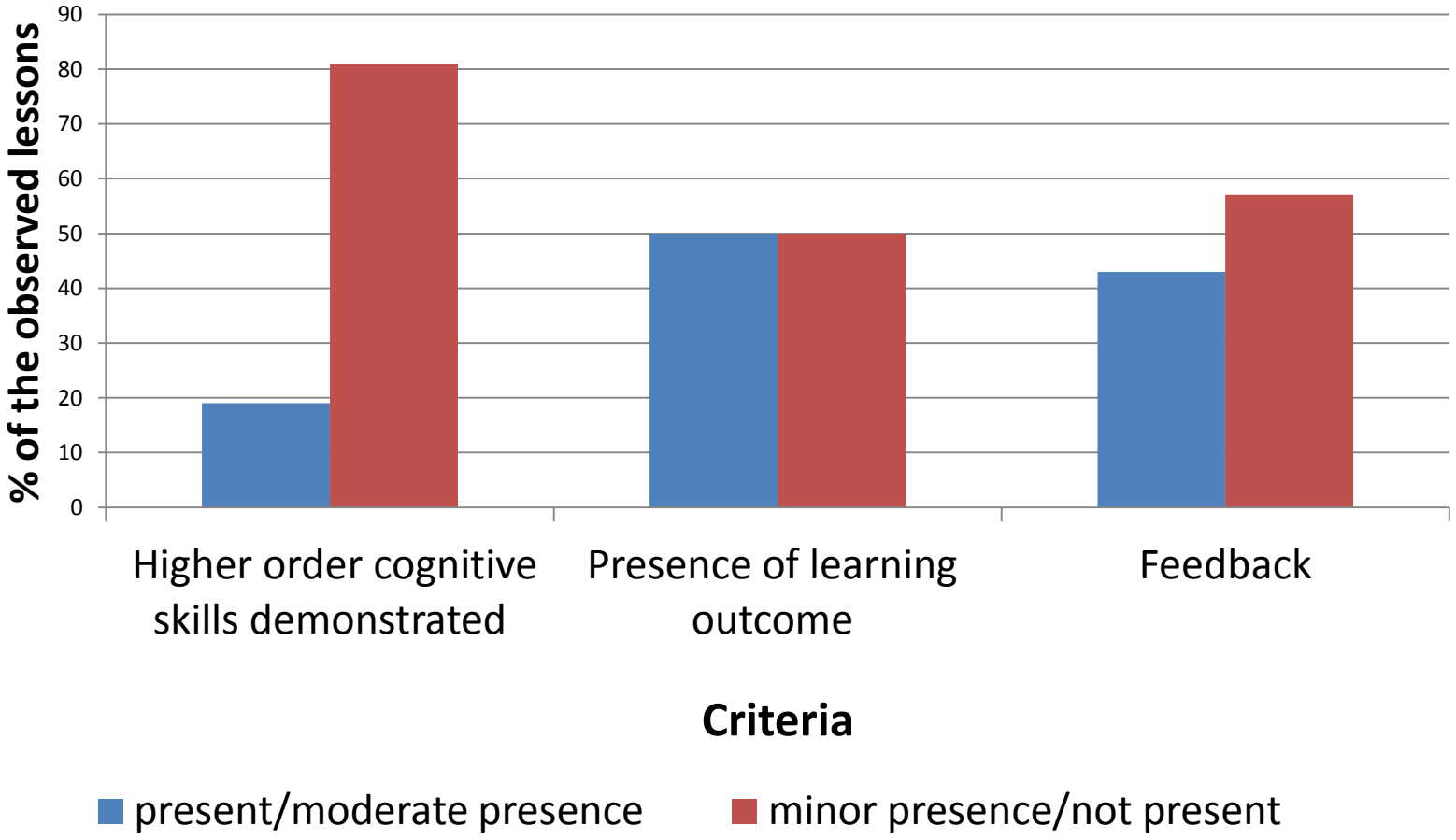
The observations were carried out by professionally trained experts from the Centre for Science and Mathematics Education.

The experts used specially developed e-observation sheets for transcript and analysis.

The information about the lesson activity was noted as well as the outcome.

Afterwards a conversation with the teacher was held.

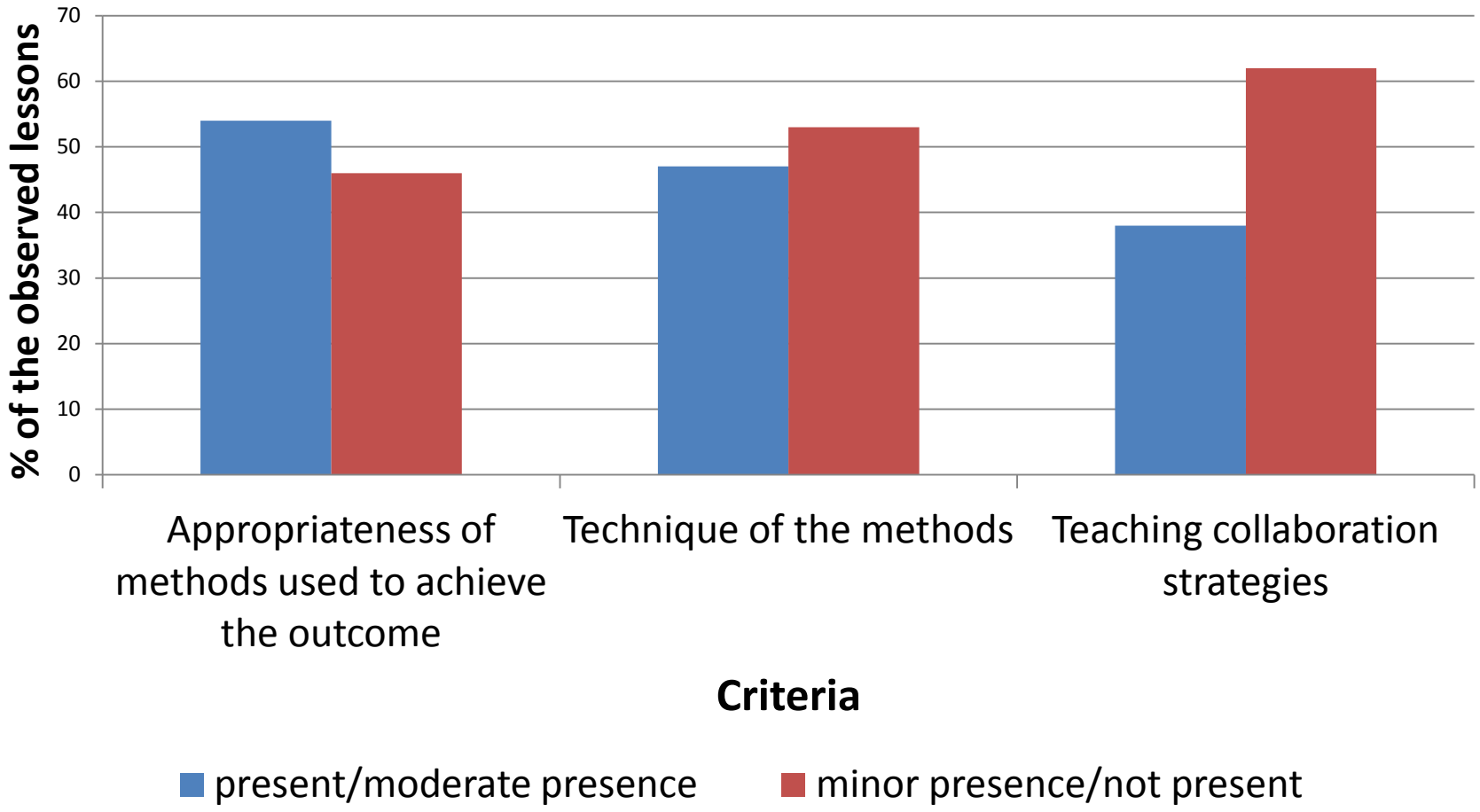
Results according to the criteria for students‘ learning analyses



The dominant description of the study process by experts characterizes the lessons as cognitively low:

- *students listen to the teacher's narrative, they engage in frontal discussion where they have to recognize and memorize the information they just heard;*
- *'conclusions are made by the teacher herself; students do laboratory tests following particular steps;*
- *students copy and write down what the teacher dictates; knowledge has been presented 'ready-made' – composition of the microscope, sequence of steps, etc.*

Results according to the criteria for analyses of teacher's skills



- The lesson lacks any scientific inquiry because it focuses on applying what has been learned according to a particular sample. At the same time the teacher asks the students what they have investigated. This means that the teacher is certain that her way of teaching is appropriate for teaching scientific inquiry.

- The situation is similar regarding collaboration skills.

- In 52% of analysed lessons the collaboration is present howewer it is obvious that assignment is not sutible for group work.
- About 10% of lessons are dedicated to students, collobaration skills development.

Comments by experts:

- *Experiments are performed in pairs because each pair has to share a set of equipment and a reagent box. No collaboration by essence.*
- *Students have conditions for joint work, but the teacher shows no organization attempts. There are a few groups where students collaborate and jointly try to solve the problem.*
- *Students follow their own collaboration pattern instead of the teacher organizing them. Pair work is based on students' self-initiative and understanding.*
- *Lack of clear assignment which leads students into self-organizing and collaboration gets out of control.*
- *The teacher says: "you can collaborate!" However, there are no clear guidelines of what has to be done, how to help the other pair and how to develop an excellent joint research.*

Conclusions and implications

1. The observed science lessons show the tendency that students have limited possibilities to master high order cognitive skills, learning skills and collaboration specified in the education policy regulations.
2. Generally the learning process can be described as reproductive and frontal.
3. Lessons show separate elements of scientific inquiry.

Students' output oriented planning requires a shift in teachers' thinking

from, "what am I, a teacher, going to tell my students during the lesson?" to

"what are my students going to learn today?"

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Practice shows that in real life teachers lack the skills in using completely new techniques and methods, teachers have to do two things at a time: perform and learn from the new practices.

- In this situation teachers' views on teaching as well as their analysis and reflection skills become extremely important

Volkinsteine et al., 2014; France et al., 2015

- If new techniques give no result, teachers with insufficient self-analysis and reflection skills are unlikely to analyze their performance. They choose the easiest way – to continue the traditional way of teaching

Darling-Hammond et al., 2008

- Teachers' analysis and reflection skills are possible to improve through discussion, opinion exchange, practicing analysis, and reflection about real learning situations in their own and their colleagues' practices.

- The research reveals the gap between the priorities described in the education policy resolutions from 2006 and the reality in the classroom in 2013 where the mode of transmitting information and only includes separate elements of new learning aspects

- If we want to improve student,s outcomes we should change the situation in the classroom.

Thanks for your attention!