Use of cross-national studies for curricular framework development in the Czech Republic

A case of TIMSS 2007 impact on mathematics curricula

Gaborone, Botswana

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ESF

Competency I

1. PIRLS 2011, TIMSS 2011

2. ICCS 2009

3. PISA 2012

4. Impact of international studies

Competency II

1. PIAAC

Why TIMSS is so important to Czech education?

Unlike most of European countries, the Czech Republic does not administer national tests in compulsory education.*

The analyses based on international tests are the only data on student achievement available.

*The national testing in grades 5 and 9 is to be introduced according to the new government.
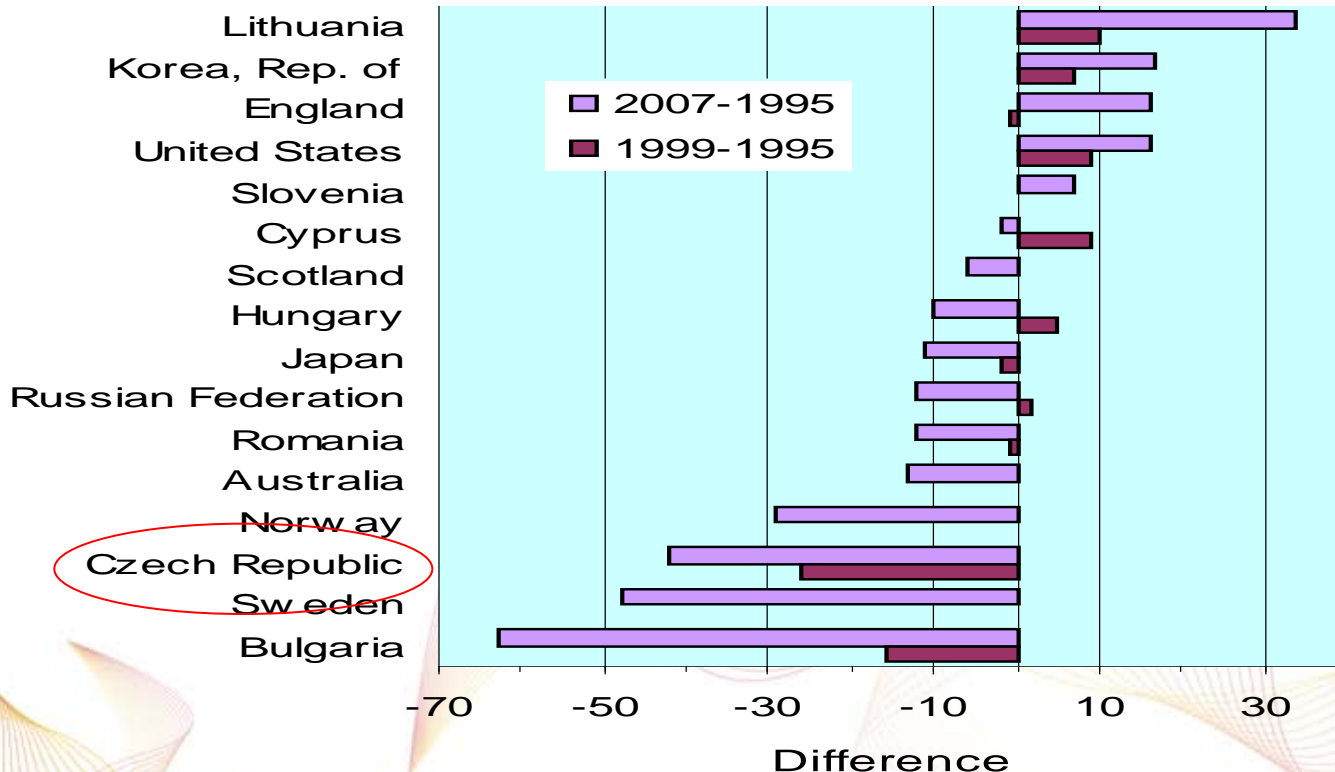
What did the data of TIMSS 2007 say?

„Taking the 12 countries that have trend data between 1995 and 2007 at both grades, the pattern persists with more improvements at the fourth than the eighth grade. Only the Czech Republic and Hungary had lower achievement at the fourth grade, as well as at the eighth grade." (TIMSS Int. Report, p. 51.)

Changes in average mathematics achievement of eighth-grade students (1995 – 2007; European or OECD states)

MATHEMATICS

Difference

What did the data of TIMSS 2007 say?

Czech Republic at the fourth grade:

The difference between average scale score

1995 and 2007 is **-54**.

This is the **largest decrease** among

all European or OECD countries that

participated in both TIMSS assessments.

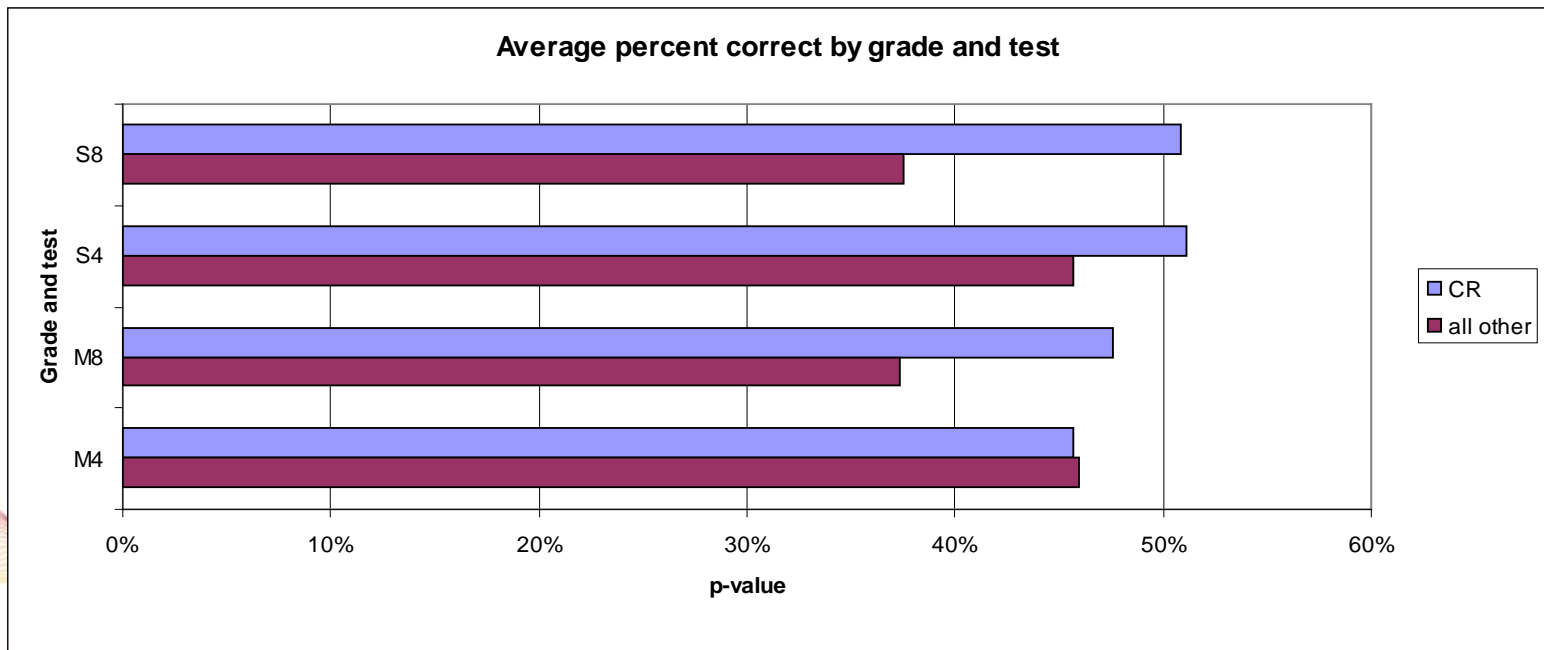# How could we use these international data

Direct use

Program Development

↓

●change of curriculum

● change of teacher
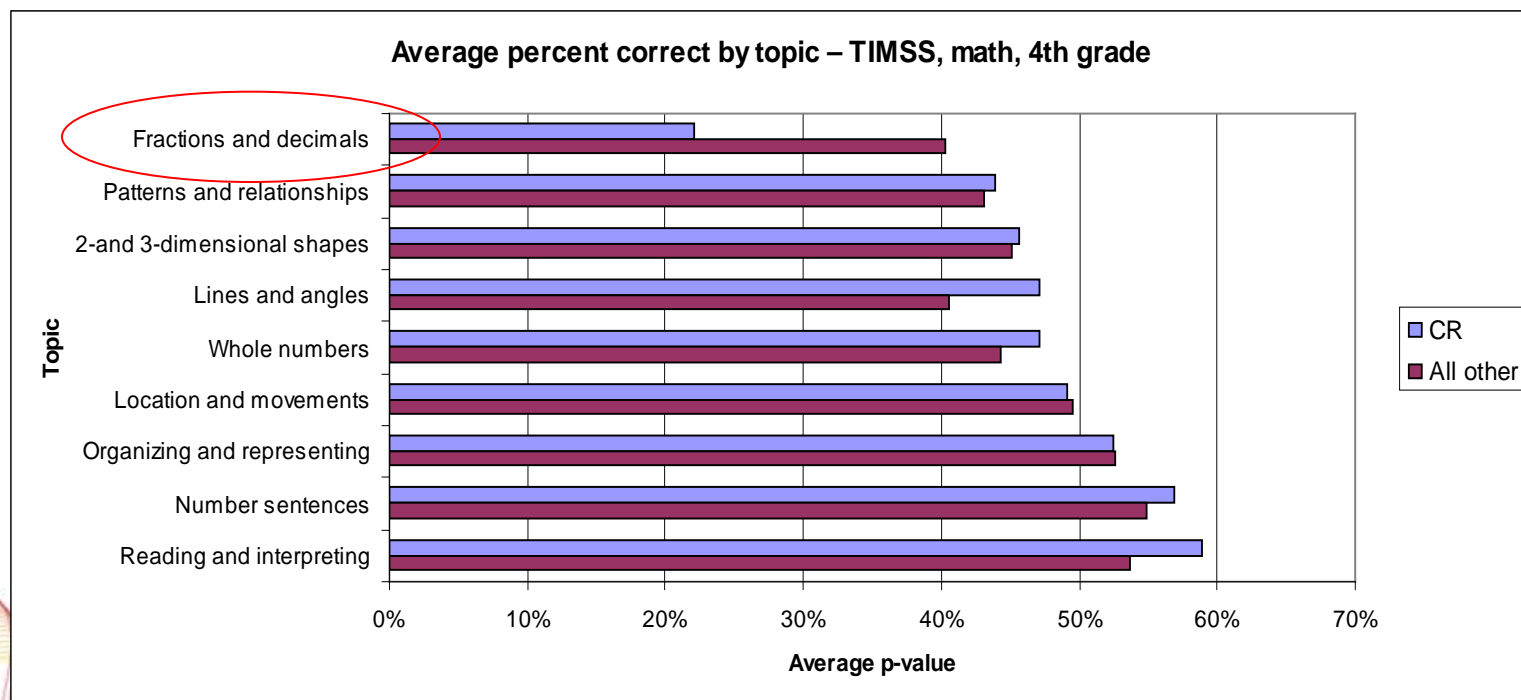development

Indirect use

● change the attitudes
of teachers, parents

● get more support from
politicians

Average p-value (percentage correct) of the Czech pupils compared to international average

Average percent correct by grade and test

Detailed analysis

Average percent correct by topic – TIMSS, math, 4th grade

How to use the TIMSS results for curriculum improvement?

For the purpose of local program development, it might be more appropriate to analyze the TIMSS data on the level of individual items

The items with the lowest performance relative to all the other countries

kod1	kod2	usp_cr	usp_vse	usp_r	Content Dc	Topic Area	Topic Area	Cognitive [	Item Label
M041046	M12_05	7,2	44,7179	-37,5179	Number	Fractions a		3 Knowing	
M041059	M12_04	2,9	40,4	-37,5	Number	Fractions a		1 Knowing	
M041298	M12_01	34,8	65,21194	-30,41194	Number	Fractions a		1 Knowing	
M031029	M07_01	23,7	53,24857	-29,54857	Number	Fraction an		4 Knowing	4/5 minus 1/5
M041076	M04_04	7,9	37,19039	-29,29039	Number	Fractions a		4 Knowing	Fraction of money Joe spent
M041320	M10_05	17,4	43,99991	-26,59991	Number	Fractions a		3 Knowing	
M031325	M11_09	5,1	28,63843	-23,53843	Geometric	Lines and /		3 Applying	
M031317	**M11_05**	15,2	38,10113	-22,90113	Number	Number Se		1 Knowing	
M041151	M08_10	40,9	61,81808	-20,91808	Geometric	2-and 3-dir		4 Reasoning	
M041152	M04_08	23,5	42,15054	-18,65054	Geometric	2-and 3-dir		5 Applying	Area of the fence to be painted
M041250	M02_05	25,3	43,89216	-18,59216	Number	Fractions a		6 Knowing	Subtract 5.3 - 3.8
M041148	M10_09	11,4	29,69307	-18,29307	Geometric	2-and 3-dir		3 Knowing	
M041069	M04_03	6,7	24,96463	-18,26463	Number	Fractions a		3 Knowing	Fraction equal to 2/3
M031183	**M09_03**	4,9	22,96216	-18,06216	Number	Whole Nun		7 Applying	
M041006	M02_04	23,2	40,70311	-17,50311	Number	Fractions a		1 Knowing	Fraction of the rectangle shaded
M041165	M14_10	9,7	26,3107	-16,6107	Geometric	Location ar		2 Applying	
M031245	M05_03	10,3	26,67378	-16,37378	Number	Number Se		1 Applying	Number in box of number sentenc
M041064	M06_03	40,4	56,75902	-16,35902	Number	Fractions a		2 Applying	
M041169	M12_07	33,1	49,34556	-16,24556	Geometric	Location ar		3 Knowing	

Released item with very low success relative to international average

$$\frac{4}{5} - \frac{1}{5} =$$

(A) $\frac{3}{5}$

(B) $\frac{3}{10}$

(C) $\frac{3}{25}$

(D) 3

M031029

TIMSS2007

Mathematics
Fourth Grade

Content Domain
Number

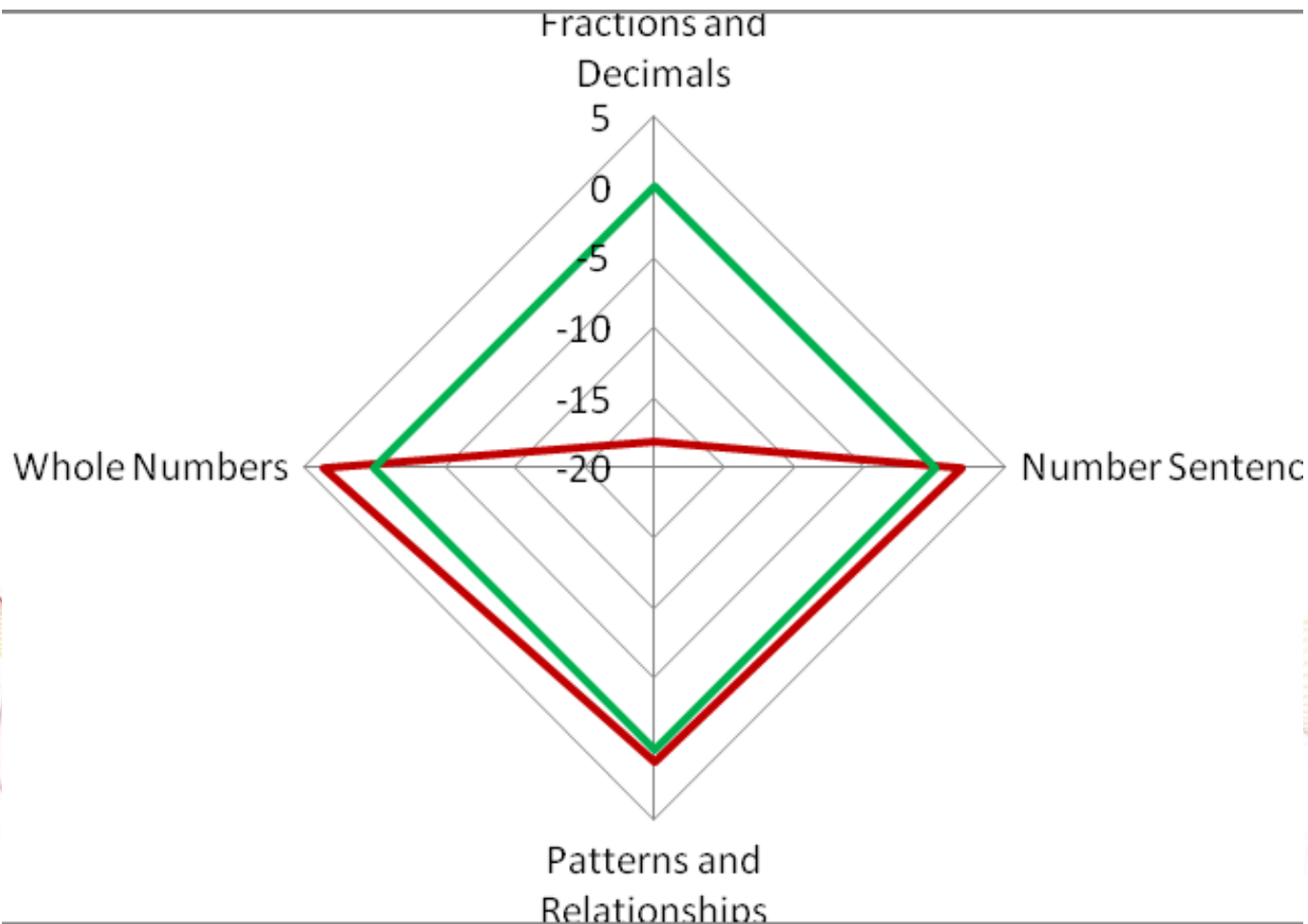**Cognitive Domain**
Knowing

What's wrong with the fractions in the Czech schools?
## Are they taught too late and/or too little?

The items that were omitted by Czech pupils more often than international average

Item	p CR	p other	omitted CR	omitted all	Difference	Released	Topic Area
M11_09	5,1	28,6	56,7	27,8	28,9	No	Lines and Angles
M01_04	6,1	15,4	57,1	28,7	28,4	Yes	Pattern & Relationships
M07_01	23,7	53,2	31,9	10,3	21,6	Yes	Fraction and Decimal
M08_04A	18,8	34,6	32,1	11,5	20,6	No	Fractions and Decimals
M07_02	0,3	14,7	33,5	14,7	18,8	Yes	Fraction and Decimal
M11_01	28,7	44,5	24,1	5,4	18,7	No	Fraction and Decimal
M14_10	9,7	26,3	43,1	24,9	18,2	No	Location and Movements
M04_04	7,9	37,2	34,9	16,7	18,2	Yes	Fractions and Decimals
M06_03	40,4	56,8	28,3	11,0	17,3	No	Fractions and Decimals
M10_08	34	44,1	35,5	19,3	16,2	No	Location and Movements
M12_04	2,9	40,4	25,2	9,5	15,7	No	Fractions and Decimals
M02_05	25,3	43,9	28,0	12,3	15,7	Yes	Fractions and Decimals
M02_04	23,2	40,7	21,4	6,6	14,8	Yes	Fractions and Decimals
M04_03	6,7	25,0	20,4	5,7	14,7	Yes	Fractions and Decimals
M10_05	17,4	44,0	19,3	5,3	14,0	No	Fractions and Decimals
M08_04B	5,2	17,6	48,6	34,8	13,8	No	Fractions and Decimals
M06_06	11,3	23,5	22,7	10,2	12,5	No	Fractions and Decimals
M03_04	24,1	26,0	38,5	28,0	10,5	Yes	Pattern & Relationships
M02_08D	26,1	25,3	35,2	25,1	10,1	Yes	2-and 3-dimensional shapes

Item disproportionally often omitted by Czech pupils
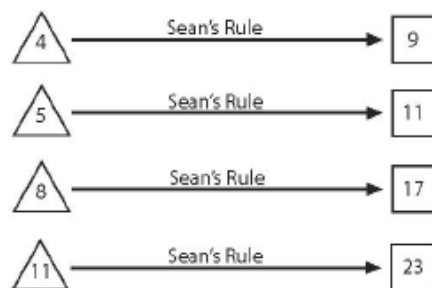
TIMSS2007

Mathematics

Fourth Grade

Content Domain
Number

Cognitive Domain
Reasoning

Suggested solutions

Short-term solution   **Long-term solution**

↓   ↓

Teacher manuals   Revision of the

national curricular

framework

A short-term solution – Teacher manuals

A series of teacher manuals is being developed that contains materials (activities, tasks) based on the analysis of the most common misconceptions or errors of the Czech pupils.

Manuals cover some of the gaps of the past and present national curricular framework.

Sample page of the manual

Examples:

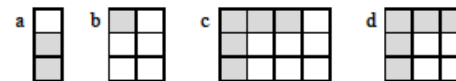What part of rectangle is colored?

Strana 1.3.6. **Zlomky**

Obdélník je rozdělen na 8 stejných kachlíků. Jeden kachlík je osmina celku. Tedy 1 = 1/8. Tři kachlíky jsou 3 osminy. Tedy 3 = 3/8. Vybarveny jsou 3/8 obdélníku. Nevybarveno je 5/8 obdélníků.
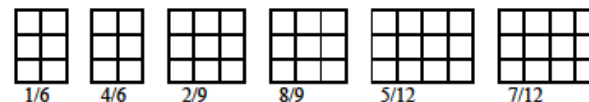
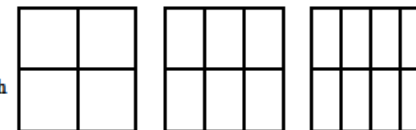1. Napiš jaká část obdélníku je vybarvena a jaká nevybarvena.

a   b   c   d

2. Vybarvi uvedenou část obdélníku

1/6   4/6   2/9   8/9   5/12   7/12

3. Jana tvrdí, že 4 desetiny jsou více než 2 pětiny, tedy že 4/10 > 2/5. Má pravdu? Vysvětli.

4. Zde jsou tři stejně velké čtverce. Vybarvi ¼ prvního, 1/6 druhého a 2/8 třetího čtverce. Která ze tří vyšrafovaných částí je nejmenší a která největší?

5. Na výletě nás bylo 30. Z toho 1/6 prváků, 2/15 druháků, 3/10 třeťáků, 7/30 rodičů a zbytek byli učitelé. Jakou část výletníků představovali učitelé?

6. Třetina tyče je modrá, polovina zbytku je červená a zbylých 30 cm je bílých. Jak dlouhá je tyč?

Komentář. Všechny úlohy zde jsou více na povídání než na počítání. Klíčové zde nejsou operace rozšiřování a krácení, ale to, že stejný objekt má více jmen. (Komentář pokračuje na následující straně.)

Výsledky. Cvičení 1. Vybarvena je a) 2/3, b) 1/6, c) 5/12, d) 5/9. Nevybarvena je a) 1/3, b) 5/6, c) 7/12, d) 4/9. **Cvičení 2.** Počet vybarvených kachlíků, zleva doprava: 1, 4, 2, 8, 5, 7. **Cvičení 3.** Jana nemá pravdu. Na obdélníku 2×5 je 1/10 = 1 , tedy 4/10 = 4 . Jedna pětina obdélníku je jeden dvojkachlík. Dvě pětiny obdélníku jsou tedy dva dvojkachlíky, což jsou 4 . Proto 4/10 = 4 = 2/5. **Cvičení 4.** Nejmenší je 1/6. Dále je ¼ = 2/8. **Cvičení 5.** Na výletě bylo 5 prváků, 4 druháci, 9 třeťáků, 7 rodičů a 5 učitelů. Učitelů byla 1/6 všech výletníků. **Cvičení 6.** Tyč je dlouhá 90 cm.

Long-term solution:
change of national curriculum

The Czech national curricular framework should be revised as the TIMSS 2007 has shown that too little and too late is covered in primary mathematics.

Unfortunately, the new curricular framework launched just in 2007 seems to exacerbate the problems that started in the mid-1990s by loosening the curriculum.

Example of suggested changes in national curricular framework

The results of TIMSS as well as other research showed that fractions are difficult but extremely important.

The concept of fraction could be taught at the primary level.

Our suggestion: Introduce the concept of fraction earlier in the Czech curricular framework.

Indirect use of the data TIMSS in the service of educational politics

Curriculum is always both a political and technical problem. It is not enough to solve technical problems of curriculum, it is necessary to change the mindset of teachers, parents and politicians as well.

In the Czech Republic, there is a weak popular support for the educational reforms as the Czechs are traditionally very satisfied with the educational system. Math is regarded as less important subject (compared to other OECD countries).

What are the next steps?

Opening a lot of questions.

Other forms of intervention based on our outputs.

Evidence based policy education!

Thank you!