

# Educational cultures in the light of comparative studies

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# Two international studies

- OECD PISA (Programme for International Student Assessment)
  - Age 15
- IEA TIMSS (Trends In Mathematics and Science Study)
  - "Grade 8" (and 4)

# Main focus of PISA

- What is important for future citizens to be able to do in realistic situations
- Not a test of what has been learnt or remembered of the school curriculum
- Mathematics, scientific and reading “literacy”
- Decided by consensus within OECD

# The focus of TIMSS

- Measuring competencies in mathematics and science
- A curriculum-based study
- "Equally unfair to all countries"

# On track of the lost information

- Results for individual items are usually not considered of value, only the overall scores are focused.
- We have heard enough about the international horse race.
- Our investigations are based on individual items, national p-values (percent correct responses)

# Looking for patterns in the p-values: p-value residuals

- How much better or worse is a national p-value than expected, on the basis of:
  - the international difficulty of the item
  - and the overall score for the country
- A simple example

	A	B	C	Mean
1	45	60	32	45,7
2	57	80	53	63,3
3	38	65	38	47,0
Mean	46,7	68,3	41,0	52,0

	A	B	C	Mean
1	-1,7	-8,3	-9,0	-6,3
2	10,3	11,7	12,0	11,3
3	-8,7	-3,3	-3,0	-5,0
Mean	0,0	0,0	0,0	0,0

	A	B	C	Mean
1	4,7	-2,0	-2,7	0,0
2	-1,0	0,3	0,7	0,0
3	-3,7	1,7	2,0	0,0
Mean	0,0	0,0	0,0	0,0

Correlations of p-value residuals between  
Norway and all other countries. Mathematics.  
TIMSS 1995

TOP 10

Sweden	.68
Iceland	.55
Denmark	.47
Germany	.40
Switzerland	.37
Scotland	.36
New Zealand	.36
England	.35
Netherlands	.30
Australia	.29

....

BOTTOM 10

....

Kuwait	-.25
Israel	-.25
Singapore	-.30
Thailand	-.34
Korea	-.34
Russia	-.35
Hong Kong	-.37
Bulgaria	-.38
Iran	-.43
Romania	-.44

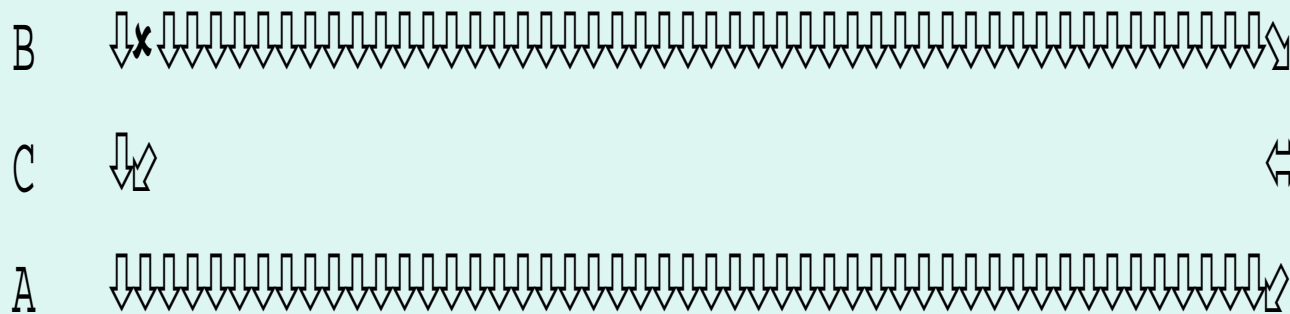
# Cluster analysis:

- A method to cluster variables into hierarchical groups based on similarities in a set of variables

# Dendrogram for the three "countries"

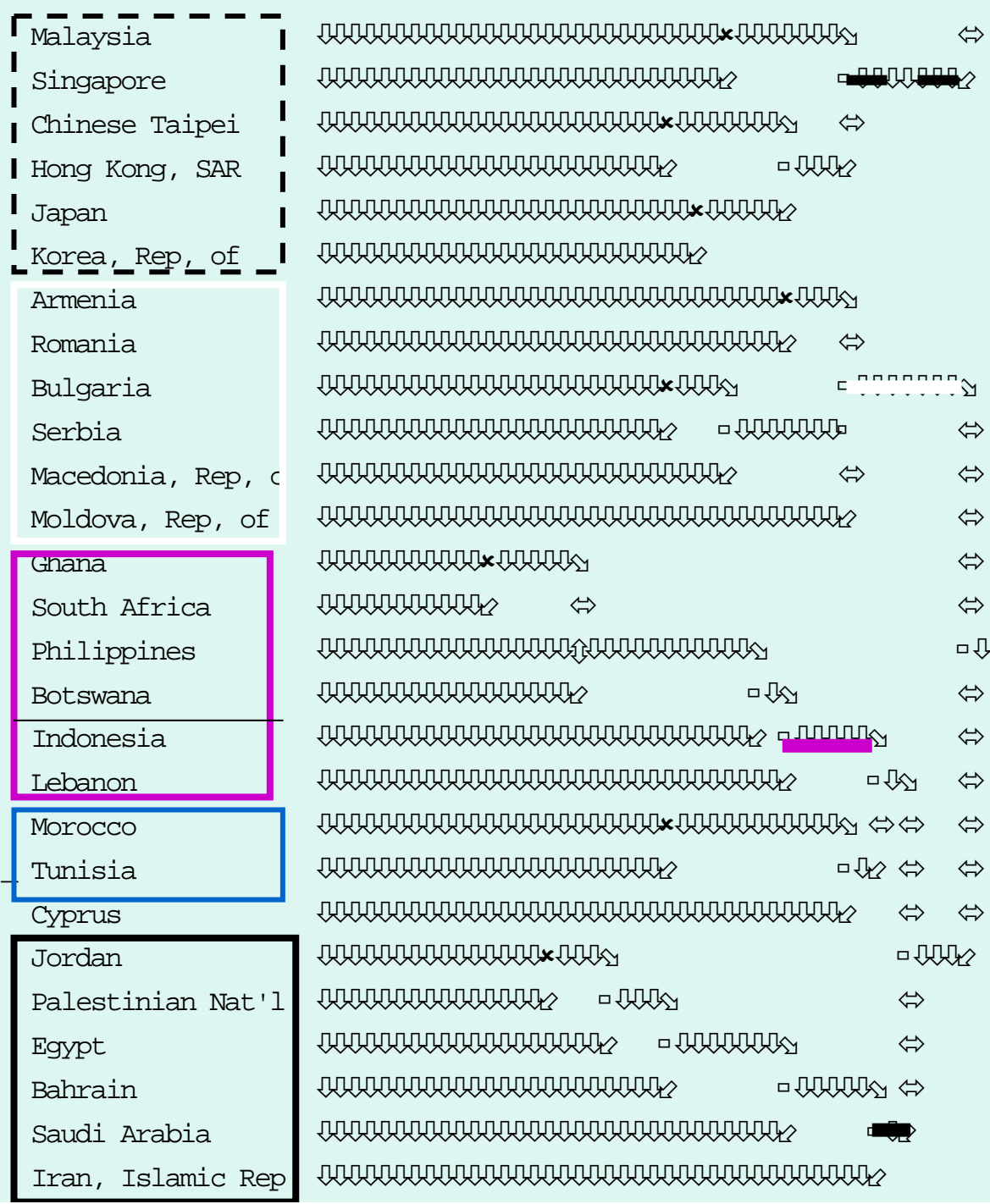
Degree of similarity increasing from left to right

	A	B	C
1	4,67	-2,00	-2,67
2	-1,00	0,33	0,67
3	-3,67	1,67	2,00



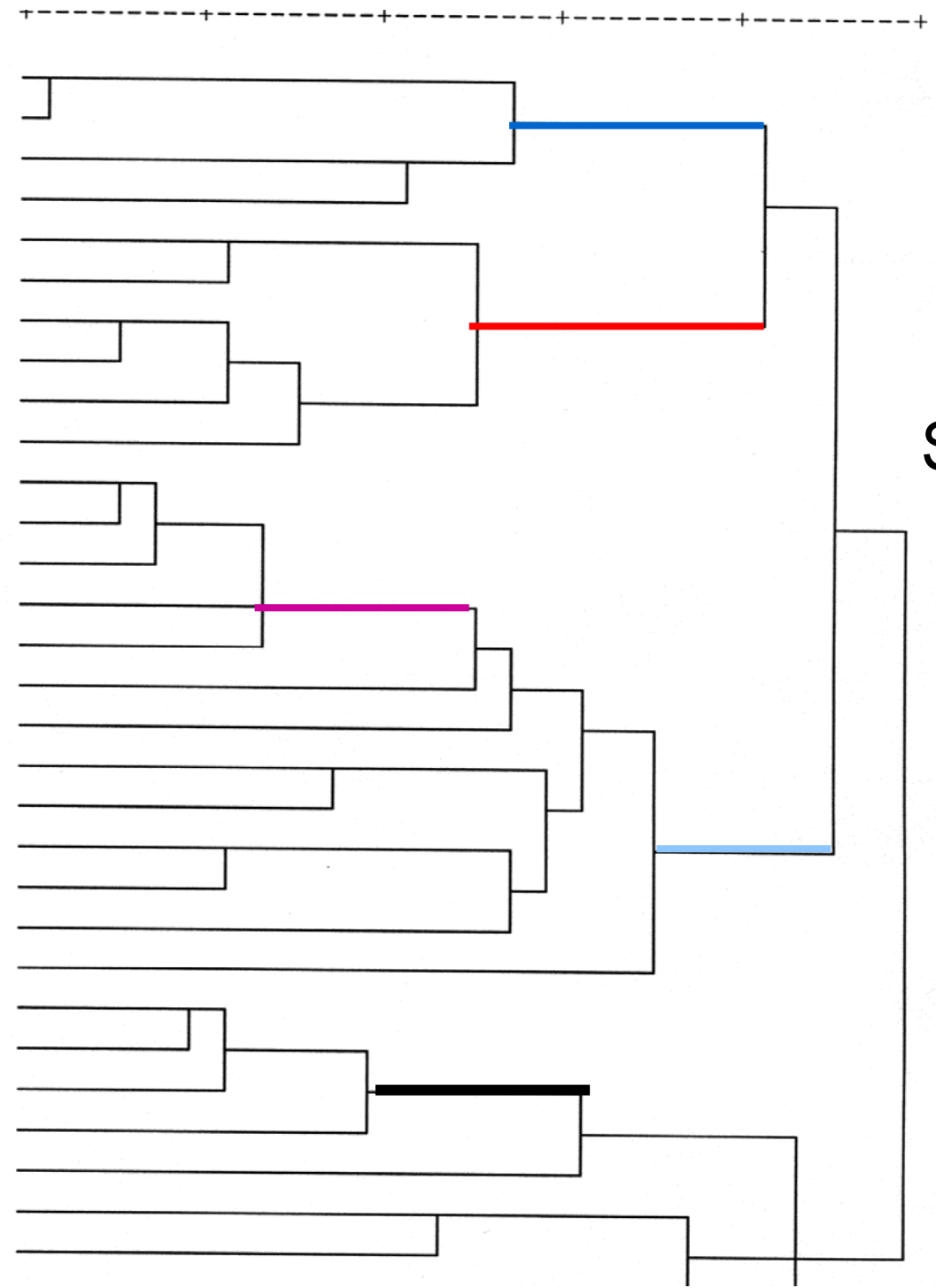


# TIMSS 2003 science (correlations)



# PISA 2003 Science

- Hong Kong
- Macao
- Japan
- Korea
- Ireland
- UK
- Australia
- New Zea.
- Canada
- USA
- Switzerl.
- Liechten.
- Germany
- Austria
- Luxemb.
- Iceland
- Finland
- Denmark
- Norway
- Belgium
- France
- Netherl.
- Sweden
- Mexico
- Brazil
- Uruguay
- Portugal
- Tunisia
- Italy
- Spain



# (Continued)

Italy  
Spain

Hungary  
Poland

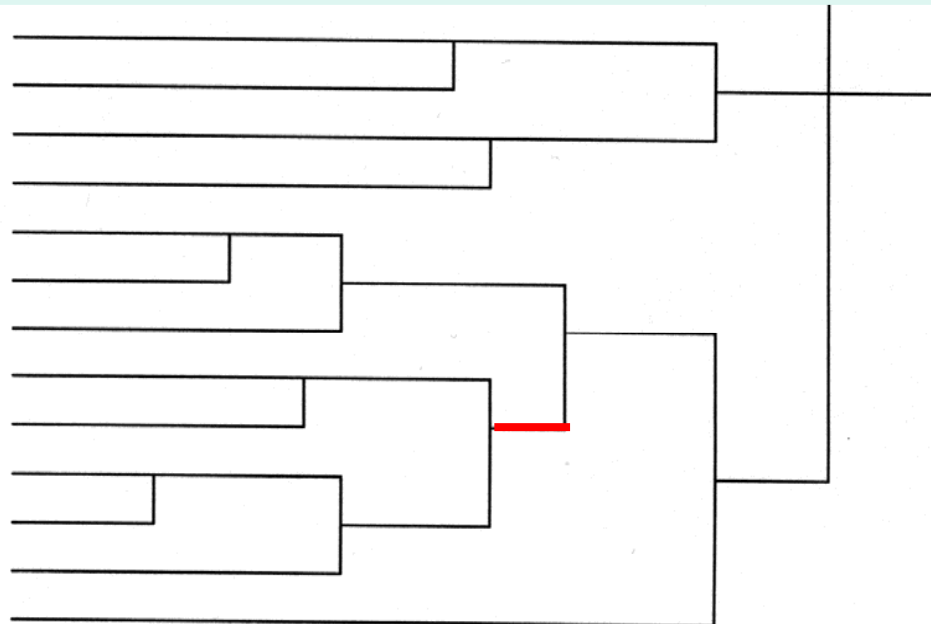
Turkey  
Indonesia  
Thailand

Latvia  
Russia

Czech R.  
Slovak R.

Serbia

Greece



# Country groups in PISA 2003-science: What are the essential factors shaping the groups?

- East Asia
- English-speaking
- German-speaking
- Nordic (not well established)
- East Europe

# Item characteristics for country groups

## Science in PISA 2003

Comp: + if process competencies are favored over content knowledge

Content: + if physical and earth science is favoured over life science

Format: + if constructed response are favoured over multiple choice

Textdist: + if item depend heavily on text interpretation

Item characteristics					
	Comp	Content	Format	Textdist	Pvalue
EastAsia	-0,27	0,18	<b>-0,42</b>	-0,15	-0,21
English	<b>0,44</b>	-0,23	-0,11	0,16	-0,05
German	-0,06	-0,15	-0,08	0,19	0,03
Nordic	0,23	-0,04	0,07	<b>0,45</b>	0,08
SouthAm	0,12	-0,13	0,22	0,14	0,13
EastEur	-0,34	0,29	0,31	<b>-0,34</b>	-0,01

# Favourite items for country groups

- East Asia: Difficult items, conceptual understanding, multiple choice, relating to the physical world
- English-speaking: Items testing scientific process skills, life and health
- Nordic: Items where the solution is found by interpreting the textual material given. Weak on items that require specific knowledge in or about science.

# Favourite items for country groups

- East Europe: Strong on constructed response, on content knowledge, particularly in the "hard" sciences,

# **TIMSS 1995: GROUPS OF COUNTRIES**

## **Math and science**

**English-speaking:** Australia, Canada, England, Ireland, New Zealand, Scotland, USA

**German-speaking:** Austria, Germany, Switzerland

**Nordic group:** Denmark, Iceland, Norway, Sweden

**East European:** Bulgaria, Czech rep., Hungary, Latvia, Lithuania, Romania, Russia, Slovakia, Slovenia

**East Asian:** Hong Kong, Japan, Korea, Singapore

# TIMSS math 1995 (upper half)

- England
- Scotland
- New Zealand
- Australia
- Netherlands
- Norway
- Sweden
- Iceland
- Denmark
- Canada
- USA
- Ireland
- Germany
- Switzerland
- Austria
- Portugal
- Spain
- Greece
- Iran
- Thailand
- Philippines
- S. Africa
- Colombia
- Kuwait
- Belgium Fl
- Belgium Fr
- France
- Hong Kong



# Reading in PISA 2000

AUSTRALIA	↓x ↓↓↓↓↓↓		
N. ZEALAND	↓↗ □ ↓↓↓↓		
UK	↓↓↓↓↓↓↓↓↗ ⇔		
IRELAND	↓↓↓↓↓↓↓↓↓↓↓✓ ↓↓↓↓↓↓↓↓↓↓↓↓		
USA	↓↓↓↓↓↓↓x ↓↓↓↗ □ ↓↗		
CANADA	↓↓↓↓↓↓↓↓↗ ⇔ ⇔		
DENMARK	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ □ ↓↓↓↓		
NORWAY	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↗ ⇔ ⇔		
SWEDEN	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ ↗ □ ↓↓↓↗ ⇔		
ICELAND	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ ↗ ⇔		
SWITZERL.	↓↓↓↓↓↓↓↓↓x ↓↗ ⇔		
GERMANY	↓↓↓↓↓↓↓↓↓↓↗ □ ↓↗ ⇔		
LUXEMBOURG	↓↓↓↓↓↓↓↓↓↓↓↓↗ □ ↓↓↓↓↓↓↓↓↓↓ ↗ ⇔		
AUSTRIA	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↗ □ ↓↓↓↗ ⇔		
LIECHTENST.	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ □ ↓✓ ↓↓↓↗		
FRANCE	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↓↓↓↓↗ ⇔ ⇔ ⇔		
BELGIUM	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ □ ↓↓↓↗ ⇔ □ ↓↗		
ITALY	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↗ ⇔ ⇔ ⇔		
FINLAND	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ ↗ ⇔ ⇔		
PORTUGAL	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↓↓↗ □ ↓↓↓↗		
SPAIN	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↗ ⇔ ⇔		
CZECH REP.	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↓↓↗ ⇔ ⇔		
POLAND	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ □ ↓↓↓↗ □ ↓↓↓↓↓↗		
HUNGARY	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↗ ⇔ ⇔		
LATVIA	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↓↓↓↓↓↓↓↓↓↓↗ ⇔ □ ↓↓↓↗		
RUSSIA	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ □ ↓↗ ⇔ ⇔		
GREECE	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↗ ⇔ ⇔		
KOREA	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↓↓↓↓↓↓↓↓↗ ⇔		
JAPAN	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓ ↗ ⇔		
BRAZIL	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓x ↓↓↓↓↓↓↓↓↓↓↓↓		
MEXICO	↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓		

# What factors are responsible for the clustering?

- Curriculum is a mediator of influence
- Cultural factors
  - Language (per se)
  - Religion, philosophy, pedagogy
  - Political and historical issues
- Geographical factors
  - Climate
  - Topography
  - Physical neighborship
- Deep cultural traits are involved
  - But obviously an interplay between many factors

# Meta-constructs in PISA

- An effort to simplify the international database into the most essential factors
- Grouping items to constructs and further to meta-constructs, based on similarities
- How do countries group on the basis of these factors?

# Meta-constructs in PISA 1.

- **Math score**
- **Home** (socio-economical level)
  - *hisei* (highest parental occupational status)
  - *hisced* (highest parental educational status)
- **Support**
  - *teachs* (Teacher support in mathematics lessons)
  - *sturel* (Student-teacher relations at school)
- **Subject motivation**
  - *intmat* (interest in mathematics)
  - *instmot* (instrumental motivation in mathematics)
  - *complr*n (motivation by competitive learning)

# Meta-constructs in PISA 2

- **Social motivation**
  - *atschl* (attitudes towards school)
  - *cooplrn* (motivation by co-operative learning)
- **Inclusive pedagogical environment**
  - *belong* (sense of belonging to school)
  - *mathef* (mathematics self-efficacy)
  - *(negative) anxmat* (mathematics anxiety)
  - *(negative) studamb* (student ambitions)

# Meta-constructs in PISA 3

- **Learning strategies**
  - *cstrat* (control strategies)
  - *elab* (elaboration strategies)
  - *memor* (memorisation strategies)
- **Accountability** (the degree to which schools are held responsible for and expected to respond to outcomes of national or local assessment)
  - *schauton* (school autonomy)
  - One question from the school questionnaire that provides information about the use of assessment for monitoring the school's own practices

# Meta-constructs in PISA 4

- **Time math**
  - *pcmath* (percent of instruction time devoted to mathematics)
  - *mmin* (time in minutes per week devoted to mathematics)
- **Shortage of math teachers**
  - *tcshort* (shortage of teachers)
  - (neg) *sc08Q01* (availability of qualified mathematics teachers)
- **Disciplinary climate in math lessons**
  - *disclim* This construct stands alone, since it did not easily combine with any of the others.



	1 Develop	2 "Nordic"	3 English	4 East Eu	5 East As	6 German	7 "French"
Home	<b>-1.7</b>	<b>1.0</b>	<b>1.0</b>	.3	-.6	.2	.3
Support	<b>1.7</b>	-.3	.7	-.9	-.8	-.4	<b>-1.0</b>
Subject motivation	<b>1.9</b>	-.7	.4	-.5	-.8	-.7	-.7
Social motivation	<b>1.4</b>	-.6	.4	-.3	<b>-1.9</b>	-.1	-.4
Inclusive	<b>-1.1</b>	.7	.1	.4	<b>-1.4</b>	<b>1.9</b>	.0
Learning strategies	<b>1.8</b>	-.8	.3	.2	<b>-1.2</b>	-.8	-.5
Accountability	.3	.1	.7	<b>1.1</b>	.1	<b>-1.2</b>	-.8
Time	.7	<b>-1.3</b>	<b>1.0</b>	-.7	<b>1.3</b>	-.6	.0
Shortage	<b>1.3</b>	-.4	.2	-.6	-.5	-.6	.5
Dis. climate	-.6	-.9	-.2	.1	<b>1.0</b>	<b>1.1</b>	-.7
Math score	<b>-1.9</b>	.7	.6	.3	<b>1.0</b>	.6	.3

# Correlations

	1 Develop	2 Nordic	3 English	4 East Eu	5 East As	6 German	7 "French"
Denmark	-0,14	0,18	0,18	-0,48	-0,31	<b>0,46</b>	0,06
Finland	-0,57	<b>0,90</b>	0,24	0,42	-0,50	0,35	0,01
Iceland	-0,30	0,38	<b>0,70</b>	0,06	0,24	-0,17	0,35
Norway	-0,56	<b>0,89</b>	0,27	0,25	-0,43	0,28	0,62
Sweden	-0,55	<b>0,90</b>	0,07	0,48	-0,35	0,38	-0,11

# Country characteristics

	Denmark	Finland	Iceland	Norway	Sweden
Learning strategies	-.6	-.8	-.4	-.8	-.4
Home	.6	.9	.9	1.3	.8
Math score	.5	<b>1.1</b>	.6	.2	.4
Inclusive	.9	.2	.7	.7	<b>1.2</b>
Social motivation	.2	-.3	-.8	-.6	-.6
Dis. climate	-.5	-.9	-.9	<b>-1.4</b>	-.4
Support	.6	-.1	.2	-.6	.6
Subject motivation	.7	-.8	.3	-.6	-.2
Shortage	-1.0	-1.2	.3	.2	.3
Accountability	<b>-1.8</b>	-.2	<b>.8</b>	-.5	.7
Time	.3	-1.5	<b>1.1</b>	-1.0	-1.1