

COGNITIVE DEMAND IN OBSERVED LESSONS AND NATIONAL TESTING COMPARED TO PISA MATHEMATICS RESULTS IN LATVIA

INTRODUCTION & BACKGROUND

Despite of reforms in education, PISA results have not changed in Latvia. Priority to increase the number of top performers - students with higher-order thinking skills. Investigation of two areas to look for possible effects and links for why the PISA scores are stagnant:

- classroom teaching practices
- national exams and diagnostic tests

RESEARCH QUESTIONS

- What is the cognitive demand level of mathematics test items on the national exams and diagnostic tests?
- How do students perform on tasks requiring deep cognitive demand?
- What is the cognitive demand level of a typical Latvian mathematics lesson?

METHODOLOGY

- PISA's 6 proficiency levels in math and the Structure of the Observed Learning Outcome (SOLO) taxonomy were used to make comparisons between national testing scores & teaching practices (school year 2015/2016). 8th (N=15564) and 9th (N=15722) grades (ages 14 to 16, representing the age of students participating in PISA assessment). Analysis was done using Iteman Test Analysis & WinsSteps Raschtest programs. Every task and item on the diagnostic tests and exams at all 5 levels were evaluated, according to the SOLO taxonomy, for their depth of subject understanding necessary to answer the question correctly (see table 1 and 2).
- Lesson analysis: one municipality as a case study with 10 different types of schools that are characteristic of the country as a whole. Observed lessons focused on 3 criteria: level of cognitive demand in the lesson, clarity of learning goals, and constructive feedback to students.

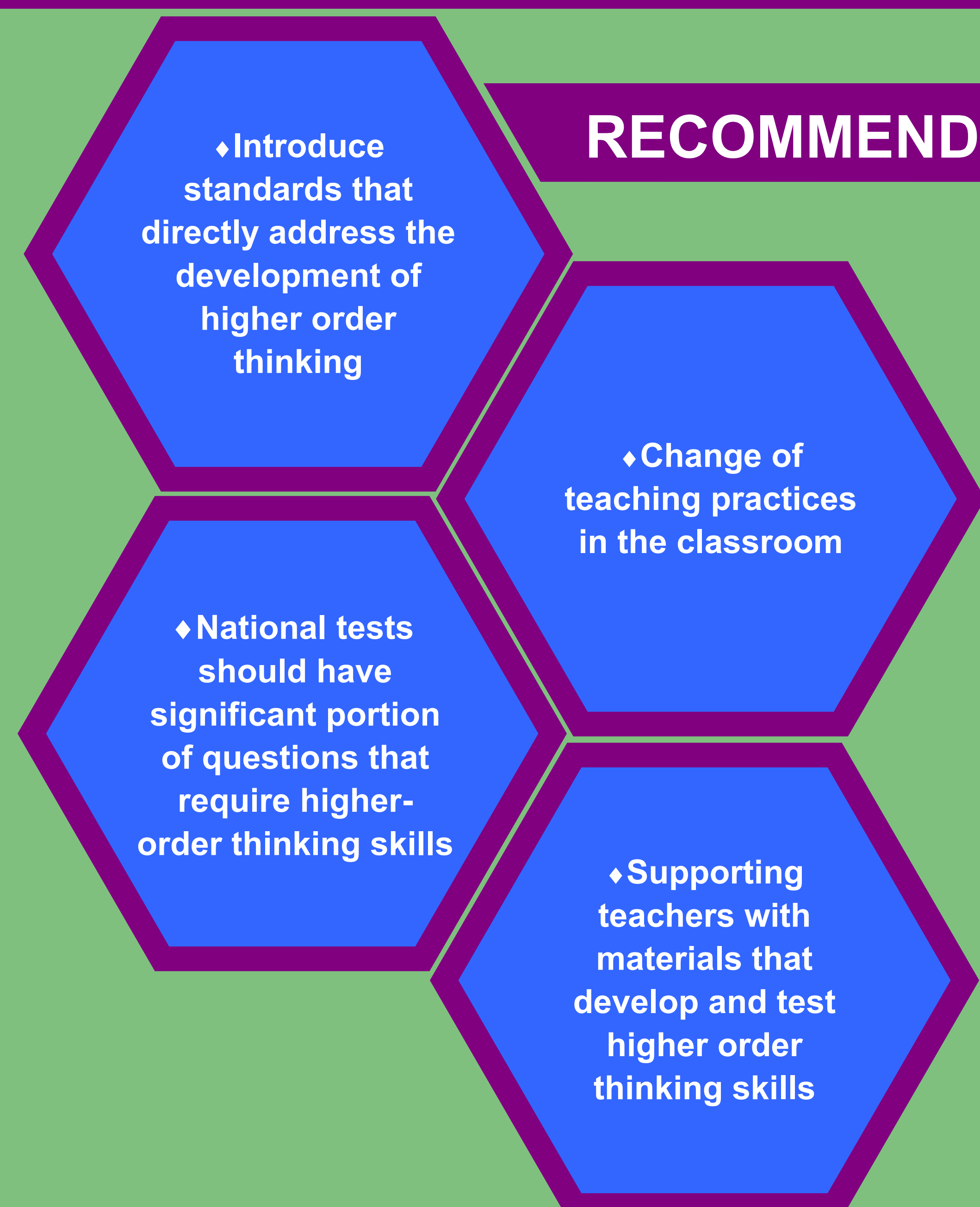
Table 1 Comparison of instruments used to measure student performance

Level of cognitive demand	PISA proficiency level	PISA cognitive level	National testing	Lesson observation	SOLO taxonomy
High	5, 6	High	High	3	Extended abstract
Medium	4, 3	Medium	Medium	2	Relational
Low	2	Low	Low	1	Multi-structural
	1a			0	Uni-structural
Under low	1b				Pre-structural

Table 2 Cognitive Demand Rubric

0	1	2	3
The learning activity doesn't require students to construct knowledge. Students can complete the activity by reproducing information or by using familiar procedures	The learning activity does require students to construct knowledge by interpreting, analyzing, synthesizing, or evaluating information or ideas but the activity's main requirement is not knowledge construction	The learning activity's main requirement IS knowledge construction but the learning activity does not require students to apply their knowledge in a new context	The learning activity's main requirement is knowledge construction and the learning activity does require students to apply their knowledge in a new context

RECOMMENDATIONS



RESULTS

National math tests minimally measure higher-order critical thinking skills. Only 8% of the 8th grade diagnostic testing requires deep cognitive thought and none of the 9th grade questions required such thinking.

Observed math lessons limit student opportunities to develop higher-order cognitive skills levels 5 & 6 (according to PISA). Only 29% of the lessons indicated the use of higher-order cognitive skills on an acceptable level (2-3 on a scale of 0-3).

FURTHER RESEARCH:

Learning of middle level cognitive demand is sufficient but why high levels of cognitive demand are missing from math classes? What are the other factors to be considered?

Whether the teachers are merely teaching at a level they know will be on the national tests, or are there more fundamental factors involved, like instructional practices in schools?

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