THE UNIVERSITY OF MELBOURNE

GRADUATE SCHOOLS

MELBOURNE GRADUATE SCHOOL OF EDUCATION

Shaping minds, shaping the world

OK, we need to do better, but how?

Wee Tiong Seah
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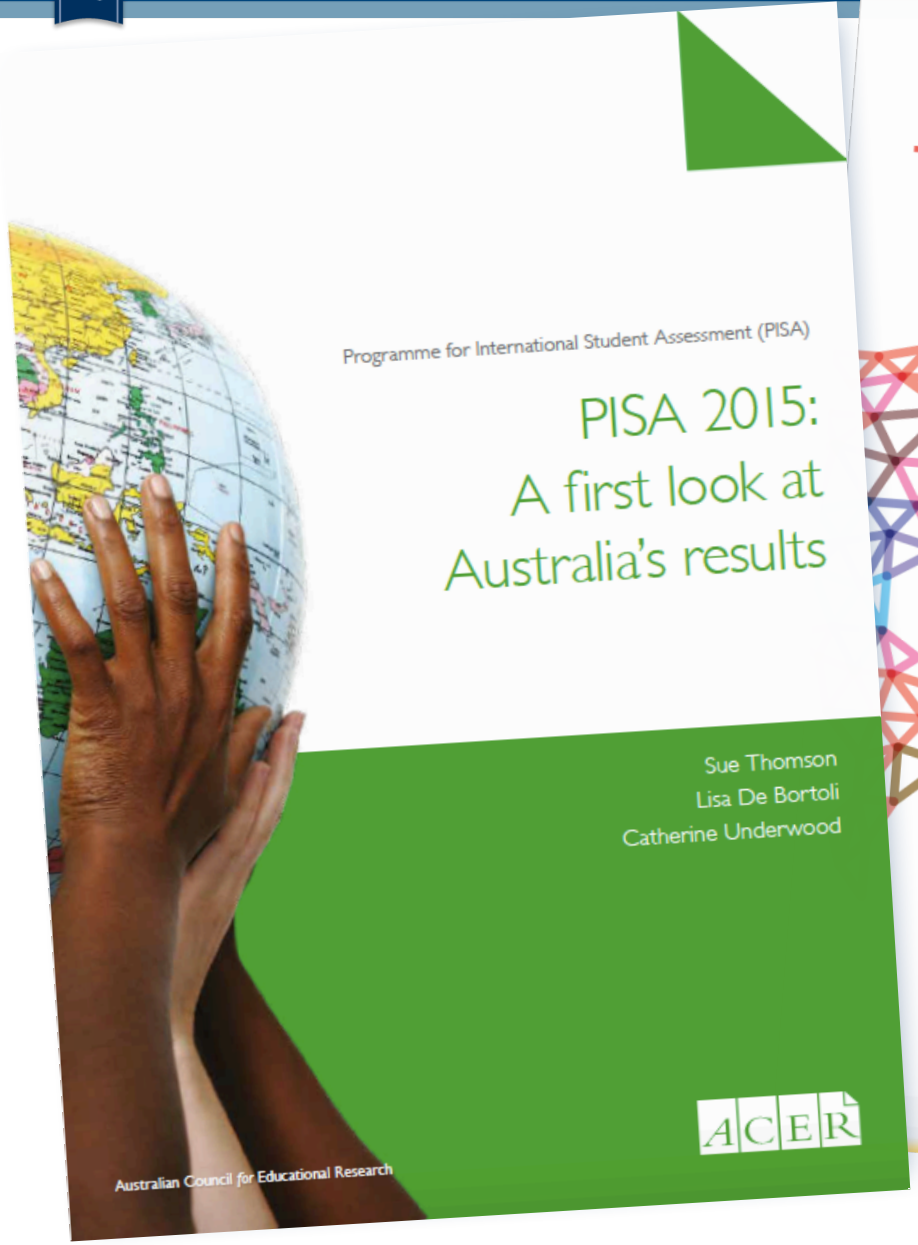
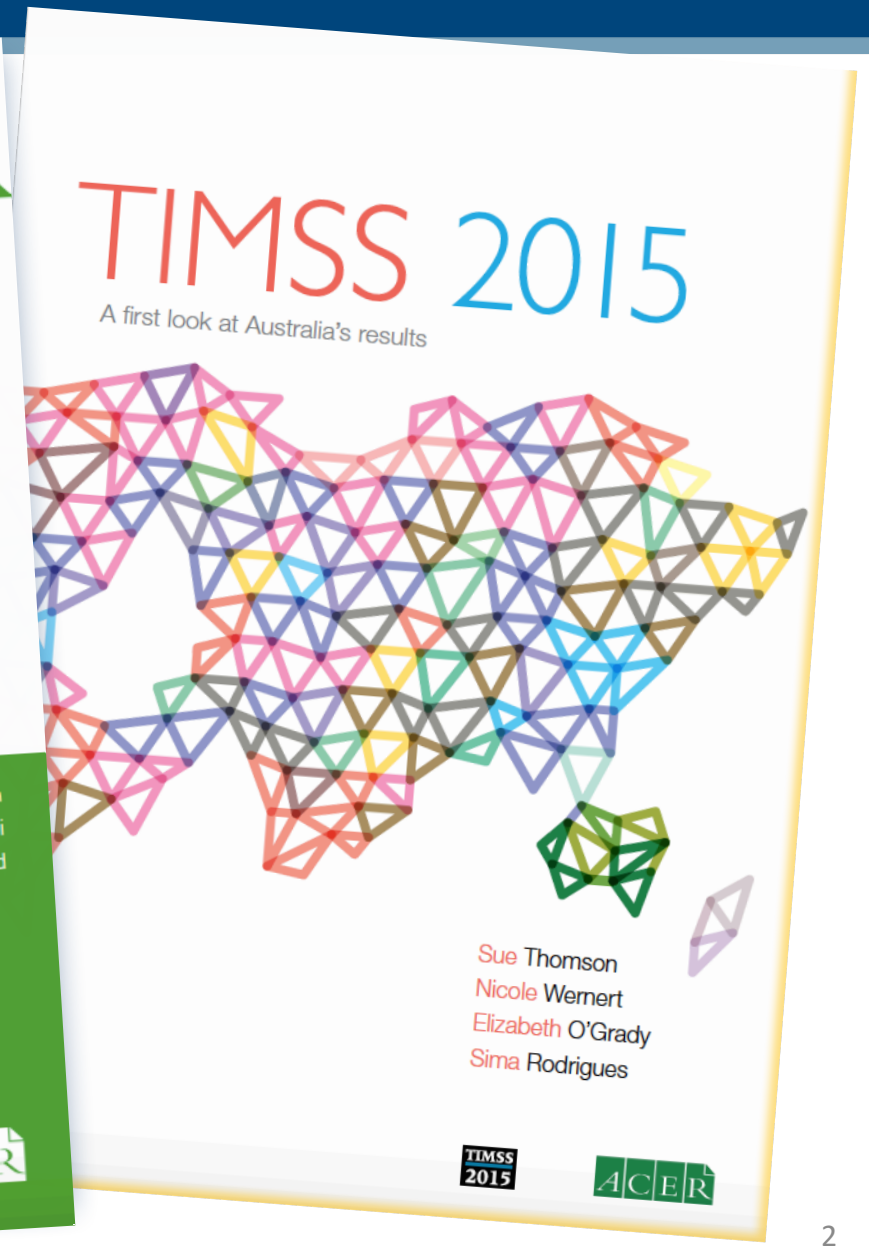
23 Jun 2017

TIMSS & PISA 2015





TIMSS Year 4

	Country	Mean	SE	Gap 95th–5th percentiles	Performance at each of the TIMSS international benchmarks
Achievement significantly higher than Australia's	Singapore	618	3.8	288	6 13 30 50
	Hong Kong	615	2.9	216	2 14 39 45
	Korea	608	2.2	221	3 16 40 41
	Chinese Taipei	597	1.9	235	5 19 41 35
	Japan	593	2.0	227	4 21 42 32
	Northern Ireland	570	2.9	282	3 11 25 34 27
	Russian Federation	564	3.4	242	2 9 30 39 20
	Norway (5)	549	2.5	231	2 12 36 36 14
	Ireland	547	2.1	238	3 13 33 37 14
	England	546	2.8	275	4 16 31 32 17
	Belgium (Flemish)	546	2.1	200	11 41 37 10
	Kazakhstan	544	4.5	269	4 16 33 31 16
	Portugal	541	2.2	237	3 15 36 34 12
	United States	539	2.3	269	5 16 32 33 14
	Denmark	539	2.7	248	4 16 34 34 12
	Lithuania	535	2.5	235	4 15 37 34 10
	Finland	535	2.0	218	3 15 39 35 8
	Poland	535	2.1	233	4 16 36 34 10
	Netherlands	530	1.7	183	16 46 33 4
	Hungary	529	3.2	288	8 17 31 31 13
	Czech Republic	528	2.2	231	4 18 40 30 8
Achievement not different to Australia's	Bulgaria	524	5.3	276	8 17 35 30 10
	Cyprus	523	2.7	266	7 19 35 29 10
	Germany	522	2.0	216	4 19 43 29 5
	Slovenia	520	1.9	228	5 20 41 28 6
	Sweden	519	2.8	228	5 20 41 29 5
	Serbia	518	3.5	287	9 19 35 27 10
	Australia	517	3.1	275	9 21 34 27 9
	Canada	511	2.3	247	8 23 38 25 6
Australia's	Italy	507	2.6	236	7 24 41 24 4
	Spain	505	2.5	226	7 26 40 24 3
	Croatia	502	1.8	215	7 26 43 21 3
	Slovak Republic	498	2.5	264	12 23 39 22 4
	New Zealand	491	2.3	297	16 25 33 20 6

21

6

20

	Country	Avg. score	SE	Confidence interval	Difference between 5th & 95th percentiles	Proficiency levels
Significantly higher than Australia	Singapore	564	1.5	561–567	312	8 58 35
	Hong Kong (China)	548	3.0	542–554	298	9 64 27
	Macao (China)	544	1.1	542–546	261	7 71 22
	Chinese Taipei	542	3.0	536–548	337	13 59 28
	Japan	532	3.0	527–538	290	11 69 20
	B-S-J-G (China)	531	4.9	522–541	345	16 59 26
	Korea	524	3.7	517–531	327	15 64 21
	Switzerland	521	2.9	516–527	313	16 65 19
	Estonia	520	2.0	516–524	264	11 75 14
	Canada	516	2.3	511–520	289	14 71 15
	Netherlands	512	2.2	508–517	298	17 68 16
	Denmark	511	2.2	507–515	264	14 75 12
	Finland	511	2.3	507–516	270	14 75 12
	Slovenia	510	1.3	507–512	288	16 70 13
	Belgium	507	2.4	502–512	316	20 64 16
	Germany	506	2.9	500–512	293	17 70 13
	Poland	504	2.4	500–509	286	17 71 12
	Ireland	504	2.1	500–508	262	15 75 10
	Norway	502	2.2	497–506	279	17 72 11
Not significantly different from Australia	Austria	497	2.9	491–502	311	22 66 12
	New Zealand	495	2.3	491–500	304	22 67 11
	Vietnam	495	4.5	486–503	275	19 72 9
	Russian Federation	494	3.1	488–500	271	19 72 9
	Sweden	494	3.2	488–500	296	21 69 10
	Australia	**494**	**1.6**	**491–497**	**306**	22 67 11
	France	493	2.1	489–497	309	23 65 11
	United Kingdom	492	2.5	488–497	303	22 67 11
	Czech Republic	492	2.4	488–497	300	22 68 10
	Portugal	492	2.5	487–497	312	24 65 11
	OECD average	**490**	**0.4**	**489–491**	**293**	23 66 11
	Italy	490	2.8	484–495	306	23 66 11
	Iceland	488	2.0	484–492	306	24 66 10

PISA2015

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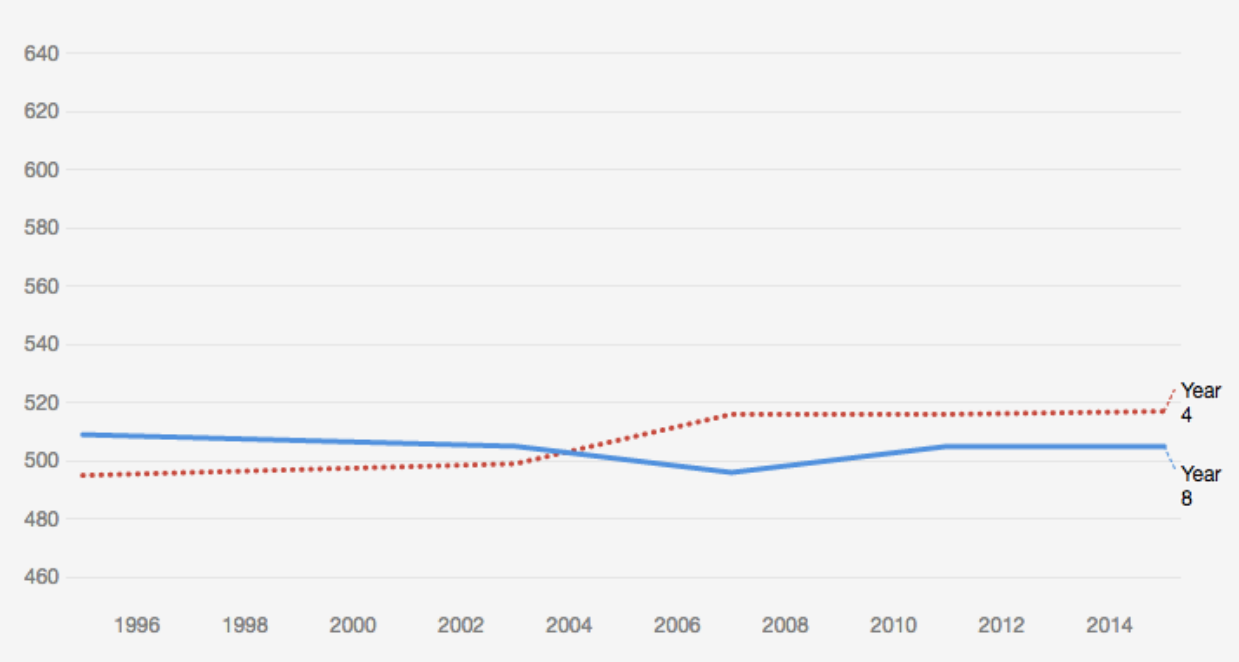
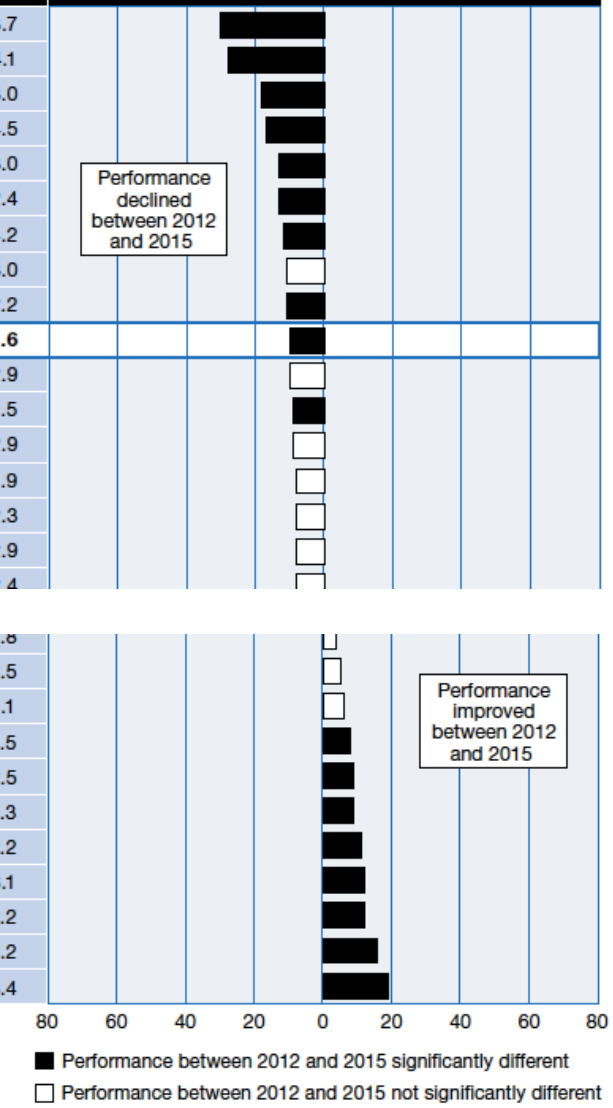
Over time in TIMSS …



No significant changes in 20 years (1995 – 2015)!

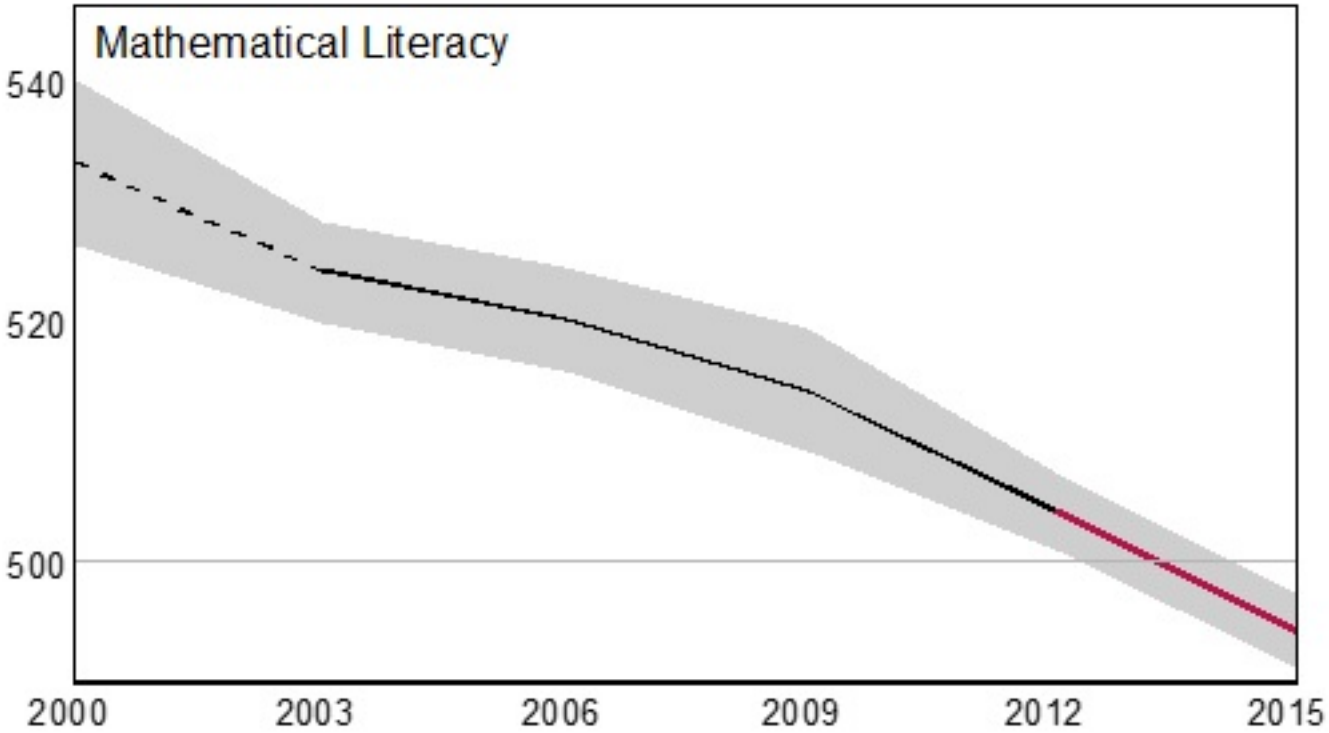
PISA 2012 vs PISA 2015

Country	PISA 2012 Avg. score	PISA 2012 SE	PISA 2015 Avg. score	PISA 2015 SE
Korea	554	4.6	524	3.7
Turkey	448	4.8	420	4.1
Chinese Taipei	560	3.3	542	3.0
Vietnam	511	4.8	495	4.5
Hong Kong (China)	561	3.2	548	3.0
Poland	518	3.6	504	2.4
United States	481	3.6	470	3.2
Thailand	427	3.4	415	3.0
Netherlands	523	3.5	512	2.2
Australia	**504**	**1.6**	**494**	**1.6**
Switzerland	531	3.0	521	2.9
Singapore	573	1.3	564	1.5
Austria	506	2.7	497	2.9
Latvia	491	2.8	482	1.9
Finland	519	1.9	511	2.3
Germany	514	2.9	506	2.9
Belgium	515	2.1	507	2.4
Italy	485	2.0	490	2.8
Portugal	487	3.8	492	2.5
Macao (China)	538	1.0	544	1.1
Montenegro	410	1.1	418	1.5
Uruguay	409	2.8	418	2.5
Slovenia	501	1.2	510	1.3
Denmark	500	2.3	511	2.2
Russian Federation	482	3.0	494	3.1
Norway	489	2.7	502	2.2
Sweden	478	2.3	494	3.2
Albania	394	2.0	413	3.4



Note: only countries that participated in PISA cycles in 2009 and 2015 are shown.

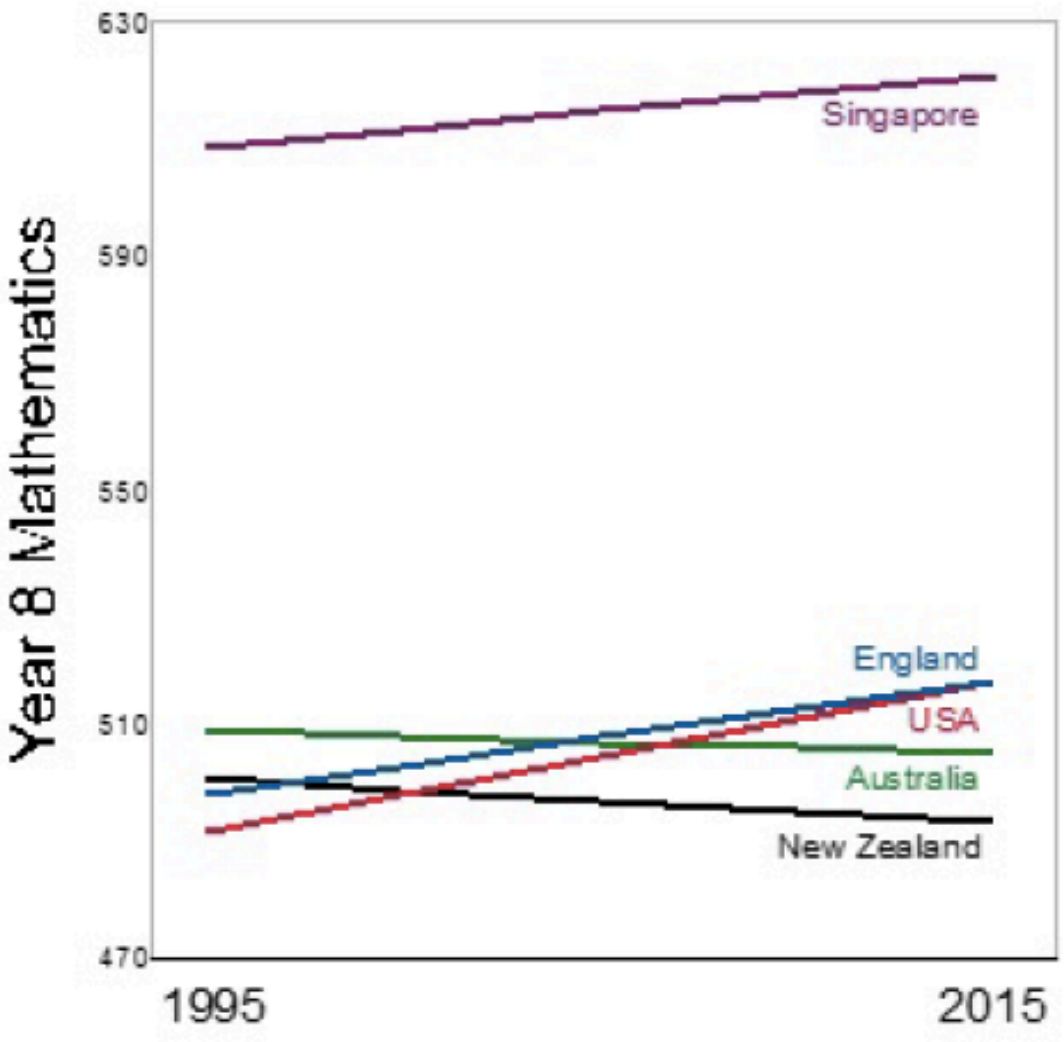
Over time in PISA …



(Source: Masters, 2016, np)

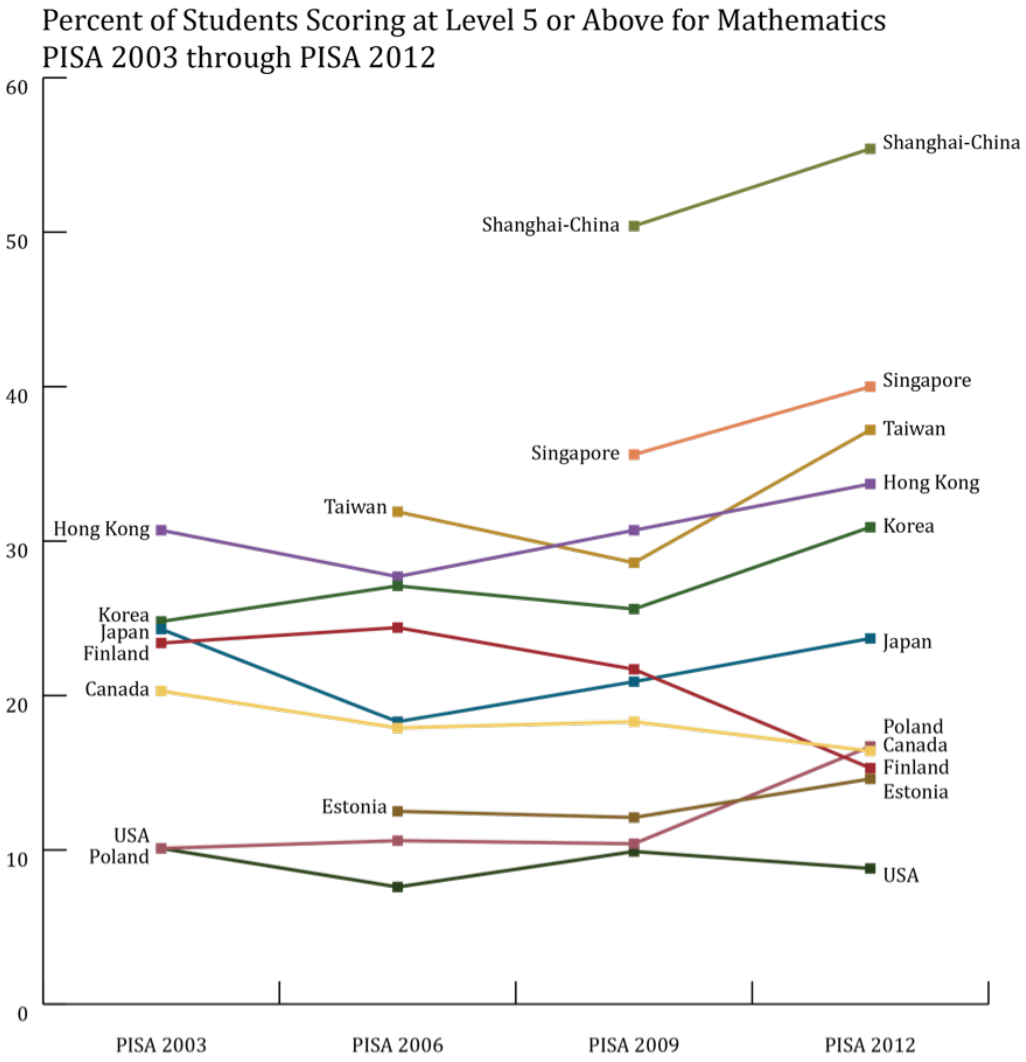
Compared with other economies…

TIMSS



Compared with other economies…

PISA

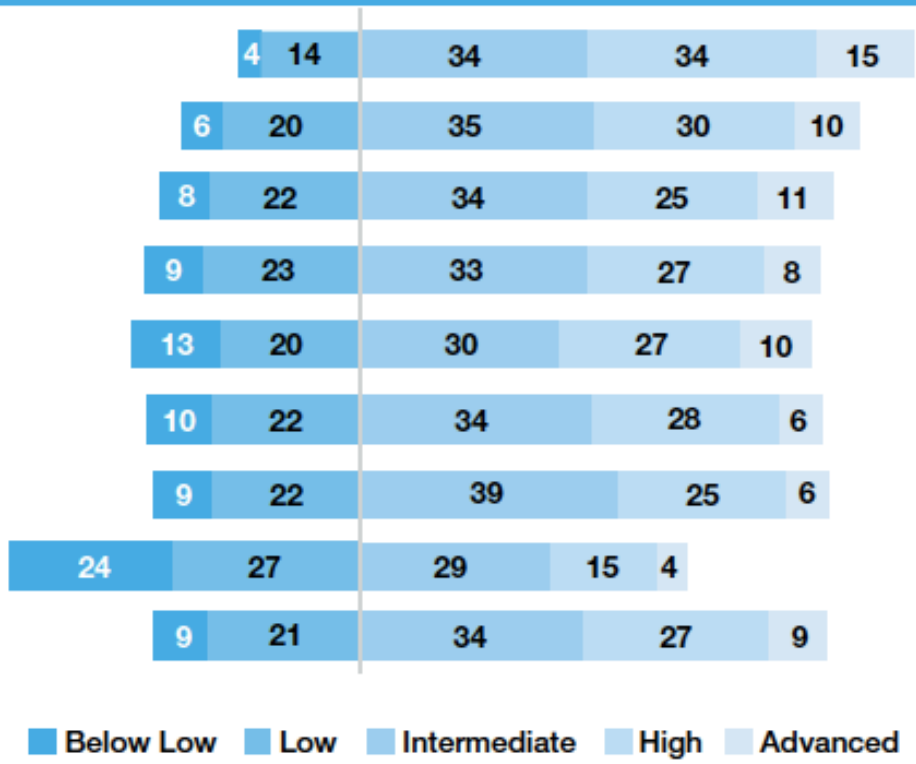


VIC in TIMSS 2015

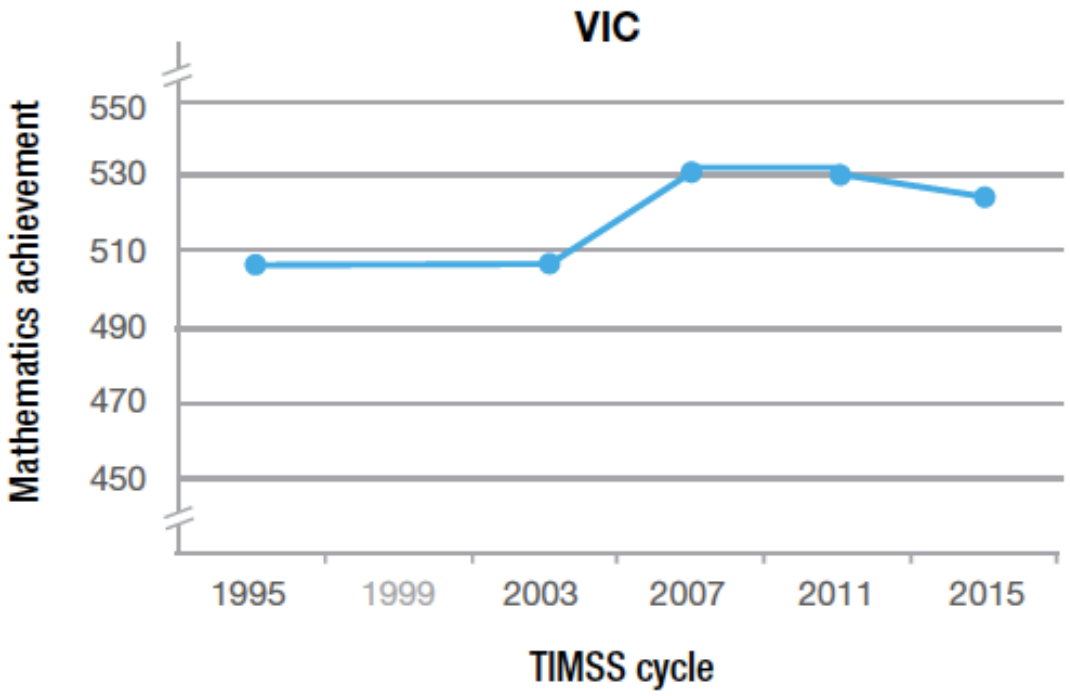
Year 4 mathematics

Jurisdiction	Mean	SE	Gap 95th–5th percentiles
ACT	544	7.9	251
VIC	525	5.5	257
NSW	519	7.5	282
TAS	513	9.6	269
WA	512	9.1	300
QLD	511	5.6	265
SA	510	7.9	255
NT	467	13.3	311
Australia	517	3.1	275

Performance at each of the TIMSS international benchmarks



VIC over the TIMSS cycles



Differences between years				
	2011	2007	2003	1995
2015	-6	-7	17 ↑	18
2011		-1	23 ↑	24 ↑
2007			24 ↑	25 ↑
2003				1

VIC in PISA 2015

Jurisdiction	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
ACT	505	3.6	498–513	306	
NSW	494	3.0	488–500	322	
VIC	499	3.1	493–505	292	
QLD	486	3.3	480–493	305	
SA	489	4.2	481–498	293	
WA	504	3.9	496–511	295	
TAS	469	4.1	461–477	309	
NT	478	6.9	465–492	332	
Australia	**494**	**1.6**	**491–497**	**306**	
OECD average	**490**	**0.4**	**489–491**	**293**	
Singapore	564	1.5	561–567	312	

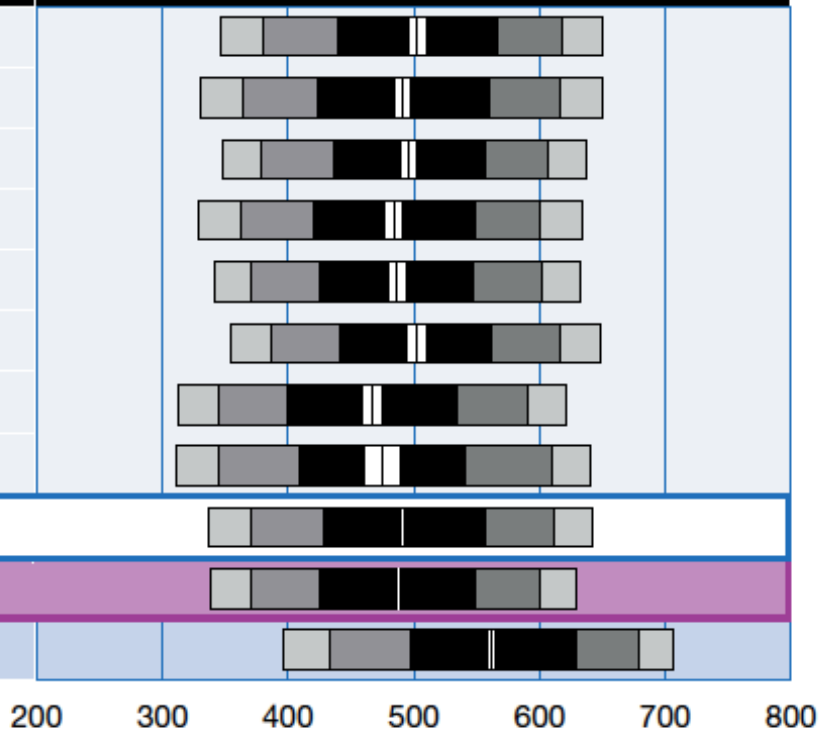
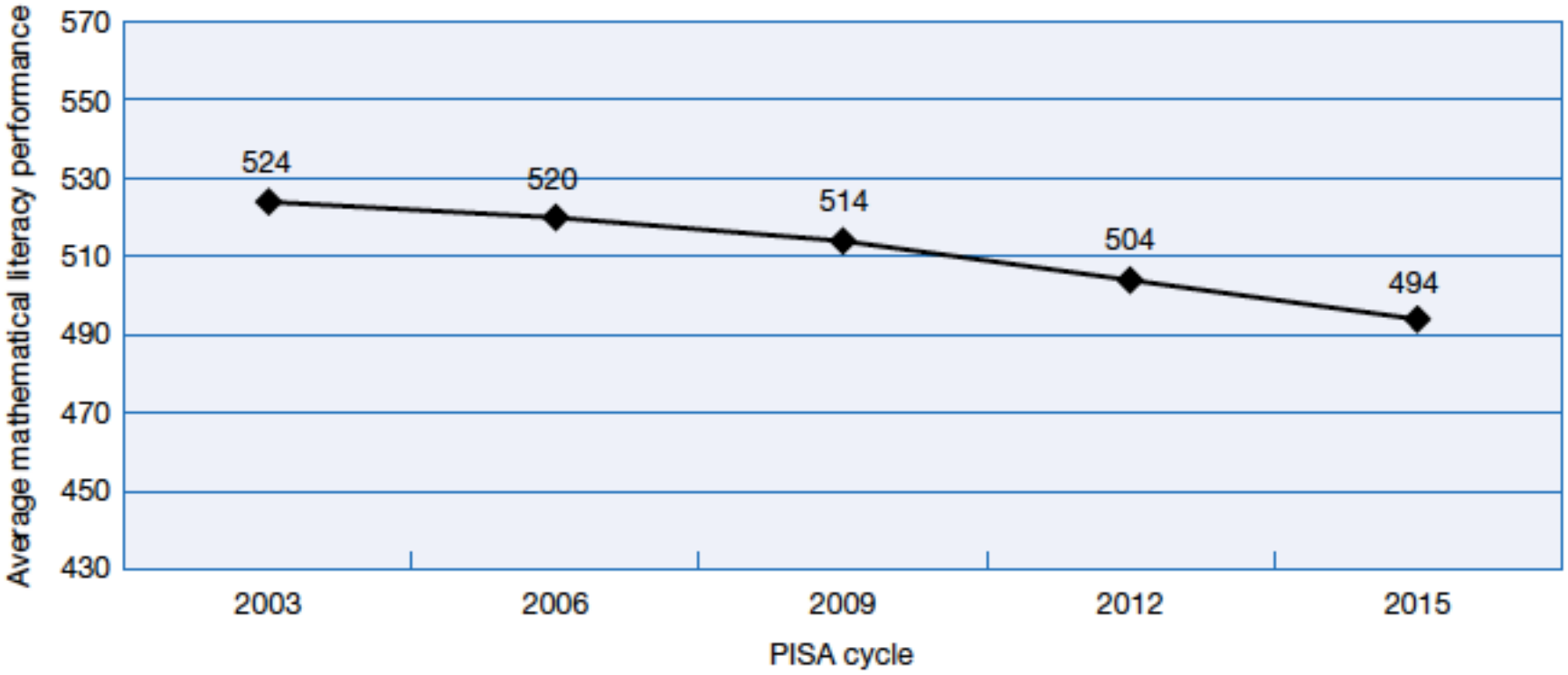


FIGURE 5.9 Average scores and distribution of students' performance on the mathematical literacy scale, by jurisdiction

VIC over the PISA cycles



In this same period, there has also been no significant change in mathematical literacy in Victoria (Cook & Jacks, 2016, np)

The migrant effect

Immigrant background	Avg. score	SE	Confidence interval	Difference between 5th & 95th percentiles	Proficiency levels	Students at or above the National Proficient Standard (%)
SCIENTIFIC LITERACY						
Australian-born	510	1.7	507–514	329	17 / 73 / 10	61
First-generation	520	2.4	516–525	333	15 / 72 / 13	64
Foreign-born	505	4.0	497–513	349	20 / 68 / 12	58
READING LITERACY						
Australian-born	501	2.3	496–505	331	18 / 72 / 10	60
First-generation	517	2.3	512–521	332	14 / 72 / 14	66
Foreign-born	500	3.9	492–508	355	21 / 67 / 12	59
MATHEMATICAL LITERACY						
Australian-born	491	1.5	488–494	299	22 / 68 / 10	55
First-generation	505	2.8	500–511	303	18 / 68 / 14	60
Foreign-born	497	4.1	489–505	324	22 / 64 / 14	56

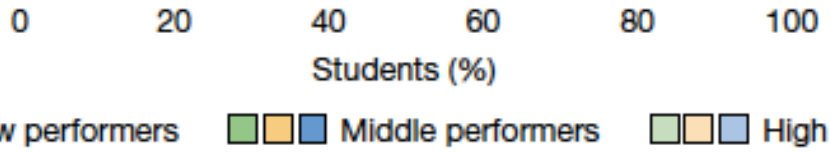
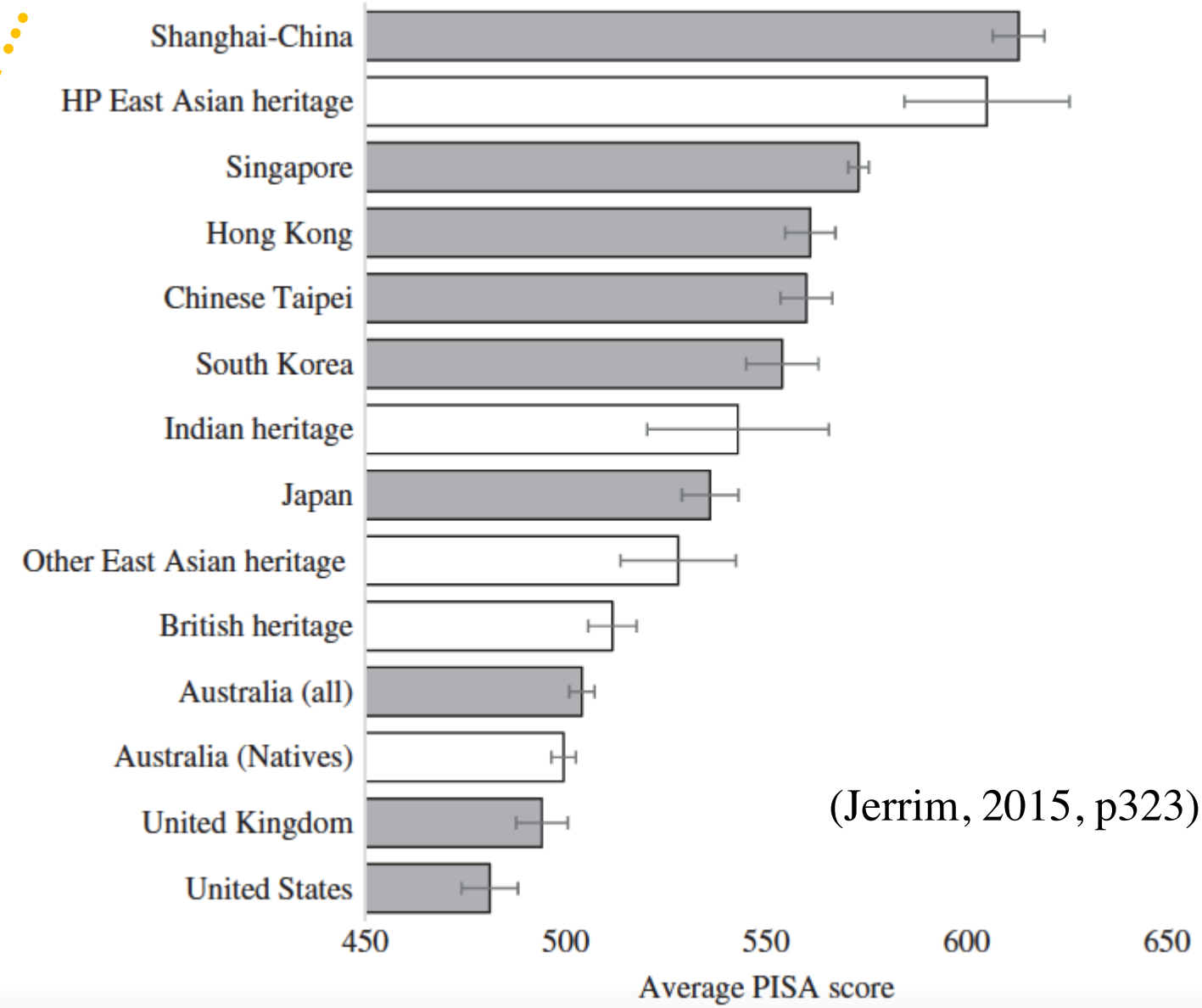


FIGURE 12.1 Average scores and proficiency levels in scientific, reading and mathematical literacy, by immigrant background

AUS could have been second …



(Jerrim, 2015, p323)

Concern #2

"Why are we learning this?"

"When are we ever gonna use this?"

Concern #3

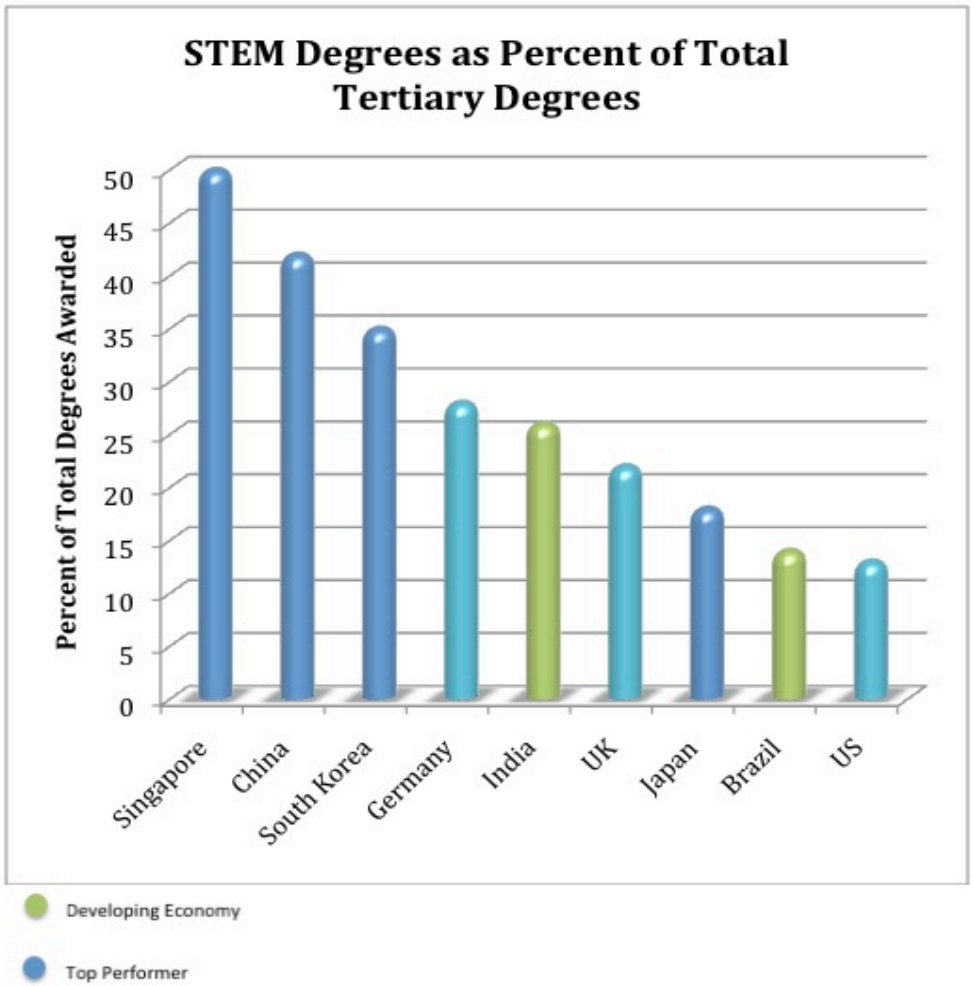
- Student engagement

Concern #4

- Declining proportions of Year 12 students (incl female students) doing advanced mathematics
  - Only 6.8% of Year 12 girls studying advanced mathematics in 2014 (AMSI, 2016)

- Declining numbers of mathematics graduates across AUS
  - 300 across AUS in 2014, lowest since 2001 (AMSI, 2016)

- Graduates in Australia with qualifications in STEM (excl health subjects):
  2001: 21.7%
  2011: 16.5%
  (Hackling, Murcia, West & Anderson, 2014)



(Accenture, 2011)

Despite priority and funding …

Over the past two decades, there has been no higher priority in Australian school education than raising students' literacy and numeracy levels. The introduction of state and national literacy and numeracy tests, the publication of NAPLAN results on the 'My School' website and national partnership funding focused on literacy and numeracy have been among many government initiatives designed to lift levels of student performance in these fundamental skill areas. Despite the high priority given to literacy and numeracy, the recently released PISA, TIMSS and NAPLAN results show no improvements in secondary schools. And there is no obvious reason to expect improvement in the future. (Masters, 2016, np)

Thinking outside the box

the answer is not to do more of the same. Reworking the school curriculum, testing students' numeracy levels and maintaining existing approaches to teacher professional development are unlikely to produce world-class improvements. (Masters, 2016, n.p.)

Top performing – the same ones!

TIMSS Year 4	TIMSS Year 8	PISA 15yo
Singapore	Singapore	Singapore
Hong Kong	Korea	Hong Kong
Korea	Chinese Taipei	Macao
Chinese Taipei	Hong Kong	Chinese Taipei
Japan	Japan	Japan
Northern Ireland	Russian Federation	B-S-J-G (China)
Russian Federation	Kazakhstan	Korea
Norway	Canada	Switzerland
Ireland	Ireland	Estonia
England	USA	Canada

How East Asia did it

Shanghai-style maths lessons to help British pupils match Chinese

By Eleanor Harding
Education Correspondent

Q&A
by Harry Mount

What is Shanghai maths?

Do the best pupils get bored?

Does it produce higher standards?

Are there fancy teaching aids?

Are the lessons longer?

Have Shanghai teachers come to Britain?

Are Chinese teachers better qualified?

Are there any faults to the system?

Austria takes Hitler house

808443100

How East Asia did it

The New York Times

HOME SEARCH

SundayReview | OPINION

An Assault Upon Our Children

South Korea's Education System Hurts Students

By SE-WOONG KOO AUG. 1, 2014

SEOUL, South Korea — After my older brother fell ill from the stress of being a student in South Korea, my mother decided to move me from our home in Seoul to Vancouver for high school to spare me the intense pressure to succeed. She did not want me to suffer like my brother, who had a chest pain that doctors could not diagnose and an allergy so severe he needed to have shots at home.

I was fortunate that my mother recognized the problem and had the means to take me abroad. Most South

Andy Rementer

Private tuitions and after-school programs

"Dominated by Tiger Moms, cram schools and highly authoritarian teachers, South Korean education produces ranks of overachieving students who pay a stiff price in health and happiness" (Koo, 2014).

How East Asia did it

Seafood intake and maths performance?

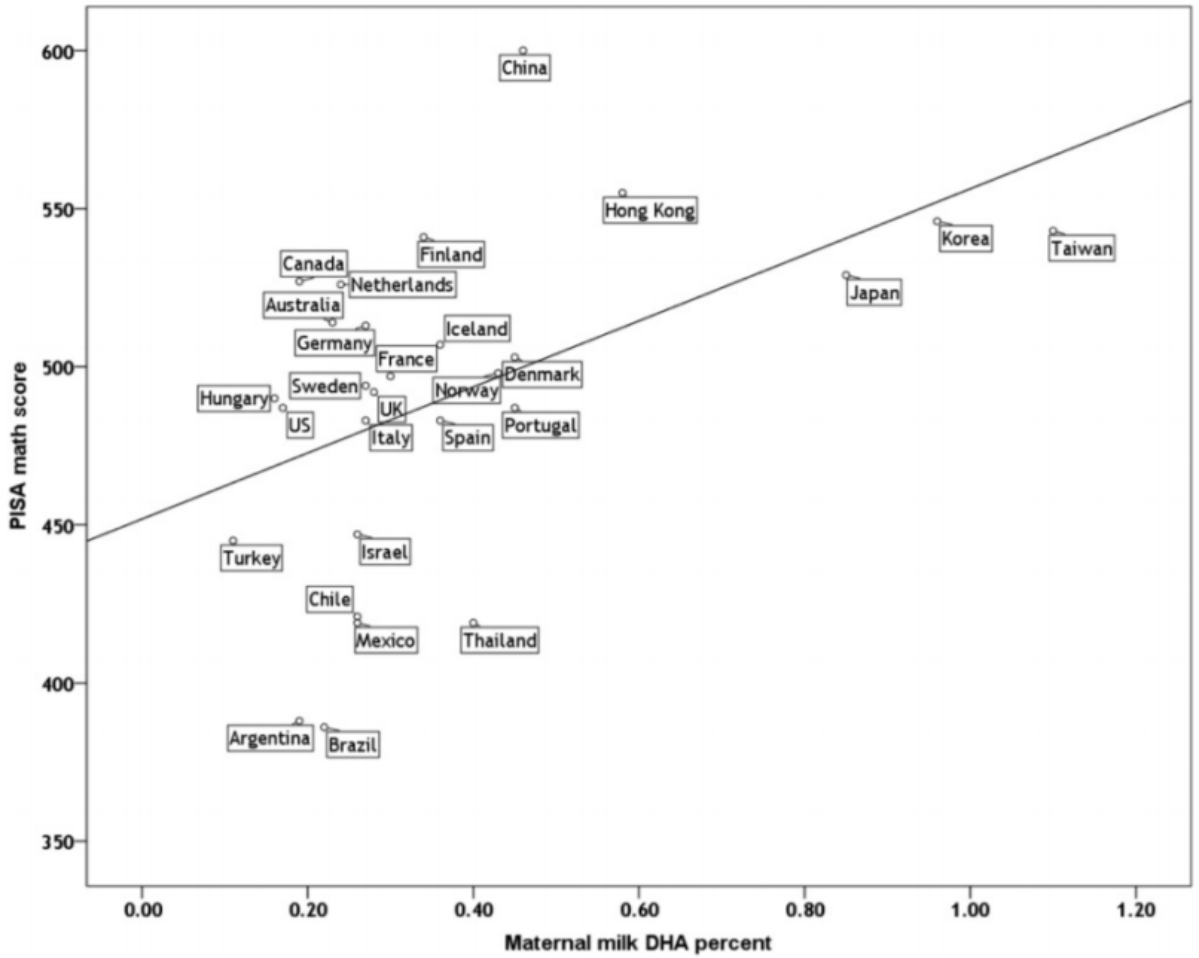


Fig. 1. Scatterplot of maternal milk docosahexaenoic acid (DHA) content and Programme for International Student Assessment (PISA) math test scores for 28 nations.

How East Asia did it

Teacher wage and maths performance?

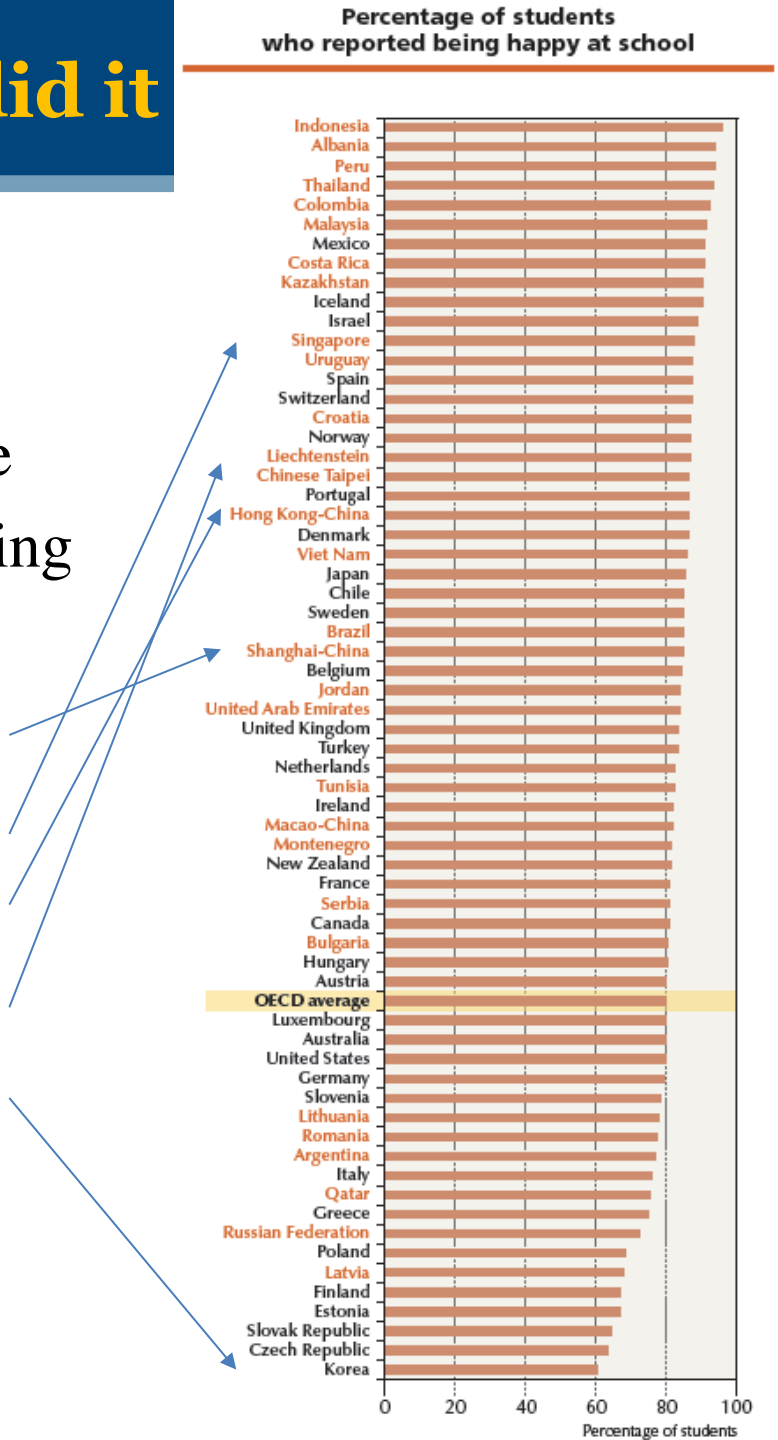
Figure 10: Respondents' estimated teacher wage correlated against average PISA scores

How East Asia did it

Affect?

Where the top 5 countries/economies are in the PISA2012 'happiest student' ranking

Shanghai - China
Singapore
Hong Kong – China
Chinese Taipei
Korea



Affect?

Where the last 5 countries/economies are in the PISA2012 'happiest student' ranking

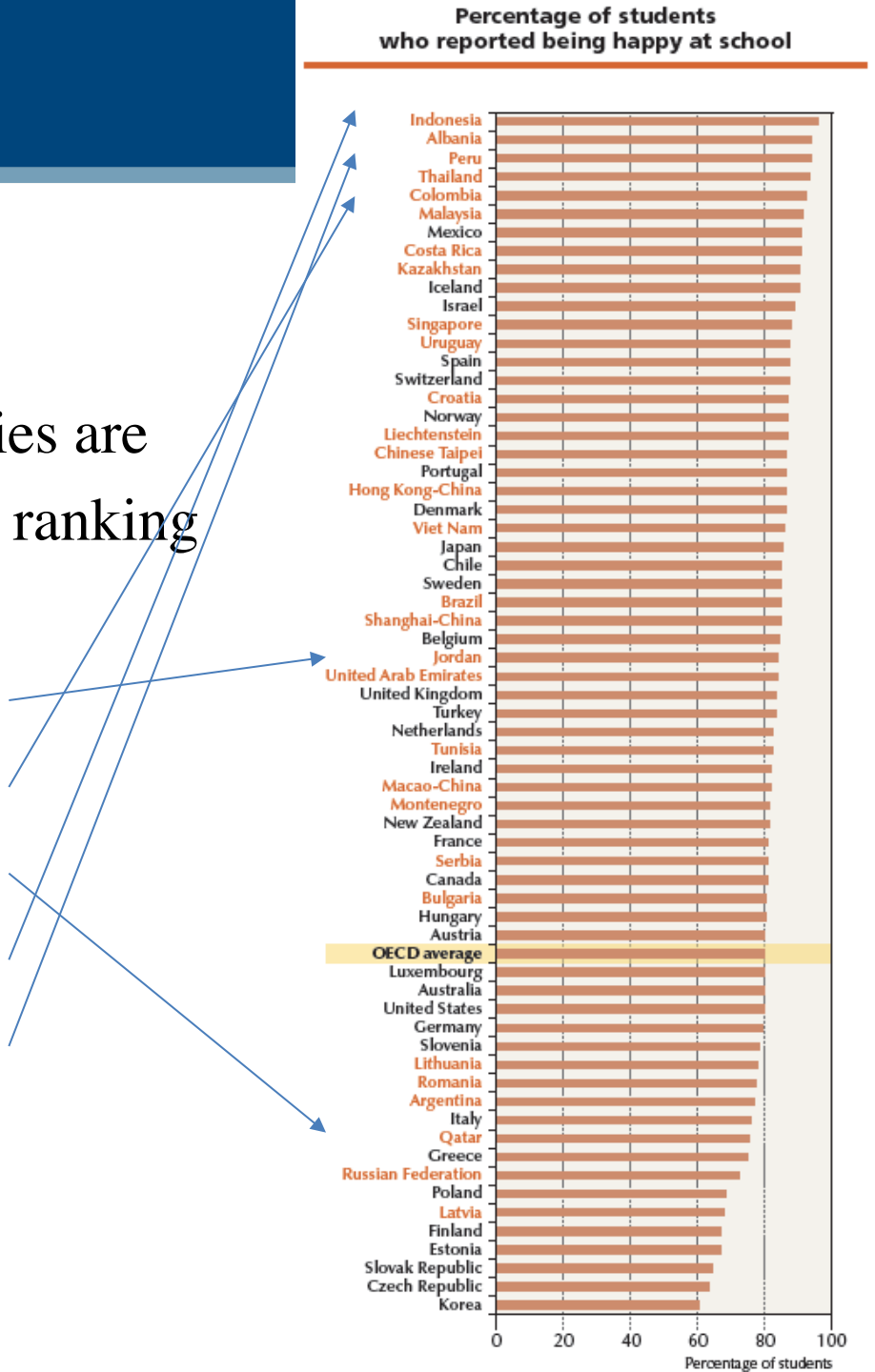
Jordan (61/65)

Colombia

Qatar

Indonesia

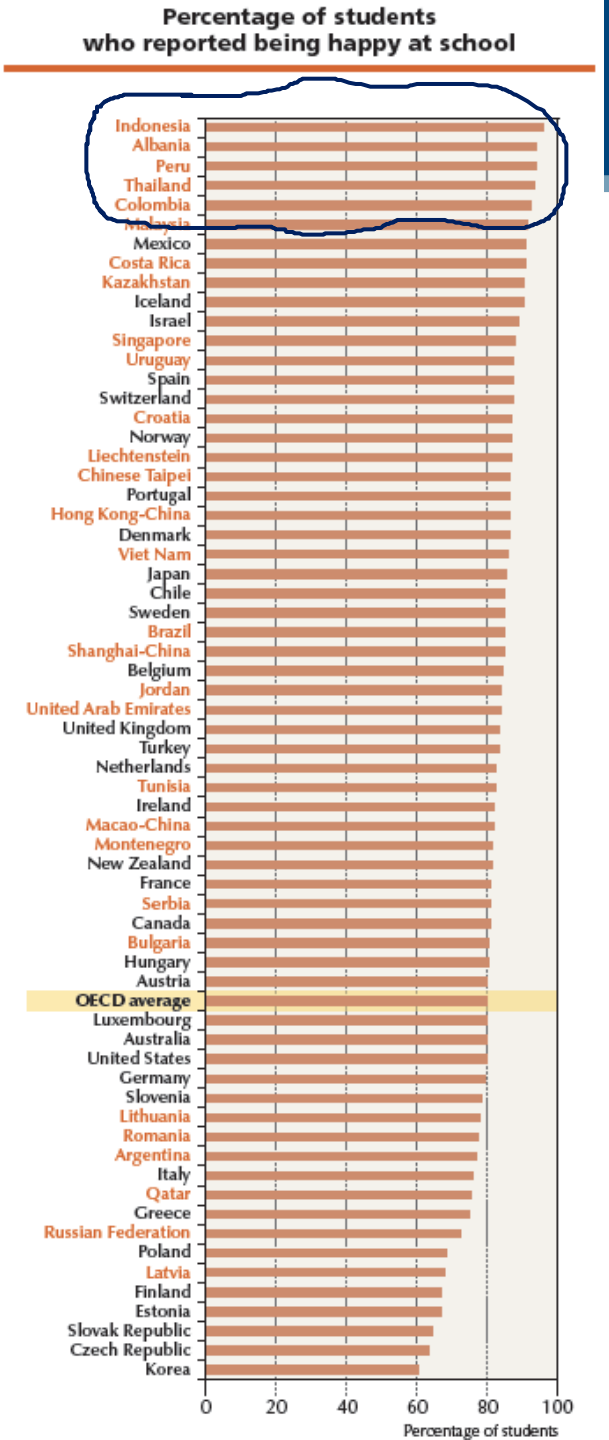
Peru (65/65)



How East Asia did it

PISA 2012 rankings of the top 5 'happiest' countries/economies

Indonesia	64 / 65
Albania	57
Peru	65
Thailand	50
Colombia	62



The missing piece of the puzzle …

WITHOUT TRAITS LIKE PERSEVERANCE, REASONING, CRITICAL THINKING, AND SENSE MAKING, THE KNOWLEDGE SKILLS LISTED FOR EACH GRADE LEVEL IN CCSSM WILL NOT BE TRULY MASTERED, AND UNDERSTANDING WILL BE SHORT-LIVED.

reasoning, critical thinking, and sense making, the knowledge skills listed for each grade level in CCSSM will not be truly mastered, and understanding will be short-lived. The

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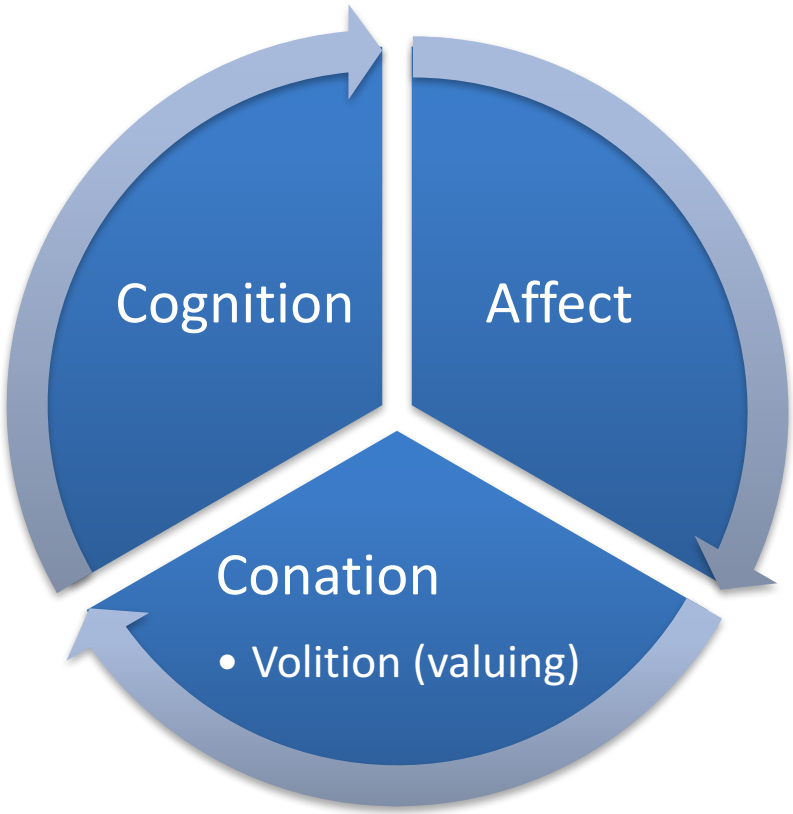
The missing piece of the puzzle …

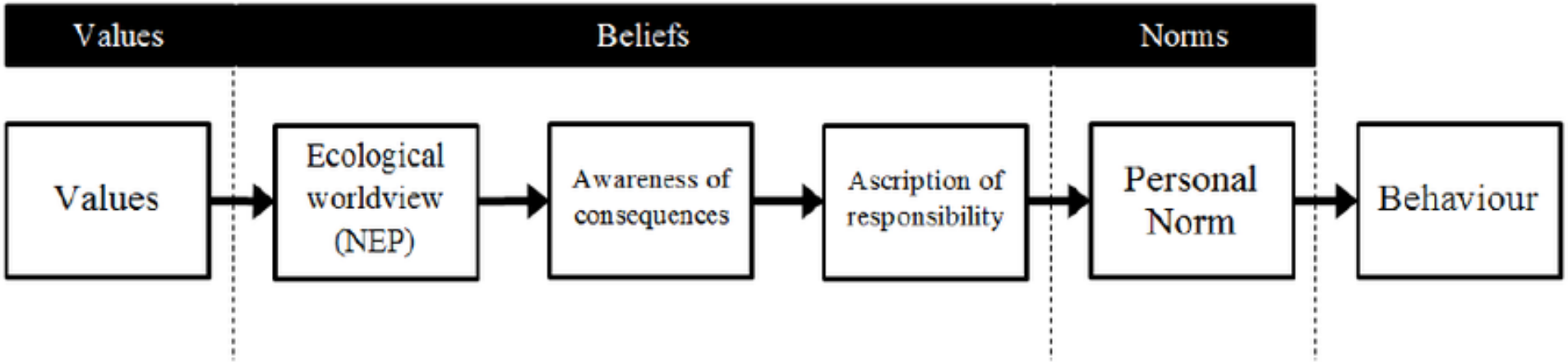
- Cognition, Affect and Conation (Goldin, 2017)

The three components of action (incl learning)



Value – Belief – Norm Theory

- Stern et al (1999), for environmentalism
- Application to teacher professional behaviour in Sahin (2013)



Valuing in the context of mathematics learning …

the convictions which an individual has internalised as being the things of importance and worth. What an individual values defines for her/him a window through which s/he views the world around her/him. Valuing provides the individual with the will and determination to maintain any course of action chosen in the learning and teaching of mathematics. They regulate the ways in which a learner's/teacher's cognitive skills and emotional dispositions are aligned to learning/teaching in any given educational context. (Seah & Andersson, 2015, p. 169)

The 'want to' mindset

- beyond the teaching of cognitive, 'how to' skills,
- beyond the nurturing of affective, 'I can' dispositions,
- to include the inculcation of the volitional, 'want to' mindset

- In turn, the 'want to' mindset will support cognitive and affective engagement

Applying the valuing perspective

"When are we ever going to use this?"

(School) mathematics as applicational

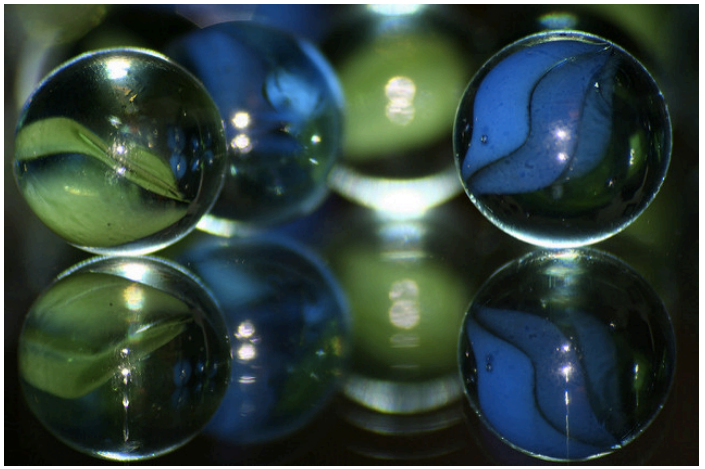
vs

(School) mathematics as developing one's thinking

Applying the valuing perspective

Example: 'Singapore mathematics'

Malcolm had 520 blue and green marbles. After giving away 1/4 of the blue marbles and 30 of the green marbles, he had an equal number of blue and green marbles. How many green marbles did he have at first?



Valuing of *concrete representation*

vs

Valuing of *visualisation*

Applying the valuing perspective

- Example: Homework

5 Copy and complete the following by placing the correct integer in the box.

a $-27 \div \square = -9$
b $-68 \div \square = 34$
c $72 \div \square = -8$
d $-18 \div \square = -6$
e $\square \div 7 = -5$
f $\square \div -4 = -6$
g $-132 \div \square = 11$
h $-270 \div \square = 27$

6 Calculate the value of each of the following by working from left to right.

a $-30 \div 6 \div -5$
b $-120 \div 4 \div -5$
c $-800 \div -4 \div -5 \div 2$

7 If $a = -12$, $b = 3$, $c = -4$ and $d = -6$, calculate the value of each of the following expressions.

a $a \div c$
b $a \div b$
c $a \div d$
d $b \div c$
e $b \div d$
f $a \div b \div d$

8 If $a = -24$, $b = 2$, $c = -4$ and $d = -12$, calculate the value of each of the following expressio

a $a \div b \times c$
b $d \times c \div b \div c$
c $b \div c \div d \times a$
d $c \times a \div d \div b$
e $a \times b \div d \div d$
f $a \div d \times c \div b$

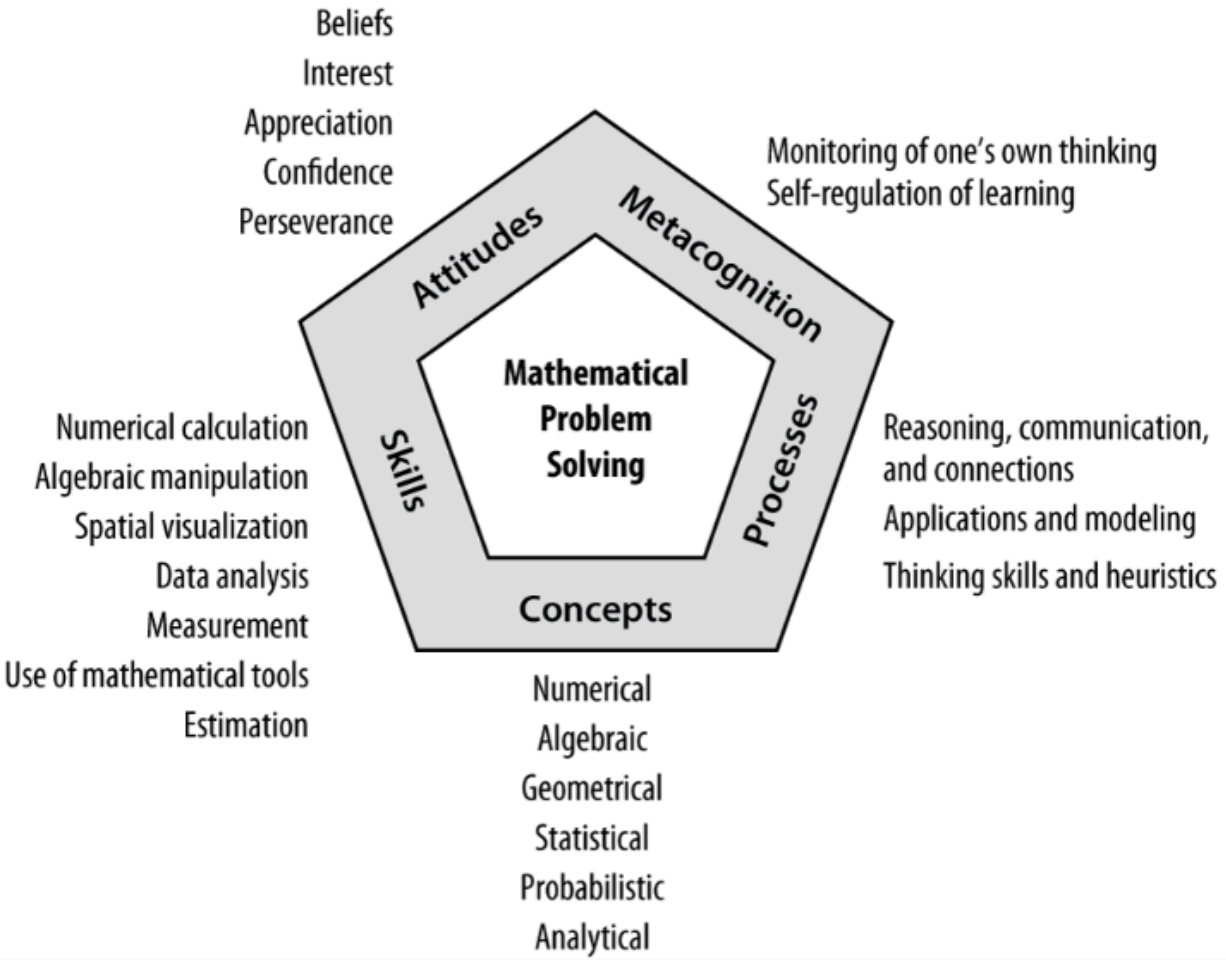
9 Copy and complete the following tables:

In top performing economies

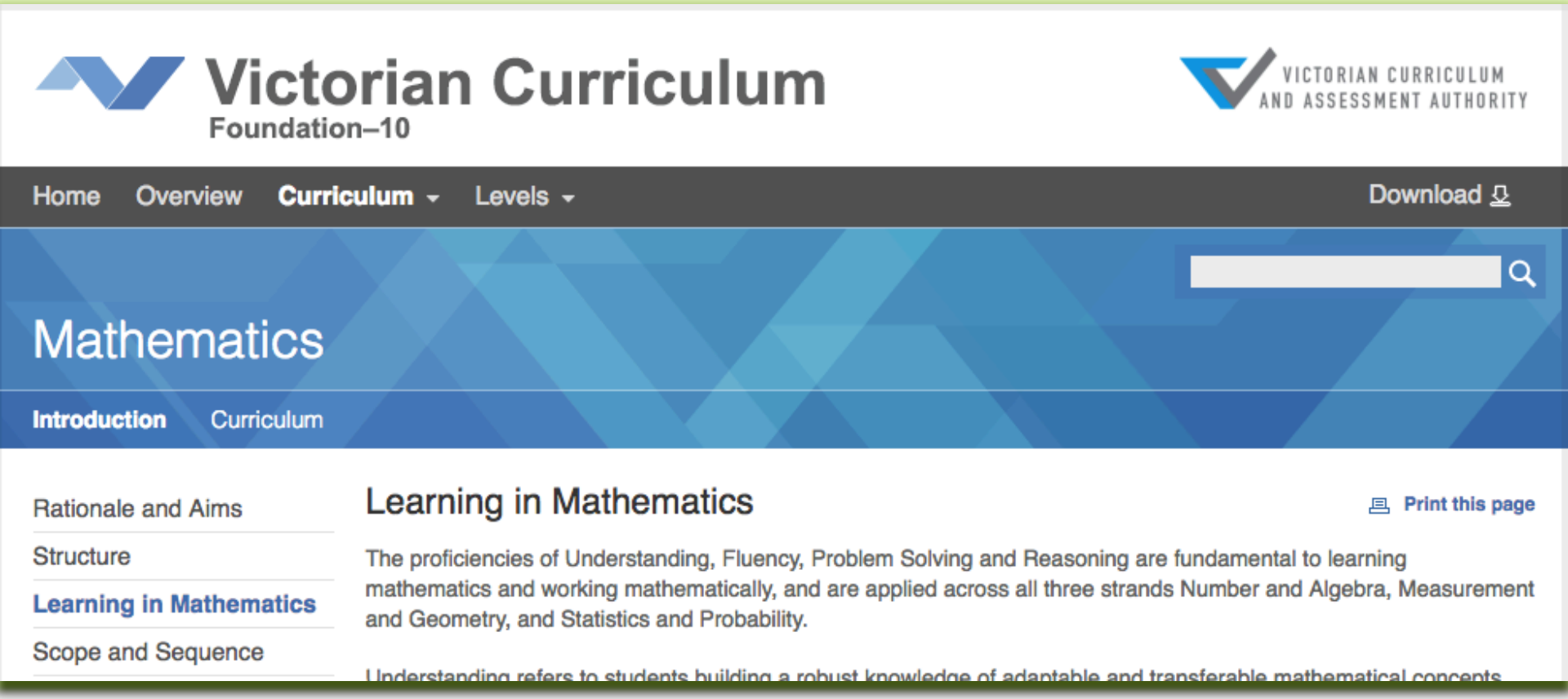
Hong Kong	Taiwan.
Understanding	Connections
Control	Recall
Effort	Effort
Ideas	Exploration
Recall	Openness
ICT	Communication
Feedback	
Connections	
Learning approach	

Singapore's maths curriculum

Exhibit 2: Singapore Mathematics Curriculum Framework[20]



Valuing in the AC / VC



Victorian Curriculum: Maths

	Number and Algebra	Measurement and Geometry	Statistics and Probability
Understanding			
Fluency			
Problem-solving			
Reasoning			

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