


---

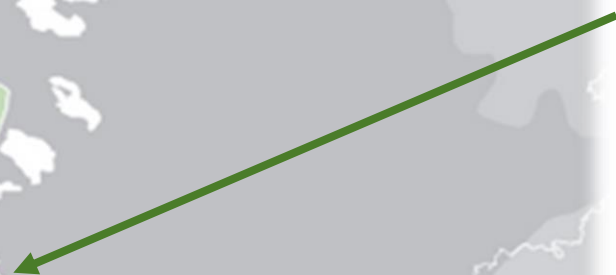
# How the Absence of Higher PISA Scores is Connected to the Science Classroom?

*Dace Namsone*  
*October 14, 2015*





**Latvia**







**Riga – Paris of the North**

# Introduction and background

---

- ❖ In 1998 development of the change of approach to the Science and Math curriculum was begun
- ❖ The implementation of complex reforms in Science and Math education in Latvia 2005-2011 (grades 7-12)
- ❖ The Center for Science and Math Education University of Latvia; from the end of 2011
- ❖ OECD PISA results show a gradual increase in students' performance in science subjects from 2006, but high level output is insufficient



# Introduction and background

*Table 1. Performance dynamics of Latvian students in PISA Science tests.*

	2006	2009	2012
<b>Student performance in science (main score)</b>	490	494	502
<b>Low performers (% of students below level 2)</b>	17.4	14.7	12.4
<b>Top performers (% of students at level 5 &amp; 6)</b>	4.1	3.1	4.4

# Methodology and Research

---

- ❖ **Research question:** What do lesson observations reveal about the students' cognitive activity, the clarity of learning goals and feedback in science subject lessons?
- ❖ Lesson observations in real classroom setting and their analysis was used in this research to identify connection to PISA results
- ❖ In order to determine how several aspects of the curriculum reforms were implemented specified criteria were picked
- ❖ SOLO taxonomy was used to compare observed lesson outcomes

# Methodology and Research

*Table 2. Categories and chosen criteria.*

Sequence in reforms		Specified criteria
Skills 2006	Competencies 2015	
Analytical and critical thinking skills	Analytical and critical thinking (Knowledge construction)	The level of cognitive demand
Learning skills	Self-directed learning	Learning goals Feedback

# Methodology and Research

*Table 3. Comparison of the levels of cognitive demand.*

Level of cognitive demand	PISA level	National testing	Lesson observation	SOLO taxonomy
<b>High</b>	5, 6	High	3	Extended abstract; relational
<b>Medium</b>	3,4	Medium	2	Multi-structural
<b>Low</b>	1a, 2	Low	1	Non-structural
<b>Under low</b>	1b		0	Pre-structural



# Methodology of Research

---

**Following research methods were used fo data collection and analysis:**

- ❖ Lesson observation and analysis by proffesionally trained experts
- ❖ Analysis of experts' feedback
- ❖ Analysis of curriculum documents, data of PISA research 2006-2012 and national testing



## Lesson Observations

# Methodology of Research

---

## Collected data:

- ❖ In total 53 physics, chemistry, biology and science lessons in 9 different schools were observed and analysed
- ❖ 94% of science subject teachers from these schools were observed
- ❖ Schools represent all school types – primary, secondary and gymnasiums

## Research results

- ❖ Research shows presence of higher order cognitive demand in 19% of observed lessons only

*Table 5. Results according to the criteria selected (% of observed lessons).*

Criteria/ Level	3	2	1	0
Level of cognitive demand	5	14	57	24
Presence and clarity of learning goals	25	25	35	15
Feedback	10	33	36	21



## Research results

---

- ❖ Clarity of learning goals on acceptable level (2-3 scale) was observed in 50% of lessons
- ❖ Use of feedback was observed in 43% lessons, but mostly teachers failed to communicate feedback
- ❖ Experts comment to lesson transcript for an example:

*“..the science class had a wonderful opportunity to focus on the essence of a solution as a concept and use previously mastered skills in a new situation in context. However, this opportunity was not used and problems were drilled by mechanically copying a set pattern.”*



## Discussion and conclusions

---

- ❖ Focus on low cognitive activity may be one of significant reasons why students fail higher levels of PISA tests
- ❖ Most of learning goals were of a low cognitive level and required memorizing and copying a set example

## Discussion and conclusions

---

- ❖ Research shows that design and implementation of teaching strategies for developing HOCS challenge even the most expert teachers (Barak, Ben-Chaim, Zoller 2007)
- ❖ Possible cause for situation is that teachers are expected to teach skills that they themselves have never learned to teach
- ❖ There is a necessity for teachers' professional development to close the gap between the content of educational documents and a classroom practice

---

**For more information please contact me:**

[dace.namsone@lu.lv](mailto:dace.namsone@lu.lv)

# References

---

- Barak, M., Ben-Chaim, D., & Zoller, U. (2007). Purposely Teaching for the Promotion of Higher-order Thinking Skills: A Case of Critical Thinking. *Research in Science Education - RES SCI EDUC*, 37 (4), 353-369.
- Baucal, A., & Pavlović-Babić, D. (2011). The Big Improvement in PISA 2009 Reading Achievements in Serbia: Improvement of the Quality of Education or Something Else? *CEPS Journal*, 1 (2011) 3, 53-74.
- Baumfield, V., & Butterworth, M. (2007). Creating and translating knowledge about teaching and learning in collaborative school/university research partnerships: an analysis of what is exchanged across the partnerships, by whom and how. *Teachers and Teaching: Theory and Practice*, 13(4), 411-427.
- Biggs, J.B., and Collis, K.F. (1982). *Evaluating the Quality of Learning – the SOLO Taxonomy*.  
New York: Academic Press.
- Bybee, R., & Fuchs, B. (2006). Preparing the 21st century workforce: A new reform in science. *Journal of Research in Science Teaching*, 43(4), 349-352.
- Cordingley, P., Bell, M., Rundell, B. & Evans, D. (2003). *The impact of collaborative CPD on classroom teaching and learning. In: Research Evidence in Education Library*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
- Darling-Hammond, L., Barron, B., Pearson, P. D., Schoenfeld, A. H., Stage, E. K., Zimmerman, T. D., Cervetti, G.N., & Tilson, J. (2008). *Powerful Learning: What We Know About Teaching for Understanding*. San Francisco: John Wiley & Sons Inc., by Jossey-Bass, a Wiley imprint.

# References

---

- France, I., Namsone, D., & Cakane, L. (2015). What Research Shows about Mathematics Teachers' Learning Needs: Experience from Latvia. In *SOCIETY, INTEGRATION, EDUCATION*, 2, 45–55). Retrieved from <http://journals.ru.lv/index.php/SIE/article/view/457>
- Fullan, M., Langworthy, M. (2014). *A Rich Seam. How New pedagogies Find Deep Learning*. London: Pearson.
- Hattie, J. (2012). *Visible learning for teachers. Maximizing impact of learning*. London and New York: Routledge.
- Kapanadze, M., & Eilks, I. (2014). Supporting Reform in Science Education in Central and Eastern Europe - Reflections and Perspectives from the Project TEMPUS-SALiS. *Eurasia Journal of Mathematics, Science & Technology Education*, 2014, 10(1), 47-58.
- Millar, R. (2013). Improving science education: Why assessment matters. In D. Corrigan, R. Gunstone, & A. Jones (Eds.), *Valuing assessment in science education: Pedagogy, curriculum, policy* (pp. 55-68). Dordrecht: Springer.
- OECD (2013). PISA 2015draft science framework. Retrieved from <http://www.oecd.org/pisa/pisaproducts/pisa2015draftframeworks.htm>
- OECD (2014). What Students Know and Can Do: Student Performance in Mathematics, Reading and Science. (Volume I, Revised edition, February, 2014). Retrieved from <http://gpseducation.oecd.org/CountryProfile?primaryCountry=LVA&treshold=10&topic=PI>
- Olson, J. (2003). School technology education: the search for authenticity. In: E.W. Jenkins (Eds.), *Innovations in science and technology education*. Vol. VIII. Paris: UNESCO Publishing.



# References

---

Park, J., Park, Y- S., Kim, Y., Park, J., & Jeong, J - S. (2014). The development of the korean teaching observation protocol (KTOP) for improving science teaching and learning . *Journal of Baltic Science Education, Journal of Baltic Science Education*, 13(2). Retrieved from <http://journals.indexcopernicus.com/abstract.php?icid=1101952>

Pavlova, M., & Pitt, J. (2003). Technology education in the Russian Federation: is the perspective clear? In: E.W. Jenkins (Eds.), *Innovations in science and technology education*. Vol. VIII. Paris: UNESCO Publishing.

Roberson, T.J. (1998). *Classroom observation: Issues regarding validity and reliability*. Paper presented at the annual meeting of the Mid-South Education Research Association, 6 November, in New Orleans, LA.

Schoenfeld, A. H. (2013). Classroom observations in theory and practice. *ZDM, the International Journal of Mathematics Education*, 45, 607–621.

VISC (2015). Diagnosticējošais darbs dabaszinātnēs 9. klasei 2014./2015. mācību gadā: rezultātu analīze un ieteikumi. Metodisks materiāls. Retrieved from

[http://visc.gov.lv/vispizglitiba/eksameni/dokumenti/metmat/2014\\_2015\\_ddarbs\\_dabzin\\_9kl\\_analize.pdf](http://visc.gov.lv/vispizglitiba/eksameni/dokumenti/metmat/2014_2015_ddarbs_dabzin_9kl_analize.pdf) p.45

Volkinsteine, J., Namsone, D., Cakane, L. (2014). Latvian chemistry teachers' skills to organize student scientific inquiry. *Problems of education in the 21st Century*, 59, 86 – 98.