TIMSS 2019 Webinar:

Enhancing learning and teaching of mathematics and science in Hong Kong – A reflection based on the TIMSS 2019 results

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政策二十一

Happy Chinese New Year 2021

新年快樂

辛丑牛年

Outline

1. Introduction: What is TIMSS?
2. Achievement of Hong Kong students in TIMSS 2019
3. (a) Attitudes of Hong Kong students towards mathematics learning
   (b) Background information of Hong Kong students
4. How should we interpret TIMSS findings?
5. What can we learn from TIMSS?
   (a)Trend in achievement; (b) Gender difference; (c) Achievement in different content and cognitive domains; (d) Relation between background factors and student achievement; (e) Efficiency of the education system; (f) Student attitudes
6. Implications for teaching and learning
   (a) Student attitudes; (b) School improvement; (c) Professional development of teachers; (d) Teaching and learning
7. Conclusion

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1. What is TIMSS?

TIMSS = Trends in **I**nternational **M**athematics and **S**cience **S**tudy

- Under the auspices of the International Association for the Evaluation of Educational Achievement (IEA)
- Started in 1995 and repeated every four years: 1999, 2003, 2007, 2011, 2015, 2019, …
- Assesses student achievement in mathematics and science at Grades 4 (Primary 4) and 8 (Secondary 2)

Goals

"The goal of TIMSS is to provide the best policy-relevant information to help improve mathematics and science teaching and learning." (TIMSS 2019 Report, p. 3)

TIMSS is NOT a competition!

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TIMSS 2019

- TIMSS 2019 is the 7th cycle of the TIMSS assessments since 1995, so it monitors 24 years of trends in educational achievement and contexts for learning mathematics and science
- 64 participating countries/regions and 8 benchmarking entities participated in TIMSS 2019
- 58 countries/regions & 6 benchmarking entities participated in the 4th grade assessment
- 39 countries/regions & 7 benchmarking entities participated in the 8th grade assessment
- More than 580,000 Primary 4 and Secondary 2 students were tested worldwide

Countries/Regions Participating in TIMSS 2019

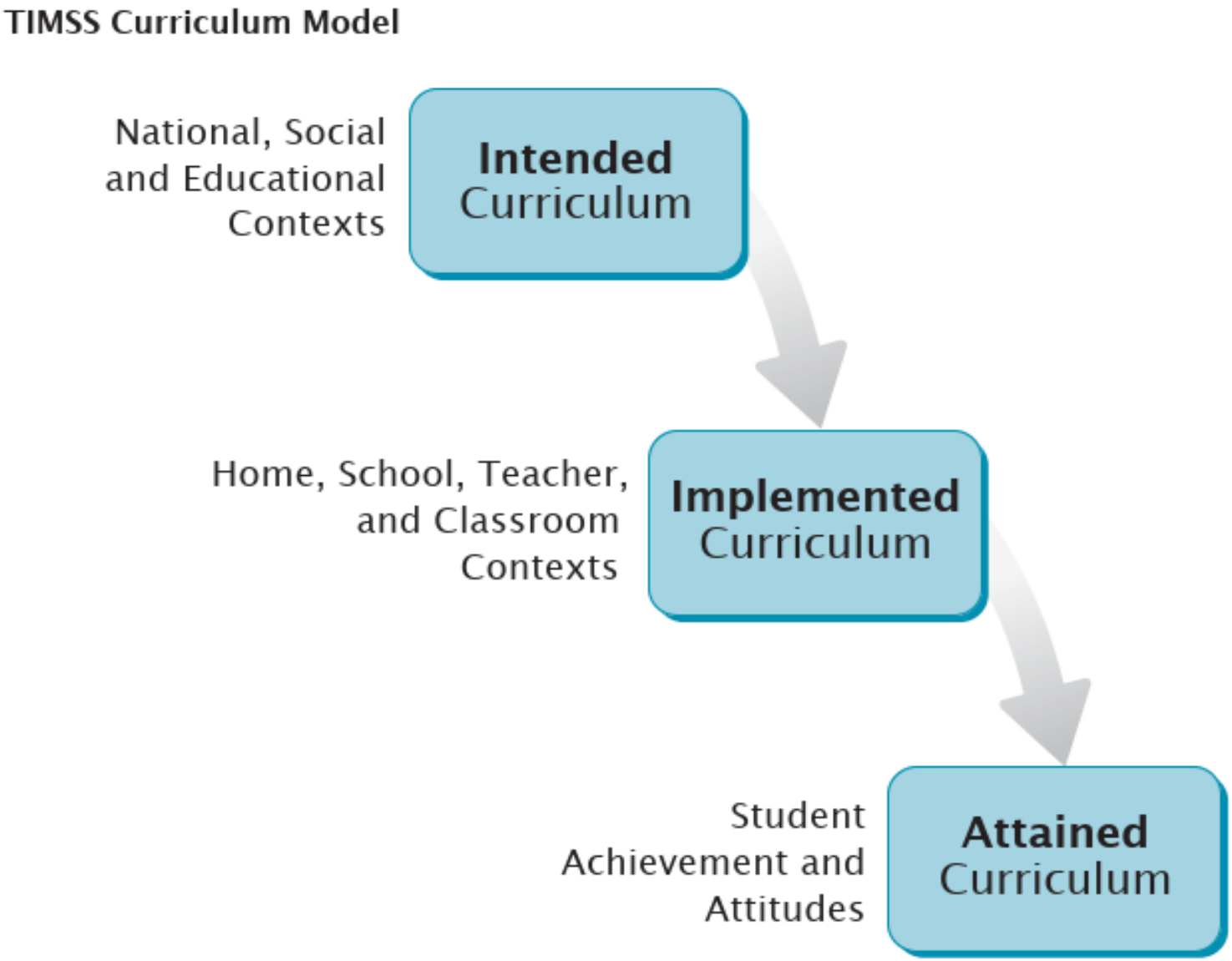
Albania
Armenia
Australia
Austria *
Azerbaijan
Bahrain
Belgium (Flemish)
Bosnia and Herzegovina
Bulgaria
Canada *
Chile *
Chinese Taipei *
Croatia *
Cyprus
Czech Republic *
Denmark *
Egypt
England *
Finland *
France *
Georgia *
Germany *
Hong Kong SAR *
Hungary *
Iran, Islamic Rep. of
Ireland
Israel *
Italy *
Japan
Jordan
Kazakhstan
Korea, Rep. of *
Kosovo
Kuwait
Latvia
Lebanon
Lithuania *
Malaysia *
Malta *
Montenegro
Morocco
Netherlands *
New Zealand
North Macedonia
Northern Ireland
Norway *
Oman
Pakistan
Philippines
Poland
Portugal *
Qatar *
Romania
Russian Federation *
Saudi Arabia
Serbia
Singapore *
Slovak Republic *
South Africa
Spain *
Sweden *
Turkey *
United Arab Emirates *
United States *

Benchmarking Participants

Ontario, Canada *
Quebec, Canada *
Moscow, Russian Fed. *
Madrid, Spain *
Gauteng, RSA
Western Cape, RSA
Abu Dhabi, UAE *
Dubai, UAE *

* Transitioned to eTIMSS

Curriculum Framework for TIMSS



Two Dimensions of Assessment

- TIMSS assessment is organized around two dimensions, a **content dimension** and a **cognitive dimension**
- A content dimension specifies the content to be assessed & cognitive dimension specifies the thinking processes to be assessed
- Content domains of mathematics:

  P4: Number, Measurement & Geometry, Data

  S2: Number, Algebra, Geometry, Data and Probability
- Cognitive domains: Knowing, Applying, Reasoning

Mathematics Content and Cognitive Domains in TIMSS 2019

Content Domains for Grade 4
Number (50%)
Measurement and geometry (30%)
Data (20%)

Content Domains for Grade 8
Number (30%)
Algebra (30%)
Geometry (20%)
Data and Probability (20%)

Cognitive Domains for Grades 4
Knowing (40%)
Applying (40%)
Reasoning (20%)

Cognitive Domains for Grades 8
Knowing (35%)
Applying (40%)
Reasoning (25%)

Mathematics Content Domains

Content domain (Grade 4)

Number (50%)	Whole number (25%)
	Expressions, simple equations, and relationships (15%)
	Fractions and decimals (10%)
Measurement and Geometry (30%)	Measurement (15%)
	Geometry (15%)
Data (20%)	Reading, interpreting, and representing data (15%)
	Using data to solve problems (5%)

Cognitive Domain

Cognitive domain (Grade 4)	
Knowing (40%)	Recall, recognize, classify/order, compute, retrieve, measure
Applying (40%)	Determine, represent/model, implement
Reasoning (20%)	Analyze, integrate/synthesize, evaluate, draw conclusions, generalize, justify

eTIMSS 2019

- TIMSS 2019 is transitioning from paper-and-pencil test (paperTIMSS) to computer-based assessment (eTIMSS)
- Reflect the growing use of digital devices in school and everyday life, and keep pace with an increasing worldwide reliance on digital communication and assessment
- Capitalize on the benefits of technology to ask students to solve mathematics problems and conduct science investigations in interactive situations
- Problem Solving and Inquiry tasks (PSIs): simulate real world and laboratory situations where students can integrate and apply process skills and content knowledge to solve mathematics problems and conduct scientific experiments or investigations

Bridge Study

- A substantial percentage of equivalent items were administered to a separate sample of students in the same school following a randomly equivalent groups design
- The "bridge" data form an intermediate link between eTIMSS 2019 and the paper-based data in 2015, and strengthens the validity and interpretability of achievement results based on linking the two modes

Exhibit 6: eTIMSS 2019 International Average Percent Correct on Paper Bridge and eTIMSS Invariant Items

Grade 4	Bridge	eTIMSS	Difference	z– test
Mathematics	53.42 (0.23)	50.77 (0.13)	2.65 (0.26)	B>E (0.05)
Science	51.51 (0.20)	49.69 (0.11)	1.82 (0.23)	B>E (0.05)
Grade 8	**Bridge**	**eTIMSS**	**Difference**	**z– test**
Mathematics	47.37 (0.33)	43.72 (0.18)	3.66 (0.38)	B>E (0.05)
Science	47.81 (0.27)	45.72 (0.16)	2.09 (0.31)	B>E (0.05)

B>E indicates the bridge students performed significantly higher than the eTIMSS students (α= 0.05).

TIMSS 2019 in Hong Kong

- Hong Kong participated in TIMSS 1995, 1999, 2003, 2007, 2011, 2015 and 2019
- The Hong Kong samples included students from local and non-local schools
- 139 primary schools and 136 secondary schools participated in TIMSS 2019 in Hong Kong
- 2968 Primary 4 students and 3265 Secondary 2 students were tested in eTIMSS
- Avg. age of Primary 4 students tested: 10.1 years old
- Avg. age of Secondary 2 students tested: 14.1 years old

Comparisons between eTIMSS & Bridge Study (East Asian Regions)

eTIMSS 2019 vs Bridge 2019 (Primary 4)					
Mathematics	eTIMSS		Bridge		Significant?
	Scale scores	s.e.	Scale scores	s.e.	
1 Chinese Taipei	599	1.9	603	2.6	n.s.
2 Hong Kong SAR	602	3.3	607	7.9	n.s.
3 Korea	600	2.2	595	2.5	n.s.
4 Singapore	625	3.9	631	5.6	n.s.
International Avg.	528	0.6	529	1.0	n.s.

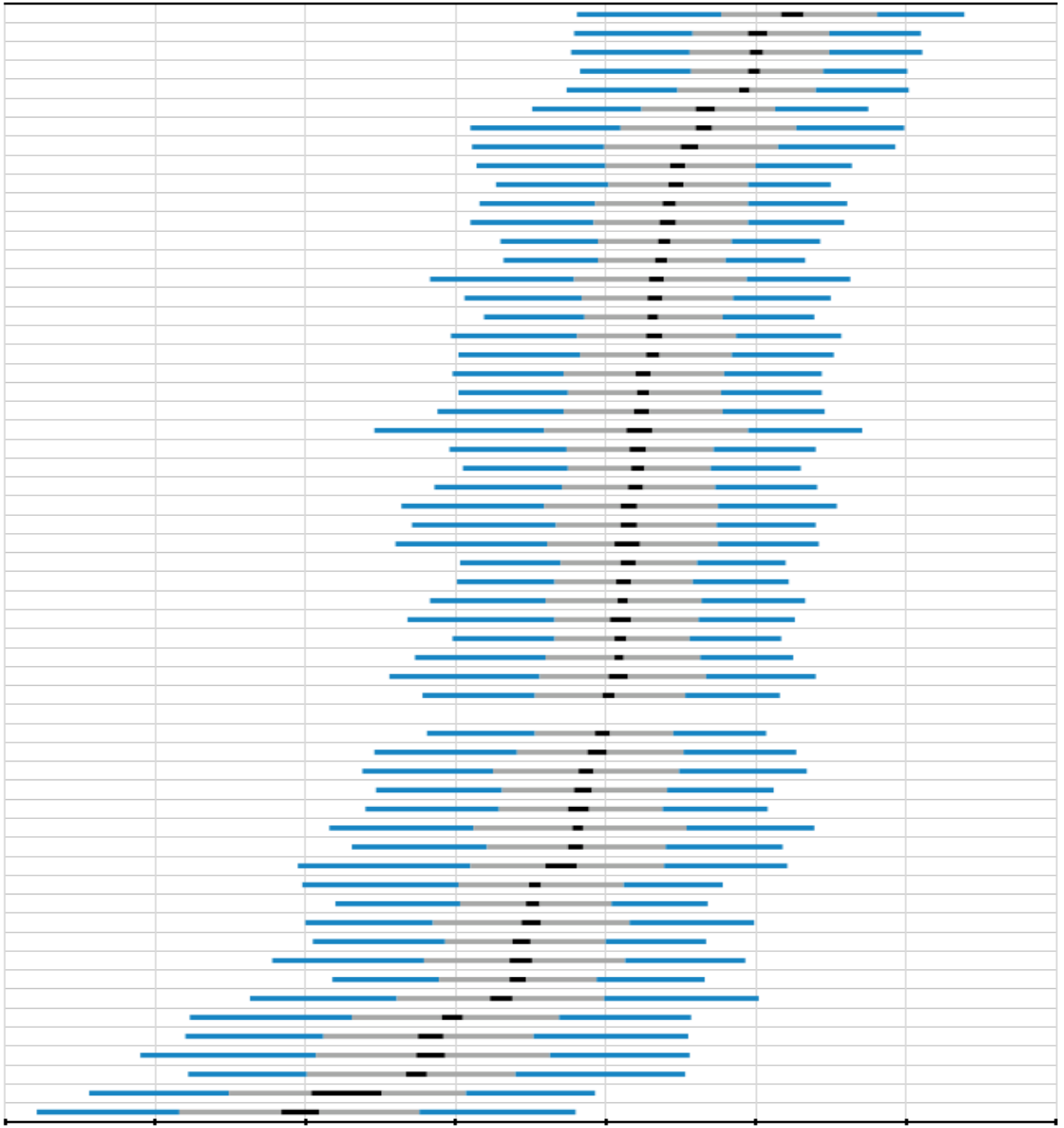
2. Achievement of Hong Kong Students in TIMSS 2019

Exhibit 1.1: Average Mathematics Achievement and Scale Score Distributions

IEA TIMSS 2019

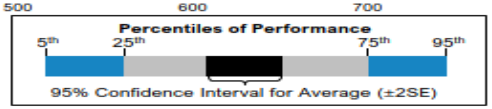
Country	Average Scale Score	
[3] Singapore	625 (3.9)	▲
† Hong Kong SAR	602 (3.3)	▲
Korea, Rep. of	600 (2.2)	▲
Chinese Taipei	599 (1.9)	▲
Japan	593 (1.8)	▲
[2] Russian Federation	567 (3.3)	▲
† Northern Ireland	566 (2.7)	▲
[2] England	556 (3.0)	▲
Ireland	548 (2.5)	▲
[2] Latvia	546 (2.6)	▲
† Norway (5)	543 (2.2)	▲
[2] Lithuania	542 (2.8)	▲
Austria	539 (2.0)	▲
≡ Netherlands	538 (2.2)	▲
[2] † United States	535 (2.5)	▲
Czech Republic	533 (2.5)	▲
† Belgium (Flemish)	532 (1.9)	▲
Cyprus	532 (2.9)	▲
Finland	532 (2.3)	▲
[2] Portugal	525 (2.6)	▲
† Denmark	525 (1.9)	▲
Hungary	523 (2.6)	▲
[2] Turkey (5)	523 (4.4)	▲
Sweden	521 (2.8)	▲
Germany	521 (2.3)	▲
Poland	520 (2.7)	▲
Australia	516 (2.8)	▲
Azerbaijan	515 (2.7)	▲
Bulgaria	515 (4.3)	▲
Italy	515 (2.4)	▲
[2] Kazakhstan	512 (2.5)	▲
[1 2] Canada	512 (1.9)	▲
[2] Slovak Republic	510 (3.5)	▲
Croatia	509 (2.2)	▲
Malta	509 (1.4)	▲
[2] Serbia	508 (3.2)	▲
Spain	502 (2.1)	
TIMSS Scale Centerpoint	**500**	
Armenia	498 (2.5)	
Albania	494 (3.4)	
[2] New Zealand	487 (2.6)	▽
France	485 (3.0)	▽
[1] Georgia	482 (3.7)	▽
United Arab Emirates	481 (1.7)	▽
Bahrain	480 (2.6)	▽
North Macedonia	472 (5.3)	▽
Montenegro	453 (2.0)	▽
Bosnia and Herzegovina	452 (2.4)	▽
Qatar	449 (3.4)	▽
[2] Kosovo	444 (3.0)	▽
Iran, Islamic Rep. of	443 (3.9)	▽
Chile	441 (2.7)	▽
Oman	431 (3.7)	▽
[2] Saudi Arabia	398 (3.6)	▽
Morocco	383 (4.3)	▽
Kuwait	383 (4.7)	▽
South Africa (5)	374 (3.6)	▽
[2 ψ] Pakistan	328 (12.0)	▽
[2 ψ] Philippines	297 (6.4)	▽

Mathematics Achievement Distribution



▲ Average significantly higher than the centerpoint of the TIMSS scale

▽ Average significantly lower than the centerpoint of the TIMSS scale



Primary 4 Mathematics

IEA TIMSS 2019

Exhibit 1.1: Average Mathematics Achievement and Scale Score Distributions

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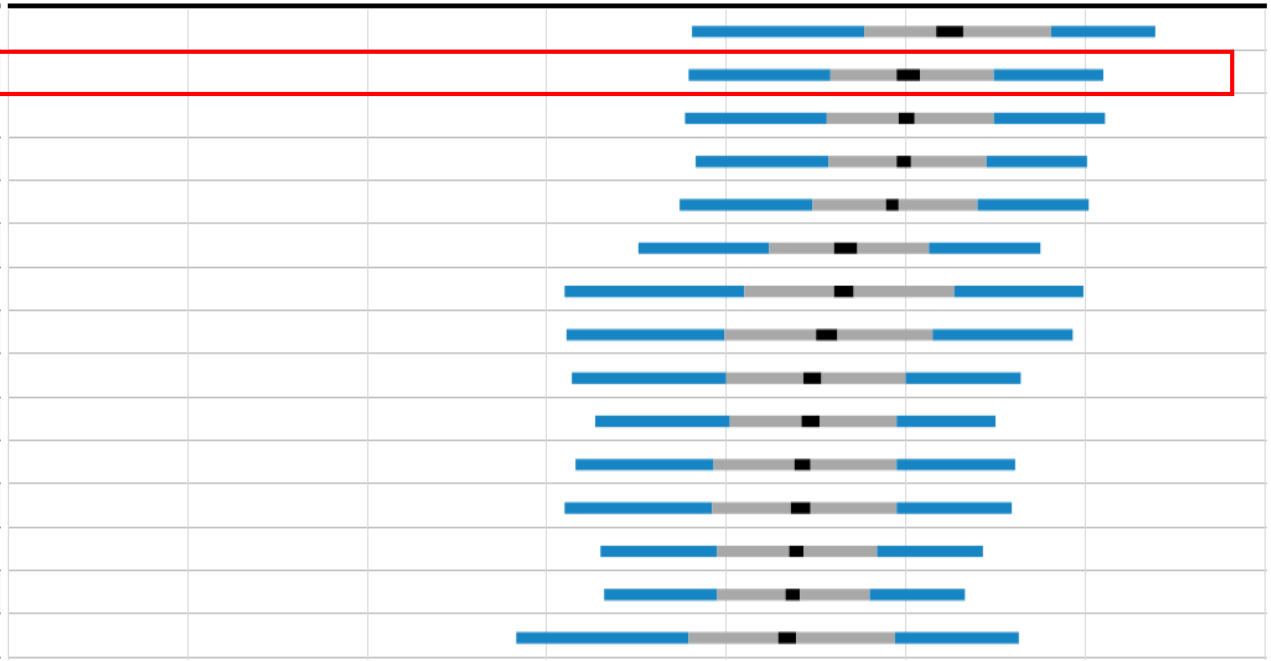
Country	Average Scale Score		Mathematics Achievement Distribution
3 Singapore	625 (3.9)	▲	
† Hong Kong SAR	602 (3.3)	▲	
Korea, Rep. of	600 (2.2)	▲	
Chinese Taipei	599 (1.9)	▲	
Japan	593 (1.8)	▲	
2 Russian Federation	567 (3.3)	▲	
† Northern Ireland	566 (2.7)	▲	
2 England	556 (3.0)	▲	
Ireland	548 (2.5)	▲	
2 Latvia	546 (2.6)	▲	
† Norway (5)	543 (2.2)	▲	
2 Lithuania	542 (2.8)	▲	
Austria	539 (2.0)	▲	
‡ Netherlands	538 (2.2)	▲	
2 † United States	535 (2.5)	▲	



▲ Average significantly higher than the centerpoint of the TIMSS scale

▽ Average significantly lower than the centerpoint of the TIMSS scale

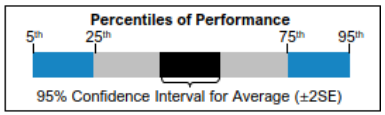


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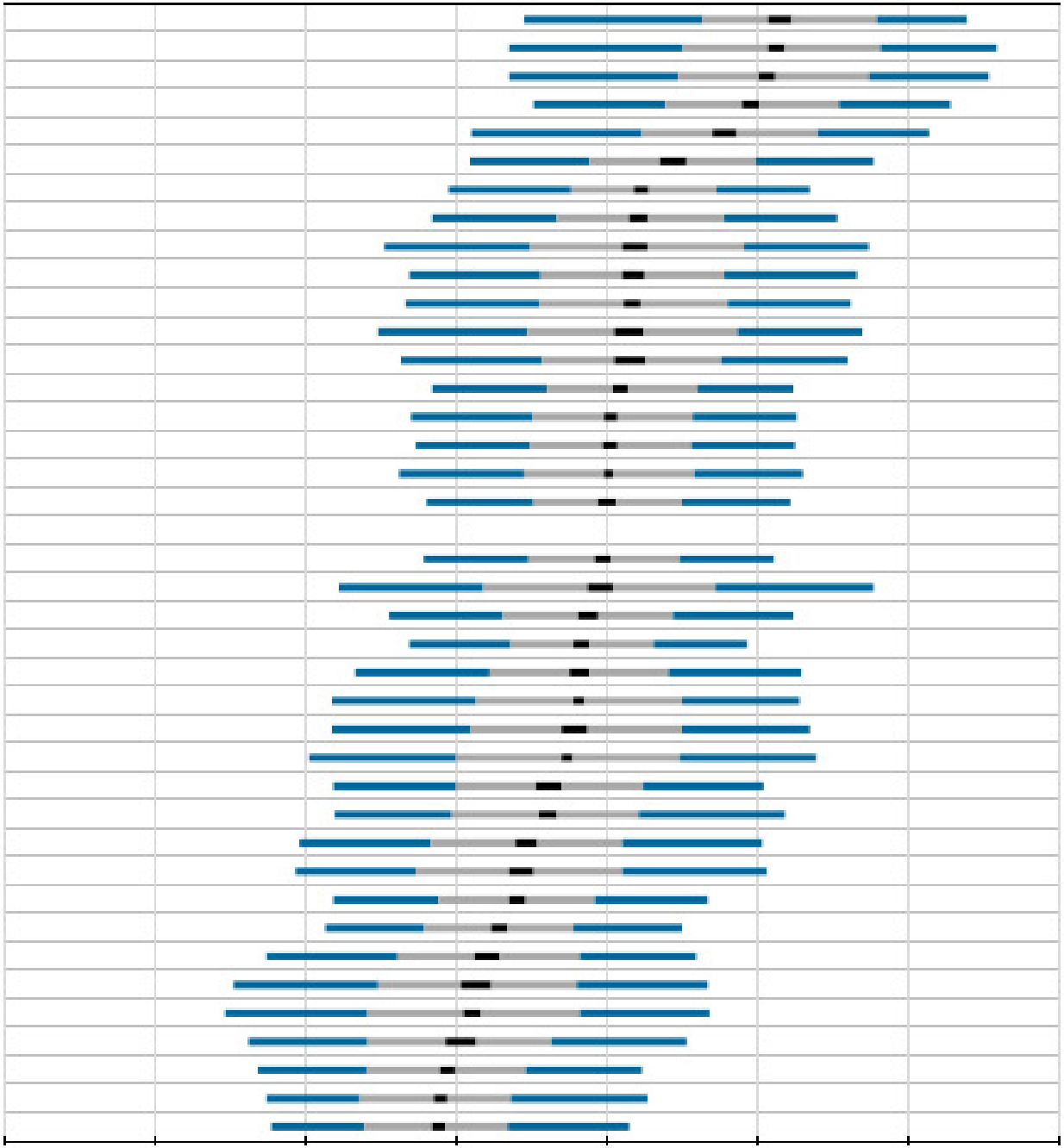
Exhibit 3.1: Average Mathematics Achievement and Scale Score Distributions

IEA TIMSS 2019

Country	Average Scale Score	
[2] Singapore	616 (4.0)	▲
Chinese Taipei	612 (2.7)	▲
Korea, Rep. of	607 (2.8)	▲
Japan	594 (2.7)	▲
† Hong Kong SAR	578 (4.1)	▲
[2] Russian Federation	543 (4.5)	▲
Ireland	524 (2.6)	▲
Lithuania	520 (2.9)	▲
[3] Israel	519 (4.3)	▲
Australia	517 (3.8)	▲
Hungary	517 (2.9)	▲
† United States	515 (4.8)	▲
England	515 (5.3)	▲
Finland	509 (2.6)	▲
† Norway (9)	503 (2.4)	
[2] Sweden	503 (2.5)	
Cyprus	501 (1.6)	
Portugal	500 (3.2)	
TIMSS Scale Centerpoint	**500**	
Italy	497 (2.7)	
Turkey	496 (4.3)	
[2] Kazakhstan	488 (3.3)	▽
France	483 (2.5)	▽
† New Zealand	482 (3.4)	▽
Bahrain	481 (1.7)	▽
Romania	479 (4.3)	▽
United Arab Emirates	473 (1.9)	▽
[1] Georgia	461 (4.3)	▽
Malaysia	461 (3.2)	▽
Iran, Islamic Rep. of	446 (3.7)	▽
[9] Qatar	443 (4.0)	▽
[9] Chile	441 (2.8)	▽
Lebanon	429 (2.9)	▽
[9] Jordan	420 (4.3)	▽
[2 9] Egypt	413 (5.2)	▽
[9] Oman	411 (2.8)	▽
[9] Kuwait	403 (5.0)	▽
[2 9] Saudi Arabia	394 (2.5)	▽
[X] South Africa (9)	389 (2.3)	▽
[9] Morocco	388 (2.3)	▽

Mathematics Achievement Distribution



Secondary 2 Mathematics

IEA TIMSS 2019

Exhibit 3.1: Average Mathematics Achievement and Scale Score Distributions

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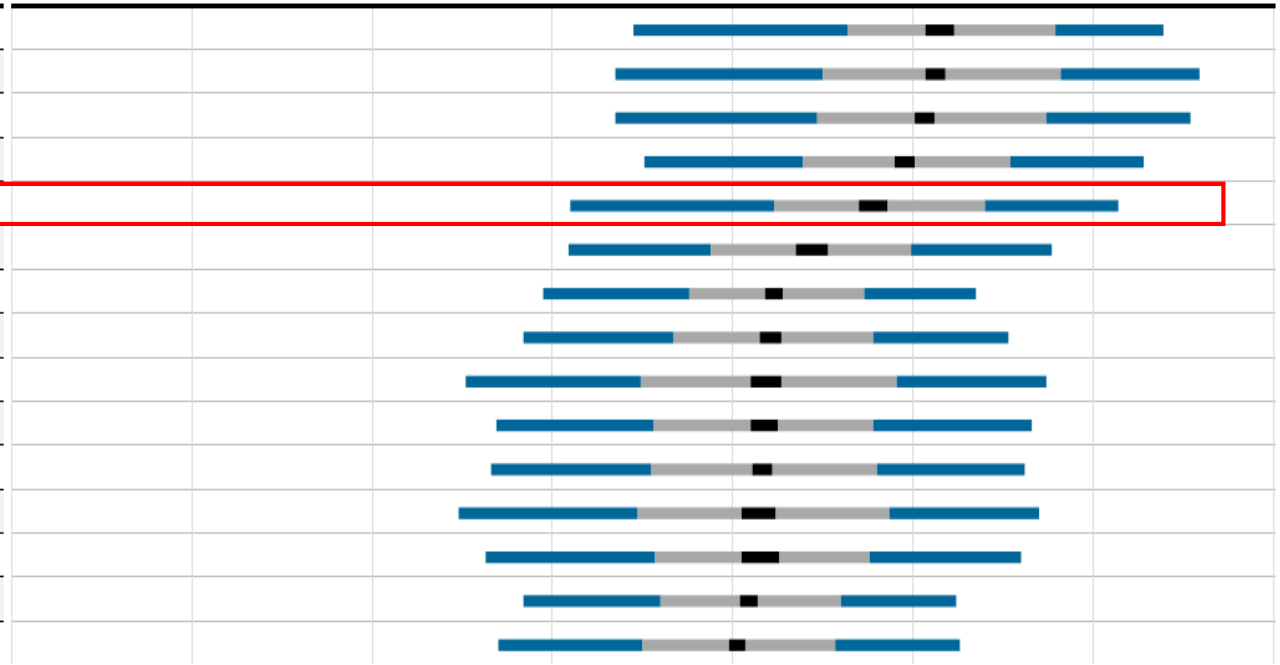
Country	Average Scale Score		Mathematics Achievement Distribution
[2] Singapore	616 (4.0)	▲	
Chinese Taipei	612 (2.7)	▲	
Korea, Rep. of	607 (2.8)	▲	
Japan	594 (2.7)	▲	
† Hong Kong SAR	578 (4.1)	▲	
[2] Russian Federation	543 (4.5)	▲	
Ireland	524 (2.6)	▲	
Lithuania	520 (2.9)	▲	
[3] Israel	519 (4.3)	▲	
Australia	517 (3.8)	▲	
Hungary	517 (2.9)	▲	
† United States	515 (4.8)	▲	
England	515 (5.3)	▲	
Finland	509 (2.6)	▲	
† Norway (9)	503 (2.4)		



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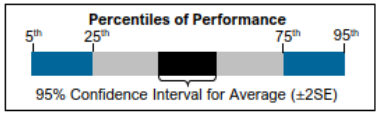

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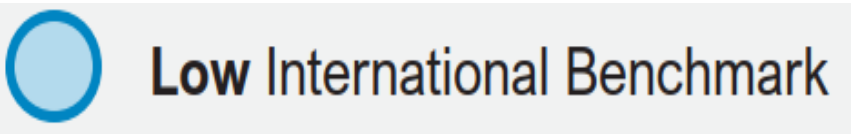
International Benchmarks - Grade 4

4 levels of International Benchmarks: Advanced (625), High (550), Intermediate (475) and Low (400)



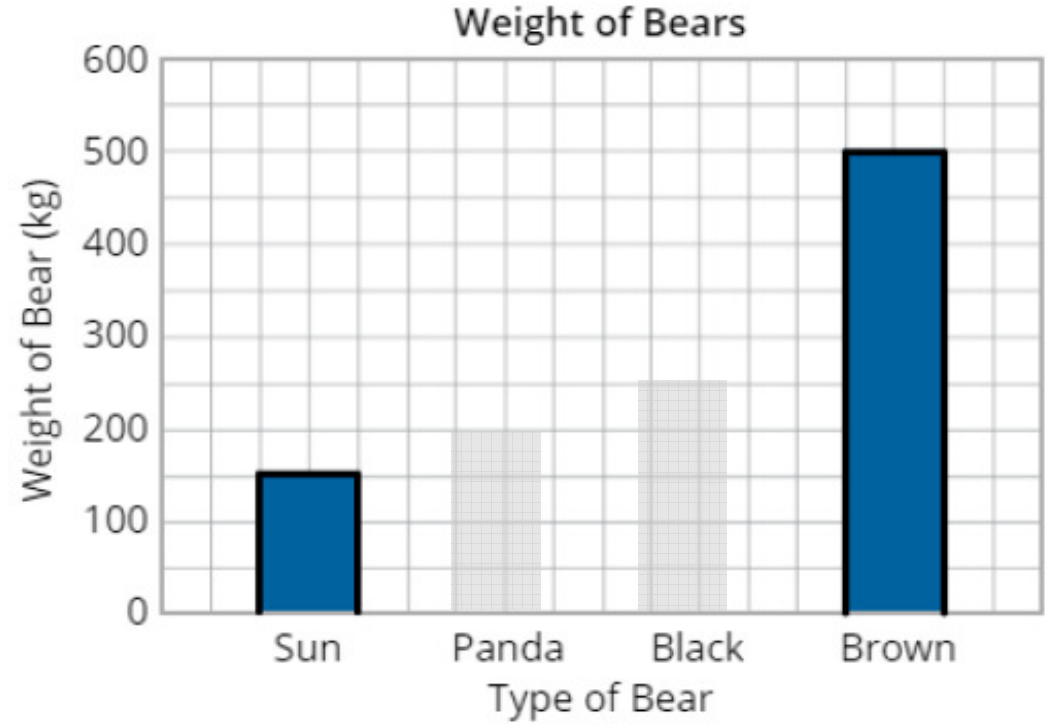
Students have some basic mathematical knowledge.
They can add, subtract, multiply, and divide one- and two-digit whole numbers.
They can solve simple word problems.
They have some knowledge of simple fractions and common geometric shapes.
Students can read and complete simple bar graphs and tables.

- It can be considered a level of minimum proficiency internationally. Many countries had >90% of their students reaching the Low Benchmark.

The table shows the weights of 4 bears.

Type of Bear	Weight (kg)
Sun	150
Panda	200
Black	250
Brown	500

Use the data to complete the graph.



98%

†	Hong Kong SAR	98 (0.6) ▲
	Korea, Rep. of	96 (0.9) ▲
	Japan	95 (0.9) ▲
3	Singapore	94 (1.0) ▲
2	Lithuania	93 (1.3) ▲
2	Latvia	93 (1.3) ▲
†	Northern Ireland	92 (1.3) ▲
	Ireland	90 (1.3) ▲
†	Belgium (Flemish)	89 (1.2) ▲
	Poland	88 (1.6) ▲
2	Russian Federation	88 (1.5) ▲
	Chinese Taipei	88 (1.7) ▲
	Czech Republic	87 (1.5) ▲
	Australia	87 (1.5) ▲
	Austria	86 (1.4) ▲
	Finland	86 (2.0) ▲
†	Norway (5)	86 (1.7) ▲
2	England	84 (1.8) ▲
2	Portugal	84 (1.5) ▲
≡	Netherlands	84 (1.9)
	Cyprus	84 (1.7) ▲
	Sweden	83 (1.8)
	Spain	82 (1.9)
	Hungary	82 (2.3)
2†	United States	82 (1.3)
	Germany	82 (1.9)
†	Denmark	82 (1.7)
2	Turkey (5)	81 (2.3)
	Azerbaijan	81 (1.7)
	International Average	**81 (0.3)**
	Malta	80 (1.7)
2	Slovak Republic	80 (1.9)
	Croatia	80 (2.1)
	Italy	79 (2.1)
2	New Zealand	79 (1.8)
1 2	Canada	77 (1.5) ▽
2	Serbia	75 (3.3)
	Bulgaria	74 (2.6) ▽
	France	71 (2.1) ▽
	United Arab Emirates	69 (0.7) ▽
	Iran, Islamic Rep. of	69 (1.9) ▽
	Bahrain	64 (2.5) ▽
	Qatar	63 (2.6) ▽

Intermediate International Benchmark

- **There are four levels of benchmarks**

Low International Benchmark

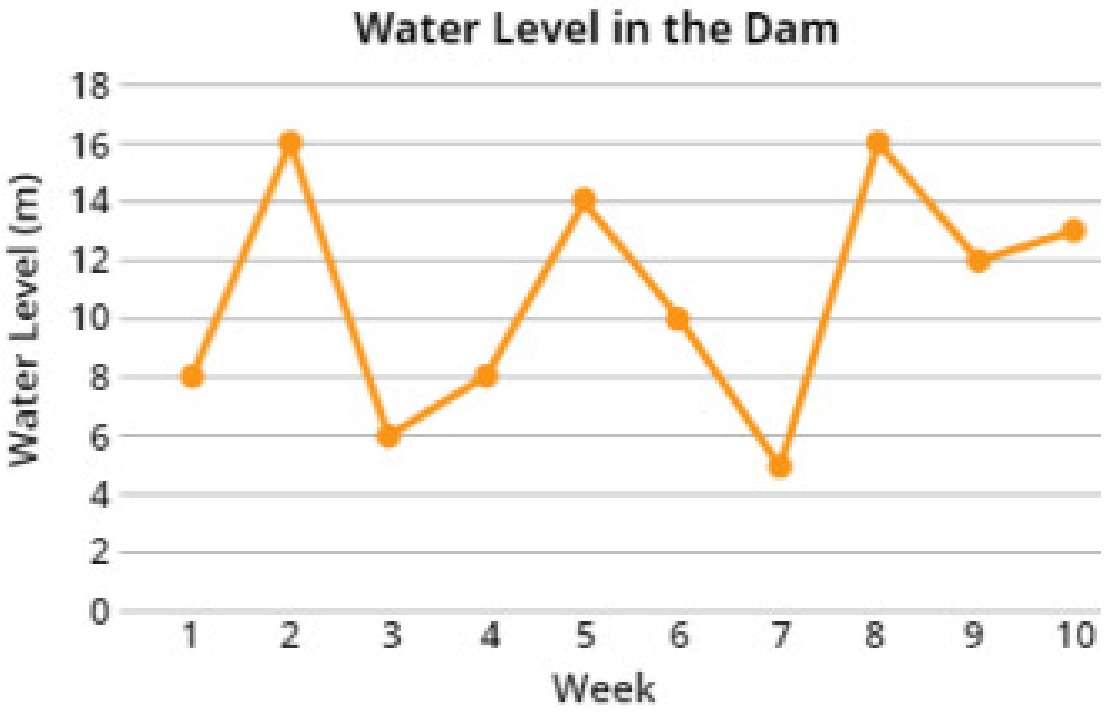
…Students can read and complete simple bar graphs and tables.

Intermediate International Benchmark

Students can apply basic mathematical knowledge in simple situations.

They can compute with 3- and 4-digit whole numbers in a variety of situations.
They have some understanding of decimals and fractions.
Students can identify and draw shapes with simple properties.
They can read, label, and interpret information in graphs and tables.

The graph shows the water level in a dam for 10 weeks.



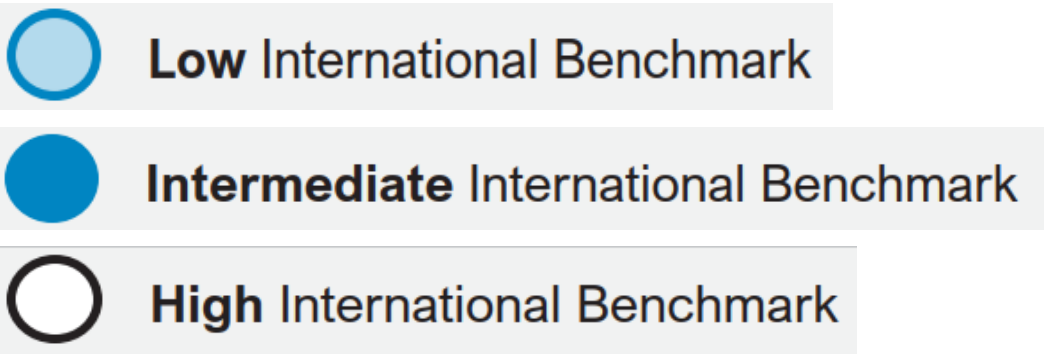
What was the water level for week 8?

Answer: ____ m

	Japan	95 (0.9) ▲
3	Singapore	92 (0.9) ▲
	Chinese Taipei	92 (1.3) ▲
	Korea, Rep. of	91 (1.3) ▲
2	England	91 (1.5) ▲
≡	Netherlands	91 (1.4) ▲
†	Hong Kong SAR	91 (1.5) ▲
†	Norway (5)	88 (1.7) ▲
†	Northern Ireland	87 (1.8) ▲
2	Russian Federation	87 (1.5) ▲
	Sweden	86 (1.9) ▲
	Finland	86 (1.6) ▲
†	Belgium (Flemish)	86 (1.6) ▲
2	Lithuania	84 (1.7) ▲
†	Denmark	84 (1.7) ▲
	Australia	84 (1.6) ▲
2	Portugal	82 (1.6) ▲
2	Latvia	81 (2.0) ▲
	Ireland	80 (1.6) ▲
	Azerbaijan	79 (2.0) ▲
2†	United States	79 (1.4) ▲
	Spain	78 (2.5) ▲
2	New Zealand	77 (1.7) ▲
	Hungary	76 (1.9) ▲
1 2	Canada	76 (1.3) ▲
	Cyprus	75 (1.7) ▲
	Malta	74 (2.0) ▲
	Czech Republic	73 (2.2) ▲
	Germany	71 (2.0)
	Austria	70 (2.4)
2	Slovak Republic	70 (2.2)
	Italy	69 (2.5)
2	Turkey (5)	69 (2.4)
	France	68 (2.6)
	International Average	**68 (0.3)**
	Albania	68 (2.2)
2	Serbia	66 (2.7)
	Poland	65 (2.2)
2	Kazakhstan	64 (2.2)

91%

High International Benchmarks



Students apply conceptual understanding to solve problems. They can apply conceptual understanding of whole numbers to solve two-step word problems. They show understanding of the number line, multiples, factors, and rounding numbers, and operations with fractions and decimals. Students can solve simple measurement problems. They demonstrate understanding of geometric properties of shapes and angles. Students can interpret and use data in tables and a variety of graphs to solve problems.

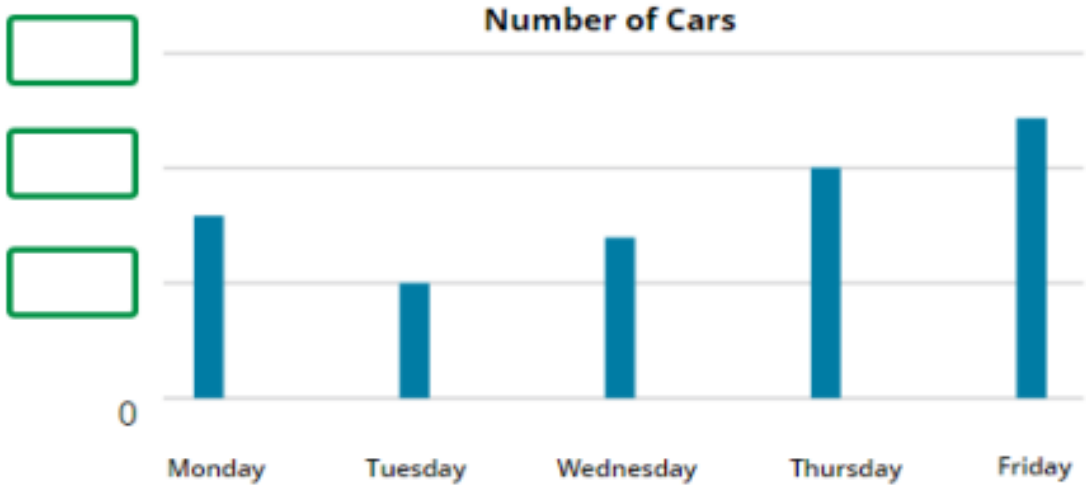
Skylar recorded the number of cars that traveled along her street each morning.

Day	Number of Cars
Monday	8
Tuesday	5
Wednesday	7
Thursday	10
Friday	12

She started making a graph of her data.

What numbers should Skylar use to label the horizontal lines on her graph?

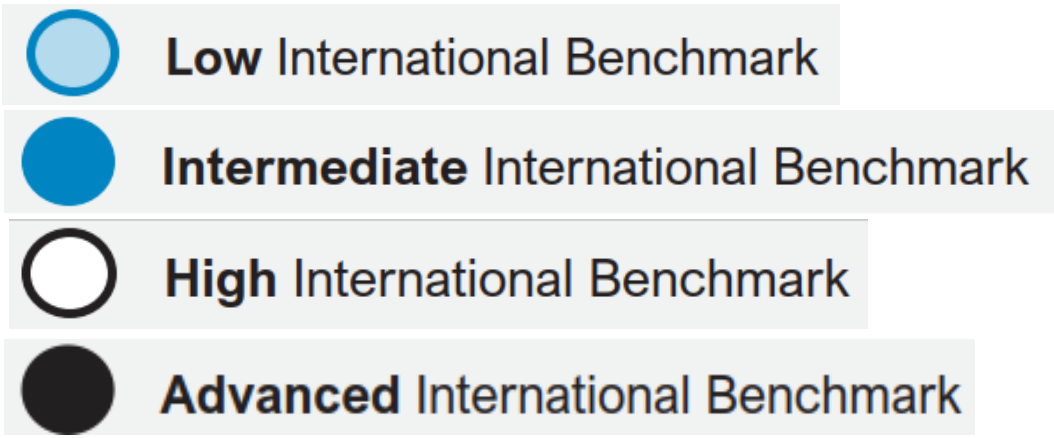
Put the numbers in the boxes on Skylar's graph.



80%

Japan	88 (1.6) ▲
Korea, Rep. of	87 (1.6) ▲
Hong Kong SAR	80 (2.3) ▲
Singapore	77 (1.9) ▲
Chinese Taipei	67 (2.2) ▲
Norway (5)	54 (2.1) ▲
England	52 (2.6) ▲
Belgium (Flemish)	51 (2.5) ▲
Netherlands	49 (2.2) ▲
Latvia	48 (2.3) ▲
Northern Ireland	47 (2.4) ▲
Cyprus	47 (2.6) ▲
Australia	47 (2.0) ▲
Ireland	47 (2.2) ▲
Sweden	45 (2.4) ▲
Canada	43 (1.7) ▲
Russian Federation	41 (2.7) ▲
Lithuania	40 (2.3) ▲
Denmark	40 (2.6) ▲
United States	40 (1.8) ▲
Finland	39 (2.1) ▲
Portugal	38 (2.0) ▲
Czech Republic	38 (2.3)
Austria	38 (2.4)
Malta	36 (1.9)
Germany	35 (2.5)
International Average	**34 (0.3)**
Hungary	34 (2.6)
Slovak Republic	33 (2.5)
United Arab Emirates	33 (1.0)
New Zealand	32 (1.8)
Poland	31 (2.1)
Italy	30 (2.6)
Albania	30 (2.7)
North Macedonia	29 (3.2)
Turkey (5)	28 (2.0) ▽

Advanced International Benchmarks



Students can apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning. Students can solve a variety of multistep word problems involving whole numbers and show an understanding of fractions and decimals. They can apply knowledge of two- and three-dimensional shapes in a variety of situations. Students can interpret and represent data to solve multistep problems.

❖ Example of an Advanced Benchmark Item – Primary 4

Country	Percent Full Credit	
3 Singapore	55 (2.4)	▲
† Northern Ireland	42 (2.7)	▲
Korea, Rep. of	39 (2.5)	▲
Chinese Taipei	38 (2.4)	▲
† Hong Kong SAR	35 (2.9)	▲
2 Latvia	35 (2.1)	▲
2 England	34 (2.6)	▲
Poland	32 (2.1)	▲
2 Russian Federation	31 (1.9)	▲
Czech Republic	29 (2.1)	▲
† Denmark	29 (2.5)	
Cyprus	27 (2.3)	
† Norway (5)	27 (2.3)	
2† United States	27 (1.4)	
† Belgium (Flemish)	26 (2.1)	
Ireland	26 (2.5)	
2 Slovak Republic	26 (2.3)	
2 Portugal	26 (2.4)	
≡ Netherlands	25 (2.2)	
Germany	25 (2.1)	
Sweden	25 (1.5)	
Japan	25 (2.0)	
Australia	25 (2.0)	
International Average	24 (0.3)	

35%

Content Domain: Number

Cognitive Domain: Reasoning

Description: Devises two ways of grouping objects that satisfy two conditions (2 of 2 points)

A teacher wants to put 30 students in groups so that

- each group has the same number of students, **and**
- each group has an odd number of students.

Show two different ways the teacher could make the groups.

Way 1

Number of groups: 6

Number of students in each group: 5

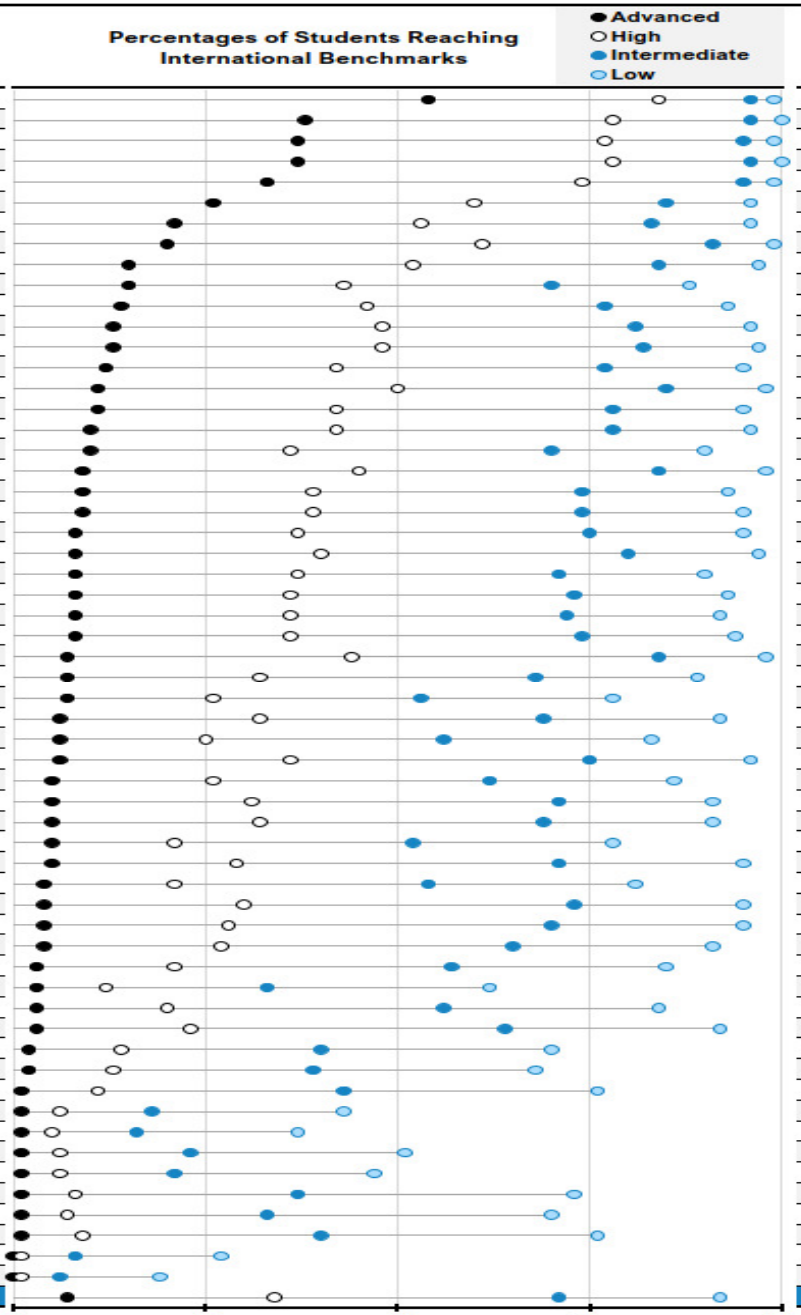
Way 2

Number of groups: 10

Number of students in each group: 3

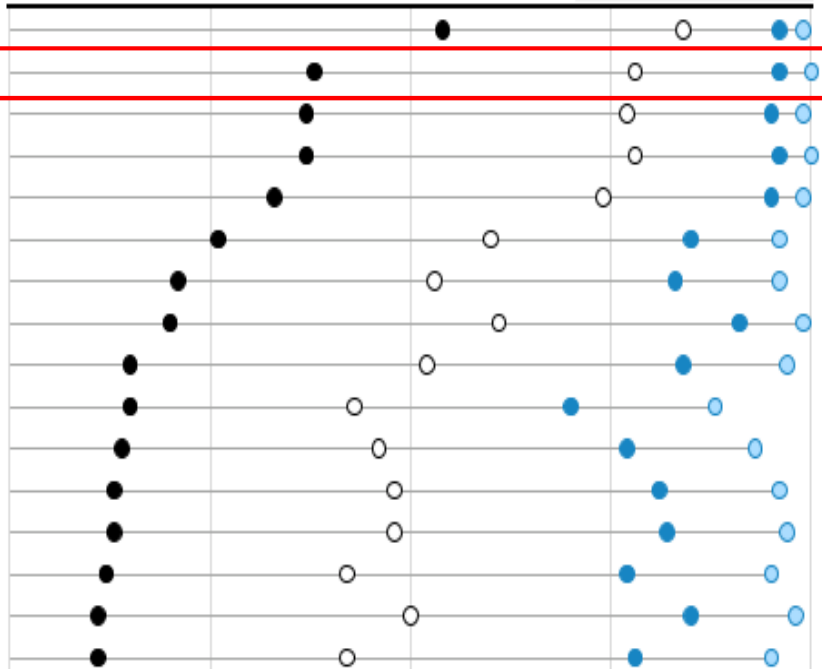
The answer shown illustrates the type of response that would receive full credit (2 points).

Exhibit 1.8: Percentages of Students Reaching International Benchmarks of Mathematics Achievement



Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
[3] Singapore	54 (2.2)	84 (1.5)	96 (0.7)	99 (0.3)
† Hong Kong SAR	38 (1.9)	78 (1.6)	96 (0.7)	100 (0.2)
Korea, Rep. of	37 (1.4)	77 (1.2)	95 (0.5)	99 (0.2)
Chinese Taipei	37 (1.3)	78 (1.1)	96 (0.5)	100 (0.2)
Japan	33 (1.3)	74 (0.9)	95 (0.4)	99 (0.2)
† Northern Ireland	26 (1.4)	60 (1.4)	85 (1.1)	96 (0.6)
[2] England	21 (1.4)	53 (1.5)	83 (1.2)	96 (0.5)
[2] Russian Federation	20 (1.6)	61 (1.9)	91 (1.0)	99 (0.3)
Ireland	15 (1.0)	52 (1.4)	84 (1.0)	97 (0.5)
[2] Turkey (5)	15 (1.3)	43 (1.8)	70 (1.7)	88 (1.3)
[2] † United States	14 (0.8)	46 (1.3)	77 (1.1)	93 (0.6)
[2] Lithuania	13 (1.1)	48 (1.6)	81 (1.1)	96 (0.6)
† Norway (5)	13 (0.9)	48 (1.3)	82 (1.2)	97 (0.6)
Cyprus	12 (0.9)	42 (1.6)	77 (1.3)	95 (0.6)
[2] Latvia	11 (0.9)	50 (1.7)	85 (1.2)	98 (0.6)
Finland	11 (0.8)	42 (1.3)	78 (1.2)	95 (0.6)
Czech Republic	10 (1.0)	42 (1.5)	78 (1.3)	96 (0.6)
Australia	10 (0.9)	36 (1.2)	70 (1.3)	90 (1.0)
Austria	9 (0.7)	45 (1.4)	84 (1.1)	98 (0.4)
Hungary	9 (0.8)	39 (1.4)	74 (1.3)	93 (0.8)
[2] Portugal	9 (0.7)	39 (1.6)	74 (1.2)	95 (0.7)
† Denmark	8 (0.9)	37 (1.3)	75 (1.0)	95 (0.5)
† Belgium (Flemish)	8 (0.5)	40 (1.2)	80 (1.2)	97 (0.4)
Bulgaria	8 (0.6)	37 (1.7)	71 (1.9)	90 (1.5)
Poland	8 (0.8)	36 (1.4)	73 (1.4)	93 (0.6)
Azerbaijan	8 (0.6)	36 (1.3)	72 (1.5)	92 (0.8)
Sweden	8 (0.8)	36 (1.7)	74 (1.4)	94 (0.7)
≡ Netherlands	7 (0.9)	44 (1.7)	84 (1.1)	98 (0.4)
[2] Serbia	7 (0.7)	32 (1.4)	68 (1.5)	89 (1.1)
United Arab Emirates	7 (0.3)	26 (0.6)	53 (0.8)	78 (0.7)
[1 2] Canada	6 (0.6)	32 (1.0)	69 (0.9)	92 (0.6)
[2] New Zealand	6 (0.5)	25 (1.2)	56 (1.3)	83 (0.9)
Germany	6 (0.6)	36 (1.5)	75 (1.2)	96 (0.6)
Albania	5 (0.6)	26 (1.4)	62 (1.8)	86 (1.3)
[2] Slovak Republic	5 (0.7)	31 (1.7)	71 (1.7)	91 (1.2)
Malta	5 (0.5)	32 (0.9)	69 (0.8)	91 (0.6)
North Macedonia	5 (0.8)	21 (1.8)	52 (2.4)	78 (1.7)
[2] Kazakhstan	5 (0.6)	29 (1.5)	71 (1.4)	95 (0.6)
Bahrain	4 (0.4)	21 (1.0)	54 (1.2)	81 (1.0)
Italy	4 (0.5)	30 (1.5)	73 (1.3)	95 (0.5)
Croatia	4 (0.6)	28 (1.3)	70 (1.5)	95 (0.7)
Spain	4 (0.4)	27 (0.9)	65 (1.3)	91 (1.0)
France	3 (0.5)	21 (1.2)	57 (1.6)	85 (1.2)
Oman	3 (0.8)	12 (1.3)	33 (1.5)	62 (1.3)
[1] Georgia	3 (0.4)	20 (1.4)	56 (2.0)	84 (1.4)
Armenia	3 (0.5)	23 (1.4)	64 (1.6)	92 (0.7)
Qatar	2 (0.4)	14 (1.2)	40 (1.6)	70 (1.4)
Iran, Islamic Rep. of	2 (0.3)	13 (1.0)	39 (1.6)	68 (1.5)
Montenegro	1 (0.2)	11 (0.7)	43 (0.9)	76 (0.9)
Morocco	1 (0.8)	6 (1.1)	18 (1.4)	43 (1.7)
South Africa (5)	1 (0.2)	5 (0.5)	16 (1.1)	37 (1.5)
[2] Saudi Arabia	1 (0.2)	6 (0.6)	23 (1.2)	51 (1.4)
Kuwait	1 (0.2)	6 (0.9)	21 (1.6)	47 (1.8)
[2] Kosovo	1 (0.2)	8 (0.8)	37 (1.5)	73 (1.4)
Chile	1 (0.1)	7 (0.6)	33 (1.4)	70 (1.5)
Bosnia and Herzegovina	1 (0.2)	9 (0.7)	40 (1.5)	76 (1.1)
[2] Ψ Pakistan	0 (0.1)	1 (0.3)	8 (1.5)	27 (4.7)
[2] Ψ Philippines	0 (0.1)	1 (0.2)	6 (0.8)	19 (1.8)
International Median	**7**	**34**	**71**	**92**
Benchmarking Participants				
Moscow City, Russian Fed.	31 (1.5)	77 (1.4)	96 (0.5)	100 (0.2)
[2] Dubai, UAE	16 (0.9)	50 (0.9)	80 (0.8)	95 (0.5)
Quebec, Canada	8 (0.8)	41 (1.4)	80 (1.3)	97 (0.5)
[2] Ontario, Canada	7 (1.0)	32 (1.8)	68 (1.6)	92 (0.9)
Madrid, Spain	5 (0.5)	33 (1.2)	74 (1.5)	96 (0.6)
Abu Dhabi, UAE	3 (0.2)	15 (0.6)	37 (1.0)	64 (1.1)

International Benchmarks (P4 maths) (first 16 countries)

Country	Percentages of Students Reaching International Benchmarks (● Advanced ○ High ● Intermediate ○ Low)	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
[3] Singapore		54 (2.2)	84 (1.5)	96 (0.7)	99 (0.3)
† Hong Kong SAR		38 (1.9)	78 (1.6)	96 (0.7)	100 (0.2)
Korea, Rep. of		37 (1.4)	77 (1.2)	95 (0.5)	99 (0.2)
Chinese Taipei		37 (1.3)	78 (1.1)	96 (0.5)	100 (0.2)
Japan		33 (1.3)	74 (0.9)	95 (0.4)	99 (0.2)
† Northern Ireland		26 (1.4)	60 (1.4)	85 (1.1)	96 (0.6)
[2] England		21 (1.4)	53 (1.5)	83 (1.2)	96 (0.5)
[2] Russian Federation		20 (1.6)	61 (1.9)	91 (1.0)	99 (0.3)
Ireland		15 (1.0)	52 (1.4)	84 (1.0)	97 (0.5)
[2] Turkey (5)		15 (1.3)	43 (1.8)	70 (1.7)	88 (1.3)
[2] † United States		14 (0.8)	46 (1.3)	77 (1.1)	93 (0.6)
[2] Lithuania		13 (1.1)	48 (1.6)	81 (1.1)	96 (0.6)
† Norway (5)		13 (0.9)	48 (1.3)	82 (1.2)	97 (0.6)
Cyprus		12 (0.9)	42 (1.6)	77 (1.3)	95 (0.6)
[2] Latvia		11 (0.9)	50 (1.7)	85 (1.2)	98 (0.6)
Finland		11 (0.8)	42 (1.3)	78 (1.2)	95 (0.6)
International Median		**7**	**34**	**71**	**92**

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政策二十一

3 (a) TIMSS 2019 Findings: Student Attitudes

Attitudinal Aspects towards Learning Mathematics

- Like learning math
- Confidence in math
- Value (Grade 8 only)

1) I enjoy learning mathematics - - - - - - - - - - - - -
2) I wish I did not have to study mathematics [R] - - -
3) Mathematics is boring [R] - - - - - - - - - - - - - - - - -
4) I learn many interesting things in mathematics -
5) I like mathematics -
6) I like any schoolwork that involves numbers - - -
7) I like to solve mathematics problems - - - - - - - -
8) I look forward to mathematics lessons - - - - - - -
9) Mathematics is one of my favorite subjects - - -

Attitudinal Aspects towards Learning Mathematics

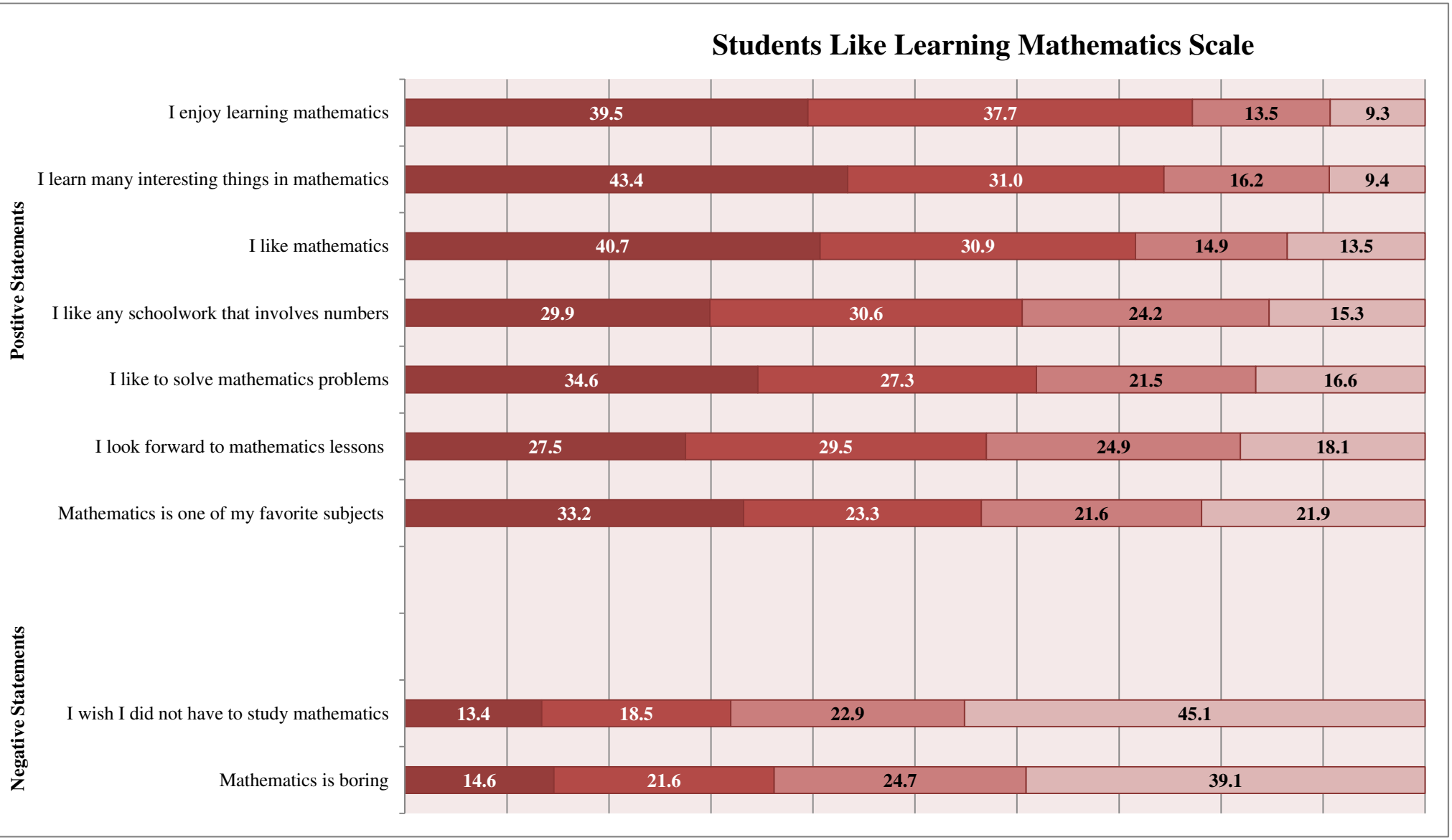
- Like learning math
- Confidence in math
- Value (Grade 8 only)

1) I usually do well in mathematics - - - - - - - - - - -
2) Mathematics is more difficult for me than for many of my classmates [R] - - - - - - - - - - - - - - - -
3) Mathematics is not one of my strengths [R] - - - -
4) I learn things quickly in mathematics - - - - - - - -
5) Mathematics makes me nervous [R] - - - - - - - - -
6) I am good at working out difficult mathematics problems -
7) My teacher tells me I am good at mathematics -
8) Mathematics is harder for me than any other subject [R] -
9) Mathematics makes me confused [R] - - - - - - - -

Attitudinal Aspects towards Learning Mathematics

- Like learning math
- Confidence in math
- Value (Grade 8 only)

1) I think learning mathematics will help me in my daily life -
2) I need mathematics to learn other school subjects -
3) I need to do well in mathematics to get into the university of my choice - - - - - - - - - - - - - - -
4) I need to do well in mathematics to get the job I want -
5) I would like a job that involves using mathematics -
6) It is important to learn about mathematics to get ahead in the world - - - - - - - - - - - - - - - - -
7) Learning mathematics will give me more job opportunities when I am an adult - - - - - - - - - -
8) My parents think that it is important that I do well in mathematics - - - - - - - - - - - - - - - - - -
9) It is important to do well in mathematics - - - - -



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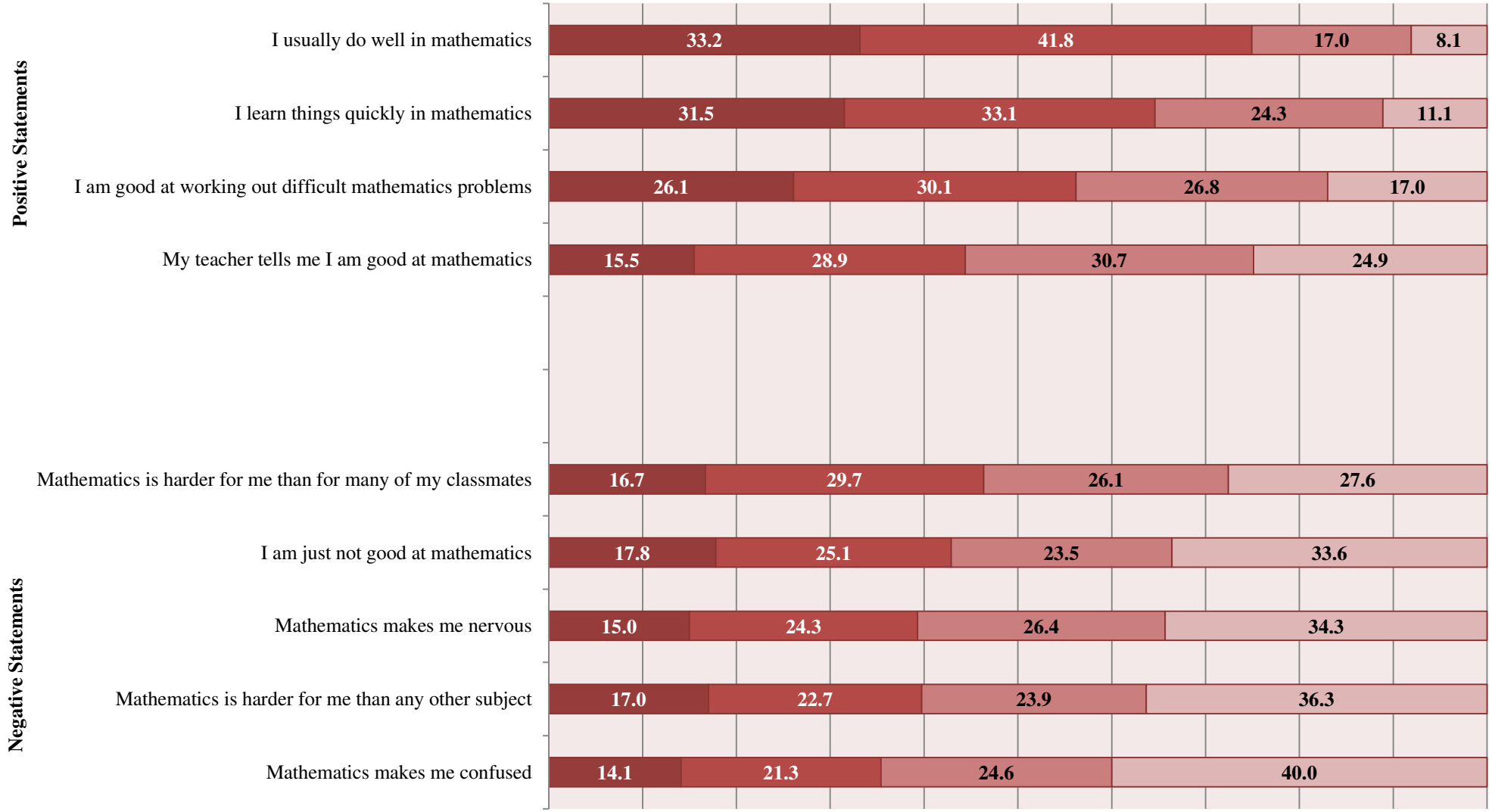
政策二十一

Students Confident in Mathematics Scale



Attitudinal Results (P4 maths)

Primary 4	Students Very Much Like Learning Mathematics	Students Somewhat Like Learning Mathematics	Students Do Not Like Learning Mathematics
HKSAR %	30%	38%	32%
International %	45%	35%	20%

Primary 4	Students Very Confident in Mathematics	Students Somewhat Confident in Mathematics	Students Not Confident in Mathematics
HKSAR %	18%	43%	39%
International %	32%	44%	23%

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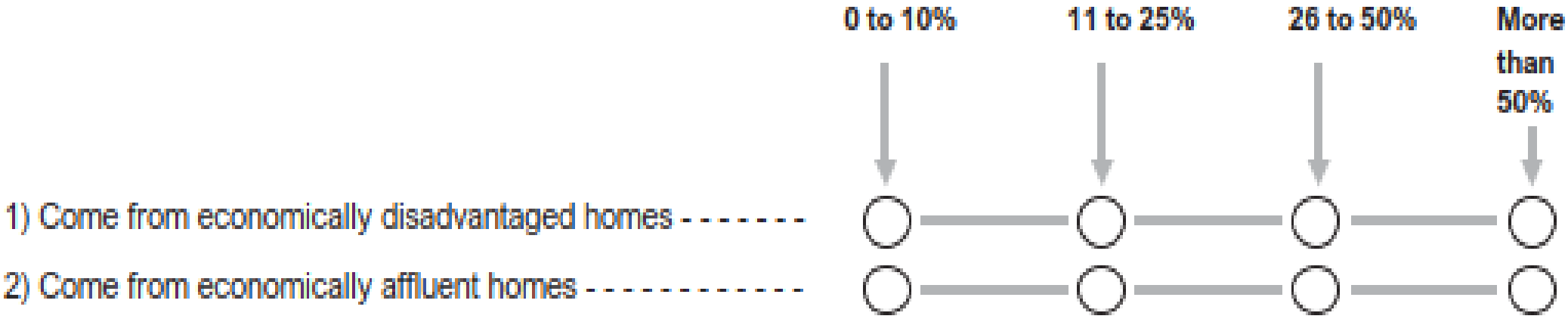
政策二十一

3 (b) Background of Students

School Composition by Socioeconomic Background of the Students

Approximately what percentage of students in your school have the following backgrounds?

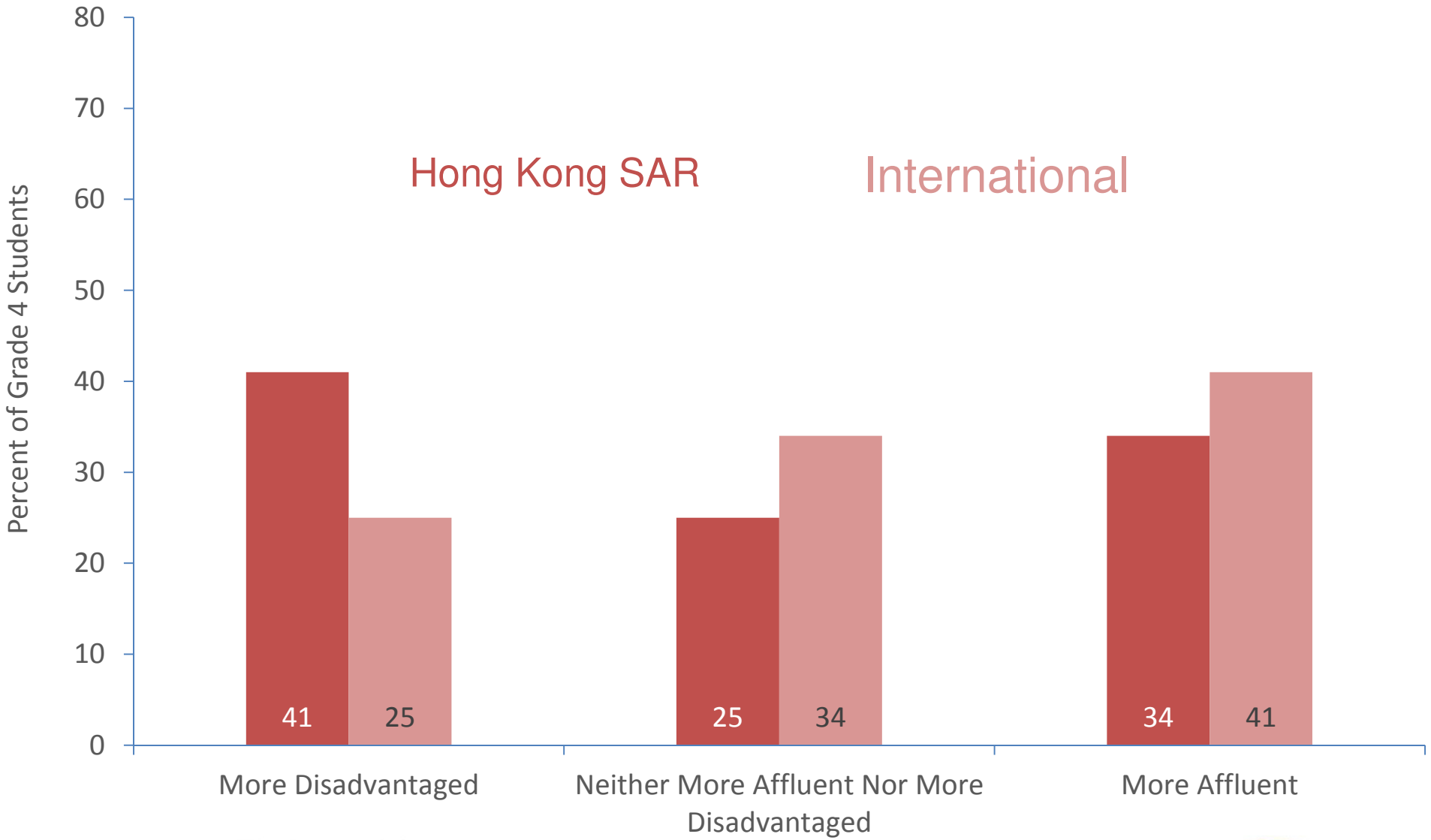


More Affluent: Schools where more than 25% of the student body comes from economically affluent homes and not more than 25% from economically disadvantaged homes

More Disadvantaged: Schools where more than 25% of the student body comes from economically disadvantaged homes and not more than 25% from economically affluent homes

Neither More Affluent Nor More Disadvantaged: All other possible response combinations

School Composition by Socioeconomic Background of the Student Body



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School Composition by Socioeconomic Background of Students (Grade 4)

	More Affluent	Neither More Affluent Nor More Disadvantaged	More Disadvantaged
	%	%	%
Chinese Taipei	25	71	4
Hong Kong SAR	34	25	41
Japan	48	45	8
Korea, Rep. of	26	57	17
Singapore	53	37	10
International Average	41	34	25

Home Resources for Learning

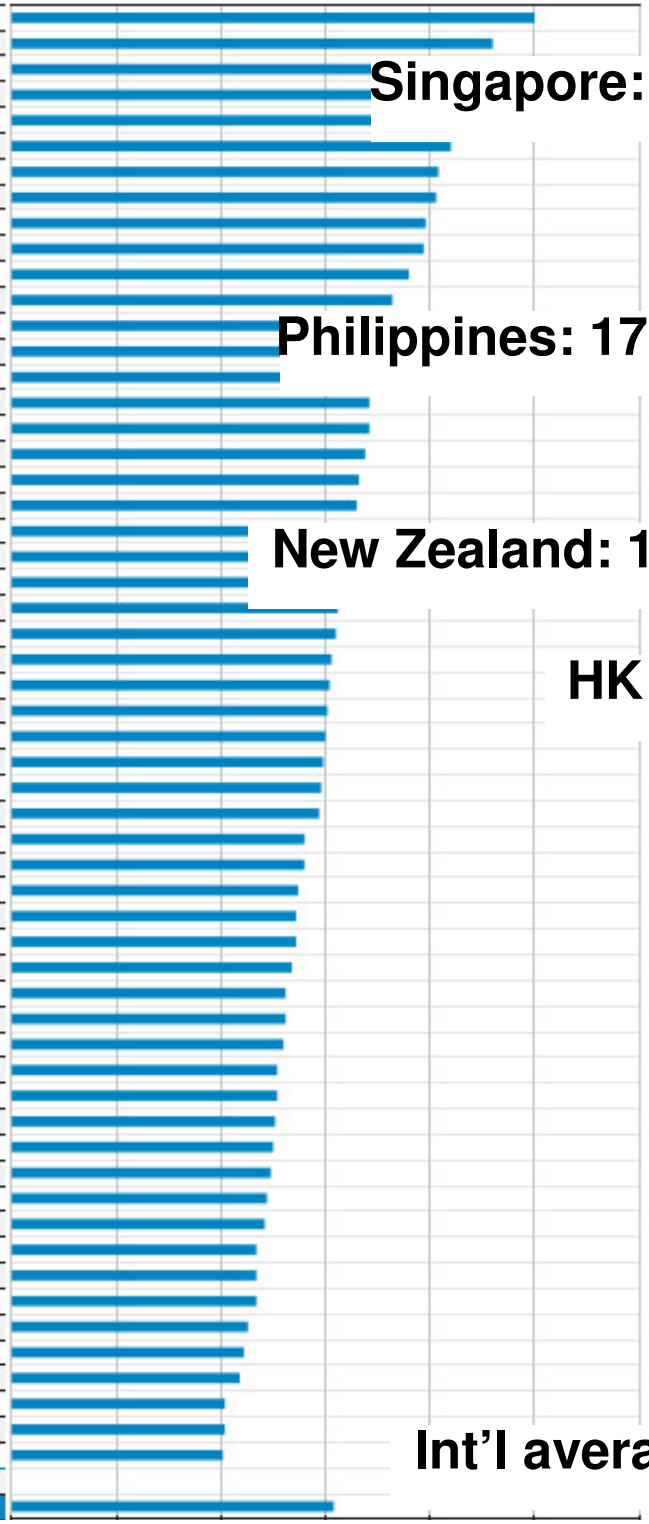
Primary 4	Many Resources	Some Resources	Few Resources
HKSAR %	27%	67%	6%
International %	17%	75%	8%

Class Size

Class Size and Achievement (Grade 4)	
	% of students (s.e.)
1-19 students	5 (2.3)
20-32 students	79 (4.0)
33 or more students	16 (3.5)

Hours for instruction Grade 4

Country	Total Instructional Hours per Year	Hours per Year for Mathematics Instruction
Portugal	887 (14.8)	250 (5.3)
Italy	1098 (15.0)	230 (5.3)
South Africa (5)	r 1205 (12.1)	r 227 (4.5)
Singapore	1009 (0.0)	211 (2.7)
United States	1106 (8.4)	210 (3.9)
Belgium (Flemish)	r 951 (14.6)	r 210 (2.9)
Chile	r 1186 (22.3)	r 204 (6.9)
Northern Ireland	r 947 (7.1)	r 203 (3.9)
Canada	951 (3.9)	r 198 (2.7)
Netherlands	s 1049 (10.3)	s 197 (6.4)
Australia	r 1015 (11.8)	r 190 (5.2)
France	r 820 (7.4)	r 182 (2.5)
Bahrain	1012 (8.2)	177 (2.5)
Philippines	1225 (12.6)	173 (3.6)
Qatar	1011 (11.8)	172 (4.7)
Cyprus	849 (10.6)	r 171 (3.1)
Morocco	1081 (20.4)	171 (3.9)
United Arab Emirates	r 1034 (3.9)	s 169 (1.7)
Malta	930 (1.4)	166 (0.4)
Ireland	925 (5.0)	165 (2.6)
New Zealand	917 (5.7)	160 (2.7)
Oman	r 1016 (13.9)	r 158 (3.1)
Pakistan	1218 (22.3)	r 157 (11.2)
Spain	869 (7.1)	156 (2.5)
Denmark	r 1043 (10.4)	s 155 (2.7)
Germany	r 833 (10.1)	r 153 (2.2)
Hong Kong SAR	r 1022 (14.3)	r 152 (3.3)
Japan	904 (4.9)	151 (1.0)
Kosovo	777 (32.0)	r 150 (4.4)
Czech Republic	763 (8.9)	149 (1.5)
Serbia	794 (19.2)	148 (2.5)
Chinese Taipei	953 (8.9)	147 (8.5)
Turkey (5)	1001 (24.2)	140 (5.1)
Hungary	842 (13.8)	140 (2.8)
Sweden	r 854 (10.7)	r 137 (2.7)
Saudi Arabia	1056 (18.0)	r 136 (4.7)
Kuwait	r 899 (24.3)	s 136 (4.3)
Kazakhstan	732 (14.0)	134 (4.6)
North Macedonia	818 (22.0)	131 (2.7)
Georgia	750 (18.7)	131 (2.6)
Austria	759 (3.1)	130 (1.0)
Slovak Republic	784 (9.9)	127 (2.0)
Norway (5)	r 868 (14.4)	s 127 (4.1)
Armenia	752 (6.4)	126 (0.7)
Lithuania	725 (10.0)	125 (2.1)
Azerbaijan	731 (19.4)	124 (1.9)
Bosnia and Herzegovina	851 (35.9)	122 (2.4)
Croatia	859 (26.2)	121 (3.0)
Finland	746 (9.9)	117 (2.0)
Montenegro	653 (1.6)	117 (1.2)
Latvia	689 (8.9)	117 (1.7)
Albania	729 (10.3)	113 (1.4)
Poland	r 737 (10.1)	r 111 (1.4)
Iran, Islamic Rep. of	627 (6.0)	109 (1.6)
Russian Federation	663 (6.8)	102 (1.6)
Bulgaria	700 (14.9)	102 (1.3)
Korea, Rep. of	694 (8.7)	101 (1.9)
England	s 989 (11.2)	y - -
International Average	**895 (1.9)**	**154 (0.5)**



Singapore: 211

Philippines: 173

New Zealand: 160

HK: 152

Int'l average154

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- How often do you usually assign mathematics homework to students in this class? (Grade 4)

	No math homework	Less than once a week	1 or 2 times a week	3 or 4 times a week	Every day
	%	%	%	%	%
Chinese Taipei	0.8	0.3	2.8	24.5	71.5
Hong Kong SAR	0.0	0.0	3.8	3.6	92.6
Japan	7.1	2.3	10.5	21.4	58.7
Korea, Rep. of	25.4	30.4	30.4	13.5	0.3
Singapore	0.5	6.0	24.4	48.3	20.9
International Average	7.3	7.6	25.2	30.5	29.5

- When you assign mathematics homework to the students in this class, about how many minutes do you usually assign? (Grade 4)

	15 minutes or less	16-30 minutes	31-60 minutes	More than 60 minutes	Not Applicable
	%	%	%	%	%
Chinese Taipei	10.9	77.2	11.0	0.0	0.9
Hong Kong SAR	6.0	71.1	22.3	0.6	0.0
Japan	19.9	64.2	8.5	0.0	7.3
Korea, Rep. of	48.7	25.8	0.3	0.0	25.2
Singapore	7.3	67.9	24.0	0.3	0.5
International Average	30.4	50.4	11.0	0.9	7.3

4. How Should We Interpret TIMSS Findings?

e.g., Which policy matters? Which factors impact achievement?

- E.g., does class size contribute to student achievement?
- It is extremely difficult for this question to be answered by an educational experiment – random assignment of students to "experimental" and "control" group
- Question best answered by international studies such as TIMSS
- What do the results tell us?

  (Use TIMSS 2007 maths results as an example)

Class Size

Class Size and Achievement (Grade 4)	
	% of students (s.e.)
1-19 students	5 (2.3)
20-32 students	79 (4.0)
33 or more students	16 (3.5)

Class Size and Achievement (Grade 4)		
	% of students (s.e.)	Scale scores (s.e.)
1-19 students	5 (2.3)	627(22.6)
20-32 students	79 (4.0)	593 (3.9)
33 or more students	16 (3.5)	629 (6.8)

Exhibit 7.2 **Achievement and Class Size for Mathematics Instruction**

TIMSS2007 Mathematics 4th Grade

Country	1–19 Students		20–32 Students		33 or More Students	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Algeria r	11 (2.8)	388 (14.2)	60 (4.3)	378 (7.0)	29 (4.0)	383 (9.4)
Armenia s	24 (3.3)	526 (14.1)	50 (3.8)	499 (7.3)	26 (3.6)	484 (6.0)
Australia	19 (3.0)	510 (9.0)	80 (3.0)	521 (4.3)	2 (1.2)	~ ~
Austria	37 (2.9)	506 (3.1)	63 (2.9)	505 (2.7)	0 (0.0)	~ ~
Chinese Taipei	3 (1.2)	548 (12.8)	45 (3.7)	570 (3.2)	51 (3.4)	583 (2.4)
Colombia	19 (3.3)	342 (13.7)	24 (4.7)	347 (14.0)	57 (4.4)	365 (8.1)
Czech Republic	31 (3.5)	482 (5.9)	69 (3.5)	489 (2.9)	0 (0.0)	~ ~
Denmark	34 (3.9)	529 (4.4)	66 (3.9)	521 (2.9)	0 (0.0)	~ ~
El Salvador	20 (2.7)	307 (10.7)	37 (4.1)	318 (9.1)	43 (3.8)	352 (4.2)
England	8 (1.9)	556 (9.6)	80 (3.0)	539 (3.2)	12 (2.4)	546 (9.0)
Georgia	37 (3.8)	454 (7.3)	50 (4.5)	428 (6.6)	13 (2.2)	454 (6.3)
Germany	21 (2.4)	512 (5.6)	79 (2.4)	528 (2.2)	0 (0.0)	~ ~
Hong Kong SAR	1 (0.7)	~ ~	25 (3.3)	588 (5.5)	74 (3.4)	616 (3.8)
Hungary	33 (3.7)	482 (6.5)	67 (3.7)	525 (4.7)	0 (0.0)	~ ~
Iran, Islamic Rep. of	25 (2.7)	381 (6.5)	59 (3.8)	406 (5.3)	16 (2.9)	421 (11.6)
Italy	44 (2.6)	506 (4.3)	56 (2.6)	507 (4.5)	0 (0.0)	~ ~
Japan	7 (1.5)	558 (8.5)	47 (2.9)	569 (3.4)	45 (3.2)	569 (2.9)
Kazakhstan	30 (4.5)	550 (20.2)	68 (4.6)	548 (5.5)	3 (1.2)	577 (29.4)
Kuwait s	7 (2.8)	330 (18.1)	88 (3.4)	314 (5.0)	5 (1.9)	302 (11.9)
Latvia	44 (2.4)	525 (3.9)	49 (3.0)	550 (2.6)	6 (2.0)	551 (9.3)
Lithuania	37 (3.0)	511 (4.7)	63 (3.0)	541 (3.1)	0 (0.0)	~ ~
Morocco r	17 (3.3)	352 (17.7)	42 (4.3)	343 (11.4)	41 (3.9)	338 (7.7)
Netherlands	27 (3.3)	531 (4.3)	71 (3.5)	535 (2.9)	2 (1.3)	~ ~
New Zealand s	13 (2.1)	489 (8.7)	81 (2.4)	497 (3.0)	6 (1.7)	524 (11.7)
Norway	42 (3.3)	473 (4.4)	53 (3.6)	474 (3.5)	5 (1.9)	467 (10.6)
Qatar r	8 (0.1)	301 (4.3)	75 (0.2)	296 (1.4)	17 (0.2)	316 (3.4)
Russian Federation	33 (2.7)	531 (10.5)	67 (2.7)	551 (3.8)	0 (0.3)	~ ~
Scotland r	16 (2.8)	492 (9.4)	79 (3.0)	493 (3.1)	5 (1.6)	506 (14.0)
Singapore	0 (0.0)	~ ~	6 (1.3)	514 (13.5)	94 (1.3)	605 (3.5)
Slovak Republic	34 (2.5)	497 (6.6)	65 (2.6)	496 (5.7)	1 (0.6)	~ ~
Slovenia	46 (2.9)	497 (2.7)	53 (3.0)	506 (2.6)	1 (0.6)	~ ~
Sweden	36 (3.4)	505 (4.5)	60 (3.6)	504 (3.2)	4 (1.6)	512 (12.4)
Tunisia	20 (2.8)	303 (12.2)	69 (3.8)	334 (5.0)	11 (2.7)	354 (21.3)
Ukraine	30 (3.3)	445 (4.9)	65 (3.5)	480 (3.8)	5 (1.4)	472 (13.4)
United States	26 (2.6)	521 (4.1)	69 (2.8)	533 (3.3)	5 (1.3)	522 (8.0)
Yemen r	9 (2.1)	262 (18.5)	17 (4.0)	227 (16.4)	74 (4.1)	219 (7.7)
International Avg.	24 (0.5)	462 (1.8)	58 (0.6)	471 (1.1)	18 (0.4)	460 (2.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

Achievement and Class Size for Mathematics Instruction

TIMSS2007 Mathematics 4th Grade

Country	1–19 Students		20–32 Students		33 or More Students	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Algeria r	11 (2.8)	388 (14.2)	60 (4.3)	378 (7.0)	29 (4.0)	383 (9.4)
Armenia s	24 (3.3)	526 (14.1)	50 (3.8)	499 (7.3)	26 (3.6)	484 (6.0)
Australia	19 (3.0)	510 (9.0)	80 (3.0)	521 (4.3)	2 (1.2)	~ ~
Austria	37 (2.9)	506 (3.1)	63 (2.9)	505 (2.7)	0 (0.0)	~ ~
Chinese Taipei	3 (1.2)	548 (12.8)	45 (3.7)	570 (3.2)	51 (3.4)	583 (2.4)
Colombia	19 (3.3)	342 (13.7)	24 (4.7)	347 (14.0)	57 (4.4)	365 (8.1)
Czech Republic	31 (3.5)	482 (5.9)	69 (3.5)	489 (2.9)	0 (0.0)	~ ~
Denmark	34 (3.9)	529 (4.4)	66 (3.9)	521 (2.9)	0 (0.0)	~ ~
El Salvador	20 (2.7)	307 (10.7)	37 (4.1)	318 (9.1)	43 (3.8)	352 (4.2)
England	8 (1.9)	556 (9.6)	80 (3.0)	539 (3.2)	12 (2.4)	546 (9.0)
Georgia	37 (3.8)	454 (7.3)	50 (4.5)	428 (6.6)	13 (2.2)	454 (6.3)
Germany	21 (2.4)	512 (5.6)	79 (2.4)	528 (2.2)	0 (0.0)	~ ~
Hong Kong SAR	1 (0.7)	~ ~	25 (3.3)	588 (5.5)	74 (3.4)	616 (3.8)
Hungary	33 (3.7)	482 (6.5)	67 (3.7)	525 (4.7)	0 (0.0)	~ ~
Iran, Islamic Rep. of	25 (2.7)	381 (6.5)	59 (3.8)	406 (5.3)	16 (2.9)	421 (11.6)
Italy	44 (2.6)	506 (4.3)	56 (2.6)	507 (4.5)	0 (0.0)	~ ~
Japan	7 (1.5)	558 (8.5)	47 (2.9)	569 (3.4)	45 (3.2)	569 (2.9)
Kazakhstan	30 (4.5)	550 (20.2)	68 (4.6)	548 (5.5)	3 (1.2)	577 (29.4)
Kuwait s	7 (2.8)	330 (18.1)	88 (3.4)	314 (5.0)	5 (1.9)	302 (11.9)
Latvia	44 (2.4)	525 (3.9)	49 (3.0)	550 (2.6)	6 (2.0)	551 (9.3)
Lithuania	37 (3.0)	511 (4.7)	63 (3.0)	541 (3.1)	0 (0.0)	~ ~
Morocco r	17 (3.3)	352 (17.7)	42 (4.3)	343 (11.4)	41 (3.9)	338 (7.7)
Netherlands	27 (3.3)	531 (4.3)	71 (3.5)	535 (2.9)	2 (1.3)	~ ~
New Zealand s	13 (2.1)	489 (8.7)	81 (2.4)	497 (3.0)	6 (1.7)	524 (11.7)
Norway	42 (3.3)	473 (4.4)	53 (3.6)	474 (3.5)	5 (1.9)	467 (10.6)
Qatar r	8 (0.1)	301 (4.3)	75 (0.2)	296 (1.4)	17 (0.2)	316 (3.4)
Russian Federation	33 (2.7)	531 (10.5)	67 (2.7)	551 (3.8)	0 (0.3)	~ ~
Scotland r	16 (2.8)	492 (9.4)	79 (3.0)	493 (3.1)	5 (1.6)	506 (14.0)
Singapore	0 (0.0)	~ ~	6 (1.3)	514 (13.5)	94 (1.3)	605 (3.5)
Slovak Republic	34 (2.5)	497 (6.6)	65 (2.6)	496 (5.7)	1 (0.6)	~ ~
Slovenia	46 (2.9)	497 (2.7)	53 (3.0)	506 (2.6)	1 (0.6)	~ ~
Sweden	36 (3.4)	505 (4.5)	60 (3.6)	504 (3.2)	4 (1.6)	512 (12.4)
Tunisia	20 (2.8)	303 (12.2)	69 (3.8)	334 (5.0)	11 (2.7)	354 (21.3)
Ukraine	30 (3.3)	445 (4.9)	65 (3.5)	480 (3.8)	5 (1.4)	472 (13.4)

Has a relation been established between class size and student achievement according to the data?

- For many countries (e.g., Austria, Italy), class size does not make any difference to student achievement
- For some countries (e.g., Armenia, Kuwait), the smaller the class size, the higher the student achievement
- For the majority of the countries (e.g., Chinese Taipei, Colombia, New Zealand), the bigger the class size, the higher the student achievement
- All the high achieving countries (e.g., Singapore, Korea, Hong Kong) have large class sizes
- How do these results guide "**educational decision making and practice**"?
- Are we going to suggest increasing class size in order to raise the achievement of students??

Comparability Problems

- Sample: grade or age? What is grade 8? Is comparing 15 year olds around the world "fair"?
- System differences: e.g., application of decimals in currencies problems (the use of "zed" in TIMSS)
- Language
  - Equivalence in the translation of instruments (TIMSS involves more than 60 countries operating in more than 30 languages; some items become meaningless after translation (e.g., "How many sides are there in a heptagon?"))
  - Does language affect the way we process mathematics in the test matter?

The Root of the Problem

- In TIMSS, we compare across cultures, using the world as "a natural educational laboratory"
- Many variables within a country or culture are uniform and cannot be manipulated, and to study the impact of those variables on student achievement, we have to collect data in different cultures, where the variables differ
- But not only are those variables of interest differ, a host of other variables are vastly different as well, and usually these variables exist as a bundle
- So it is difficult, if not impossible, to control for all the other variables in studying the variables of interest
- And we are never sure whether we have taken all relevant variables into account
- Husen (1983): in international studies, "**we are comparing the incomparables**"!

So Is It Legitimate to Rank Countries?

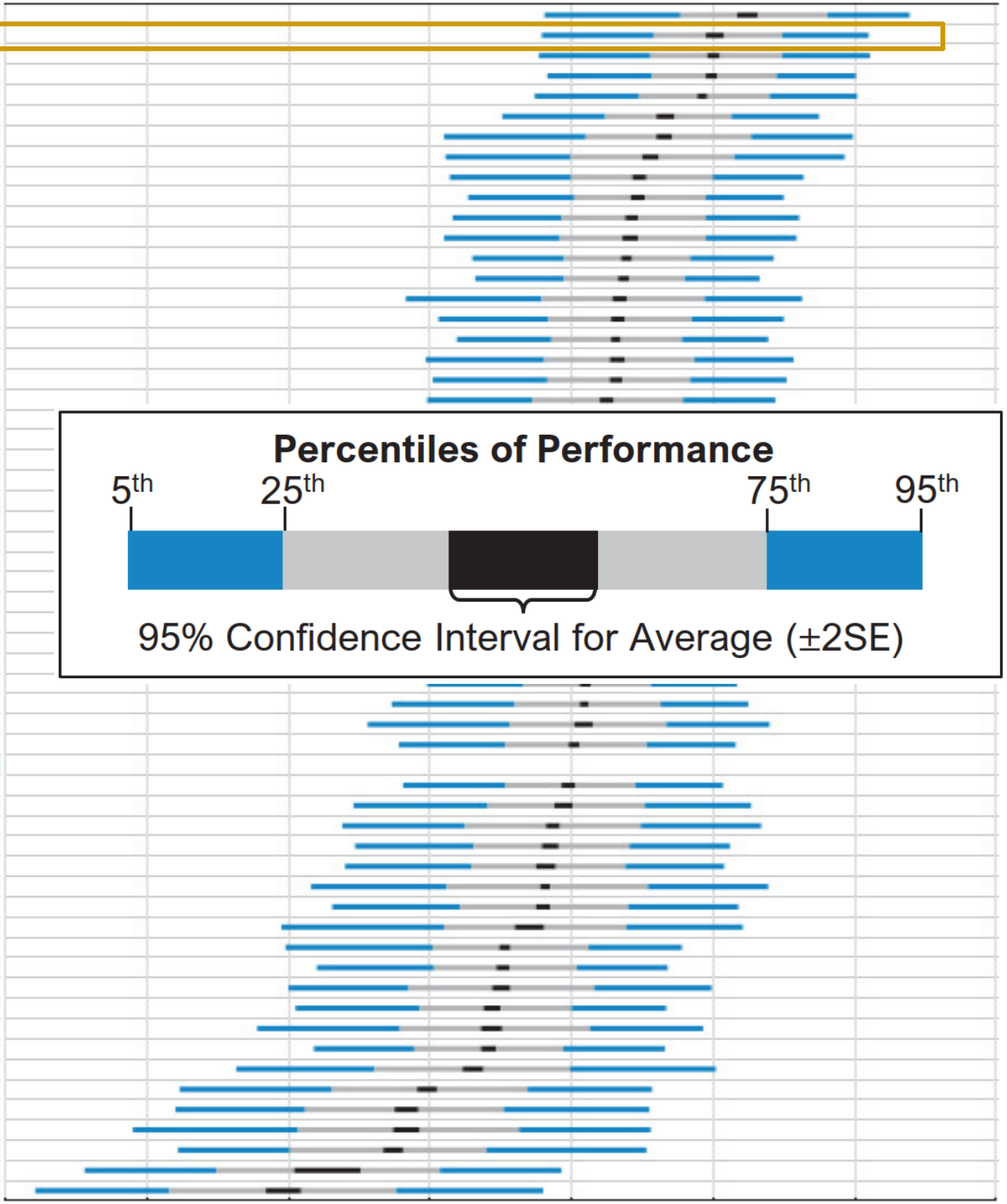
- Rigorous methodology adopted in TIMSS means that results on student achievement rather reliable
- So methodologically speaking, the data of these studies do allow us to rank countries
- But we need to be careful in interpreting rankings
- Participating countries in TIMSS change from one cycle to another, so a rank of say 20th in a certain cycle may not mean the same thing as a rank of 20th in another cycle
- Also, when comparing the relatively rankings between two countries, we should take the standard error of measurement into consideration

Country	Average Scale Score	
[3] Singapore	625 (3.9)	▲
† Hong Kong SAR	602 (3.3)	▲
Korea, Rep. of	600 (2.2)	▲
Chinese Taipei	599 (1.9)	▲
Japan	593 (1.8)	▲
[2] Russian Federation	567 (3.3)	▲
† Northern Ireland	566 (2.7)	▲
[2] England	556 (3.0)	▲
Ireland	548 (2.5)	▲
[2] Latvia	546 (2.6)	▲
† Norway (5)	543 (2.2)	▲
[2] Lithuania	542 (2.8)	▲
Austria	539 (2.0)	▲
[3] Netherlands	538 (2.2)	▲
[2] † United States	535 (2.5)	▲
Czech Republic	533 (2.5)	▲
† Belgium (Flemish)	532 (1.9)	▲
Cyprus	532 (2.9)	▲
Finland	532 (2.3)	▲
[2] Portugal	525 (2.6)	▲
† Denmark	525 (1.9)	▲
Hungary	523 (2.6)	▲
[2] Turkey (5)	523 (4.4)	▲
Sweden	521 (2.8)	▲
Germany	521 (2.3)	▲
Poland	520 (2.7)	▲
Australia	516 (2.8)	▲
Azerbaijan	515 (2.7)	▲
Bulgaria	515 (4.3)	▲
Italy	515 (2.4)	▲
[2] Kazakhstan	512 (2.5)	▲
† [2] Canada	512 (1.9)	▲
[2] Slovak Republic	510 (3.5)	▲
Croatia	509 (2.2)	▲
Malta	509 (1.4)	▲
[2] Serbia	508 (3.2)	▲
Spain	502 (2.1)	
TIMSS Scale Centerpoint	**500**	
Armenia	498 (2.5)	
Albania	494 (3.4)	
[2] New Zealand	487 (2.6)	▽
France	485 (3.0)	▽
[1] Georgia	482 (3.7)	▽
United Arab Emirates	481 (1.7)	▽
Bahrain	480 (2.6)	▽
North Macedonia	472 (5.3)	▽
Montenegro	453 (2.0)	▽
Bosnia and Herzegovina	452 (2.4)	▽
Qatar	449 (3.4)	▽
[2] Kosovo	444 (3.0)	▽
Iran, Islamic Rep. of	443 (3.9)	▽
Chile	441 (2.7)	▽
Oman	431 (3.7)	▽
[2] Saudi Arabia	398 (3.6)	▽
Morocco	383 (4.3)	▽
Kuwait	383 (4.7)	▽
South Africa (5)	374 (3.6)	▽
[2] ψ Pakistan	328 (12.0)	▽
[2] ψ Philippines	297 (6.4)	▽

602

500

Mathematics Achievement Distribution



Percentiles of Performance

5th 25th 75th 95th

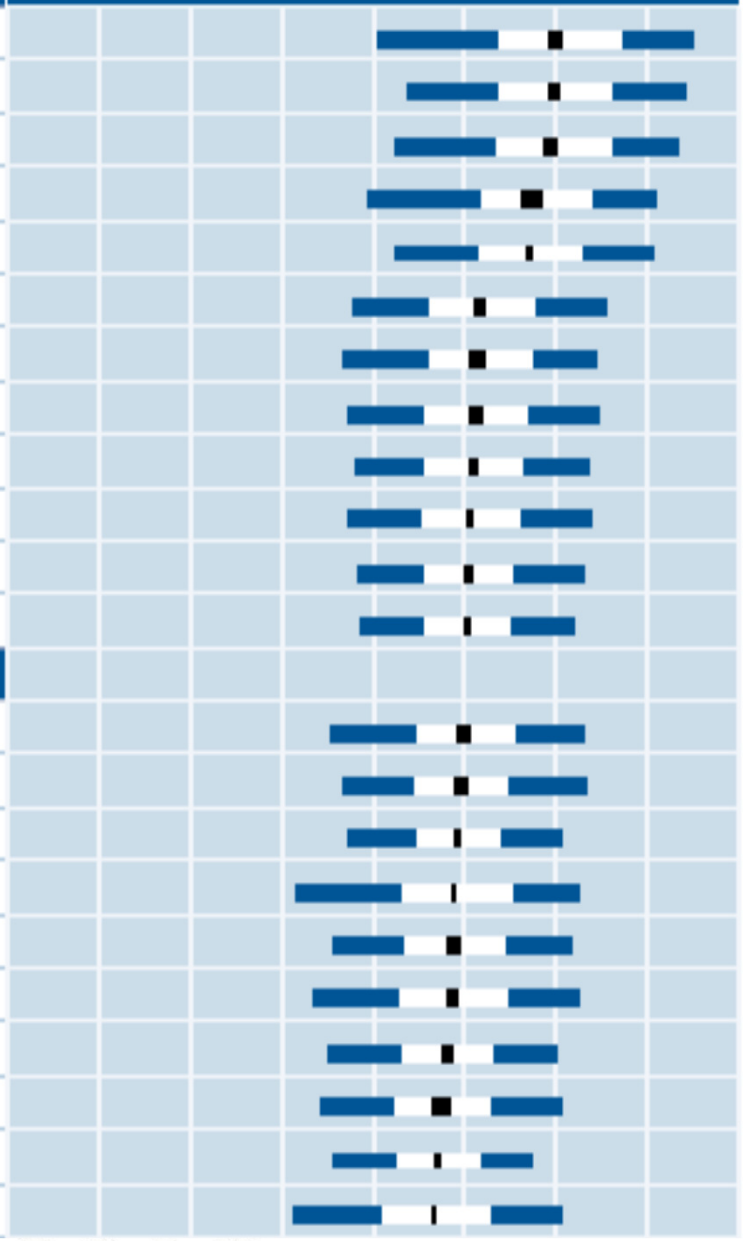
95% Confidence Interval for Average (±2SE)

e.g., Singapore TIMSS 2003 and 2007

- Compared to TIMSS 2003, grade 8 students in Singapore may be seen as "dropping" from the first place to the third place in TIMSS 2007
- But if we take the standard errors of measurement into consideration, the differences between the score for Singapore and those of Korea (rank 2) and Chinese Taipei (rank 1) in 2007 are not statistically significant
- From a statistical point of view, we cannot say that the scores of Chinese Taipei and Korea are higher than that of Singapore
- So we should not be too sensitive about fine changes in ranking from cycle to cycle - it is usually not too meaningful to say that a country's ranking has dropped from say 15th to 18th without further qualification

Exhibit 1.1 TIMSS 2007 Distribution of Mathematics Achievement (Continued)

TIMSS2007 Mathematics 8th Grade

Country	Table 2	Mathematics Achievement Distribution	Average Scale Score	Years of Formal Schooling*	Average Age at Time of Testing	Human Development Index**
Chinese Taipei			▲ 598 (4.5)	8	14.2	0.932
Korea, Rep. of			▲ 597 (2.7)	8	14.3	0.921
Singapore			▲ 593 (3.8)	8	14.4	0.922
† Hong Kong SAR			▲ 572 (5.8)	8	14.4	0.937
Japan			▲ 570 (2.4)	8	14.5	0.953
Hungary			▲ 517 (3.5)	8	14.6	0.874
† England			▲ 513 (4.8)	9	14.2	0.946
Russian Federation			▲ 512 (4.1)	7 or 8	14.6	0.802
2 † United States			▲ 508 (2.8)	8	14.3	0.951
1 Lithuania			▲ 506 (2.3)	8	14.9	0.862
Czech Republic			504 (2.4)	8	14.4	0.891
Slovenia			501 (2.1)	7 or 8	13.8	0.917
TIMSS Scale Avg.			**500**			
Armenia			499 (3.5)	8	14.9	0.775
Australia			496 (3.9)	8	13.9	0.962
Sweden			▼ 491 (2.3)	8	14.8	0.956
Malta			▼ 488 (1.2)	9	14.0	0.878
† Scotland			▼ 487 (3.7)	9	13.7	0.946
1 2 Serbia			▼ 486 (3.3)	8	14.9	0.810
Italy			▼ 480 (3.0)	8	13.9	0.941
Malaysia			▼ 474 (5.0)	8	14.3	0.811
Norway			▼ 469 (2.0)	8	13.8	0.968
Cyprus			▼ 465 (1.6)	8	13.8	0.903

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

Can We Draw Causal Relations?

- **TIMSS is a survey, and not an experiment**
- So we have to be extra cautious in drawing conclusions about causal relations
- In most instances, the best that we can conclude is that a certain variable A ***may*** have caused or impacted student achievement, based on the correlations between the measure of variable A and the achievement scores, since it is unlikely or illogical that achievement leads to changes in variable A
- But we cannot rule out the possibility that there is a third "hidden" variable which influences both variable A and achievement, causing variable A and achievement to be correlated with each other
- And there are so many possible variables that may have influenced both variable A and achievement!

Examples:

(1) Class size and achievement

Does big class size lead to high achievement, or are there variables which lead to both large class size and high achievement?

(2) The relation between amount of homework and achievement

Students may have better achievement because they do more homework, but students may need to do more homework because they have low achievement

It is therefore not surprising that there is no clear relationship between student achievement and the amount of homework students do.

5. What Can We Learn from TIMSS?

- Despite all the limitations of TIMSS mentioned above, the rigorous methodologies adopted in these studies do provide us with a reliable measure of student achievement, and hence "effectiveness" of an education system
- Since these studies are "international (studies) with endorsement from a large number of countries", they provide benchmarks against which countries may measure the achievement of their students
- What can we learn from these studies?

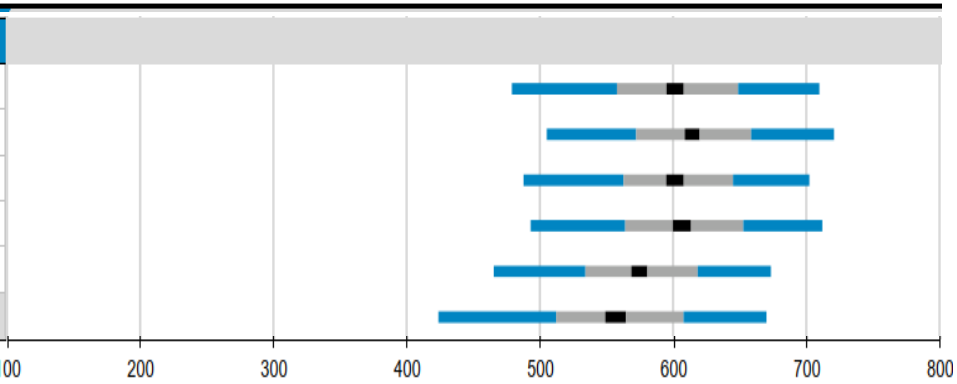
5(a) Trend of Student Achievements

- For those countries which have participated in more than one cycle of TIMSS, it is instructive to look at the change of scores (rather than change of ranking) across different cycles
- Scores in TIMSS are standardized across years and are thus theoretically comparable
- But these are not truly longitudinal studies
- E.g., when the scores of TIMSS 2015 grade 4 students in a certain country are compared to the TIMSS 2019 grade 8 students, the students come from the same cohort but not the same students were taking the tests, so any “gain” in scores only gives rough indication of “trends”
- Notwithstanding this limitation, this rough information on trends of performance should be informative to educators in the country, especially when there are major curriculum changes taking place in between the cycles of study

Trends in Hong Kong Achievement (Primary 4)

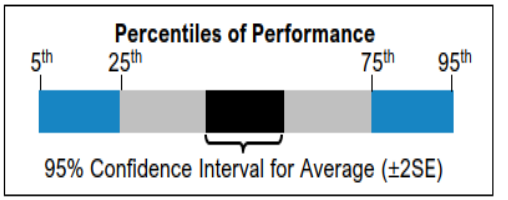
Country	Average Scale Score	Differences Between Years				
		2015	2011	2007	2003	1995
Hong Kong SAR						
† 2019	602 (3.3)	-13 ▽	0	-5	27 ▲	45 ▲
† 2015	615 (2.9)		13 ▲	8	40 ▲	58 ▲
2 2011	602 (3.4)			-5	27 ▲	45 ▲
2007	607 (3.5)				32 ▲	50 ▲
† 2003	575 (3.1)					18 ▲
1995	557 (4.0)					

Mathematics Achievement Distribution



▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower



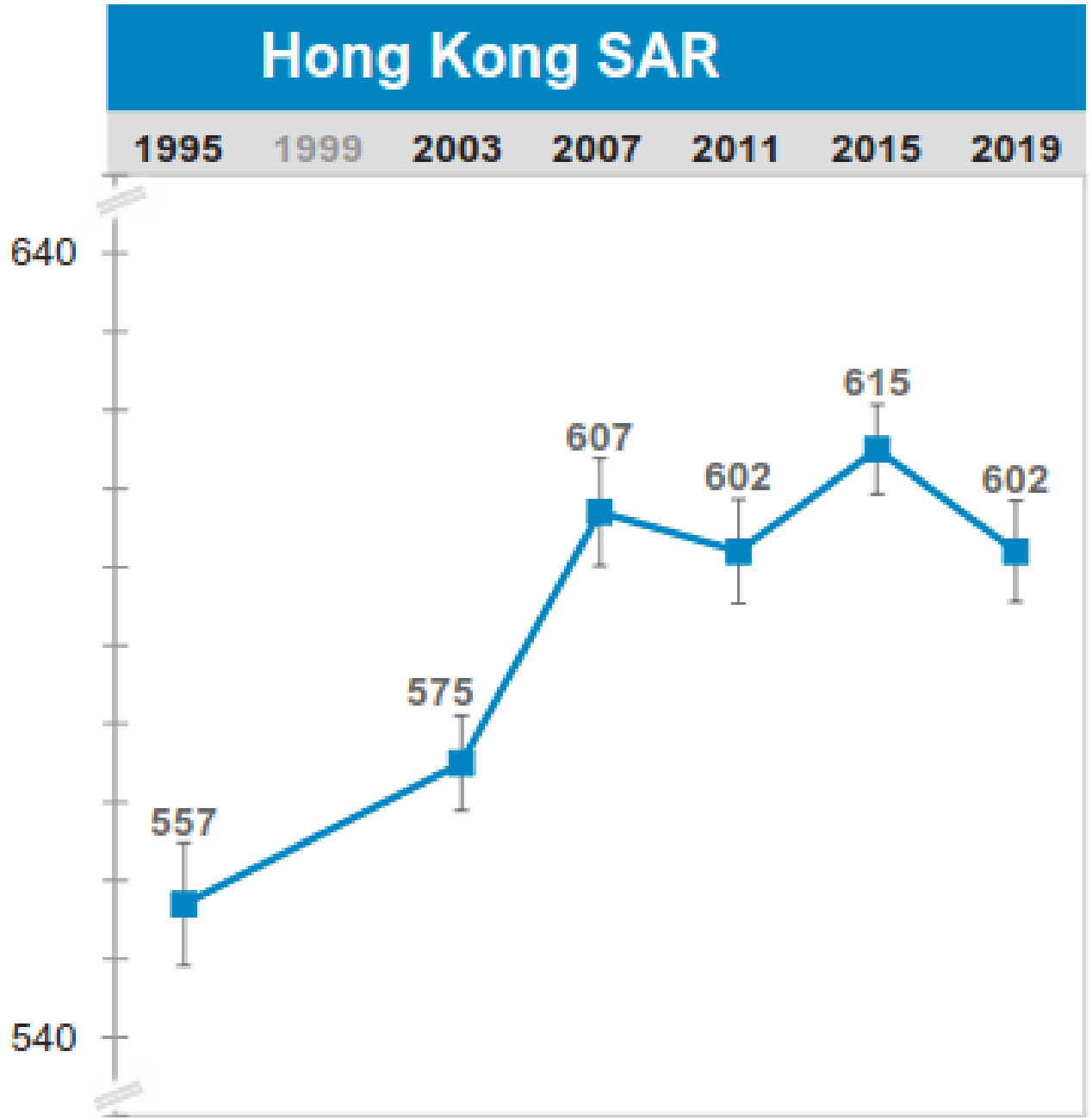
Faculty of Education
The University of Hong Kong
香 港 大 學 教 育 學 院

IEA

Policy 21
政策二十一

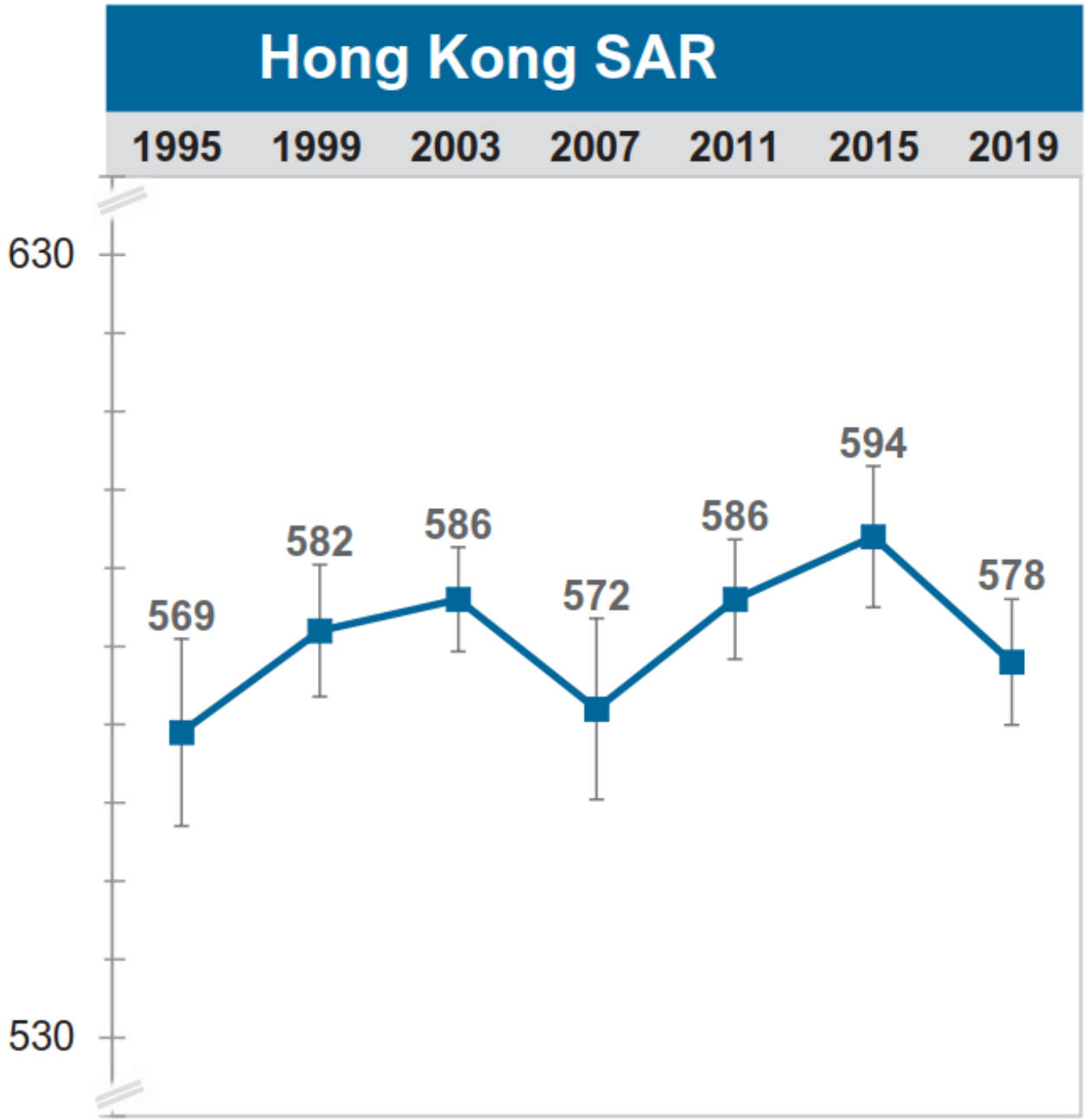
Trends

Grade 4
Mathematics

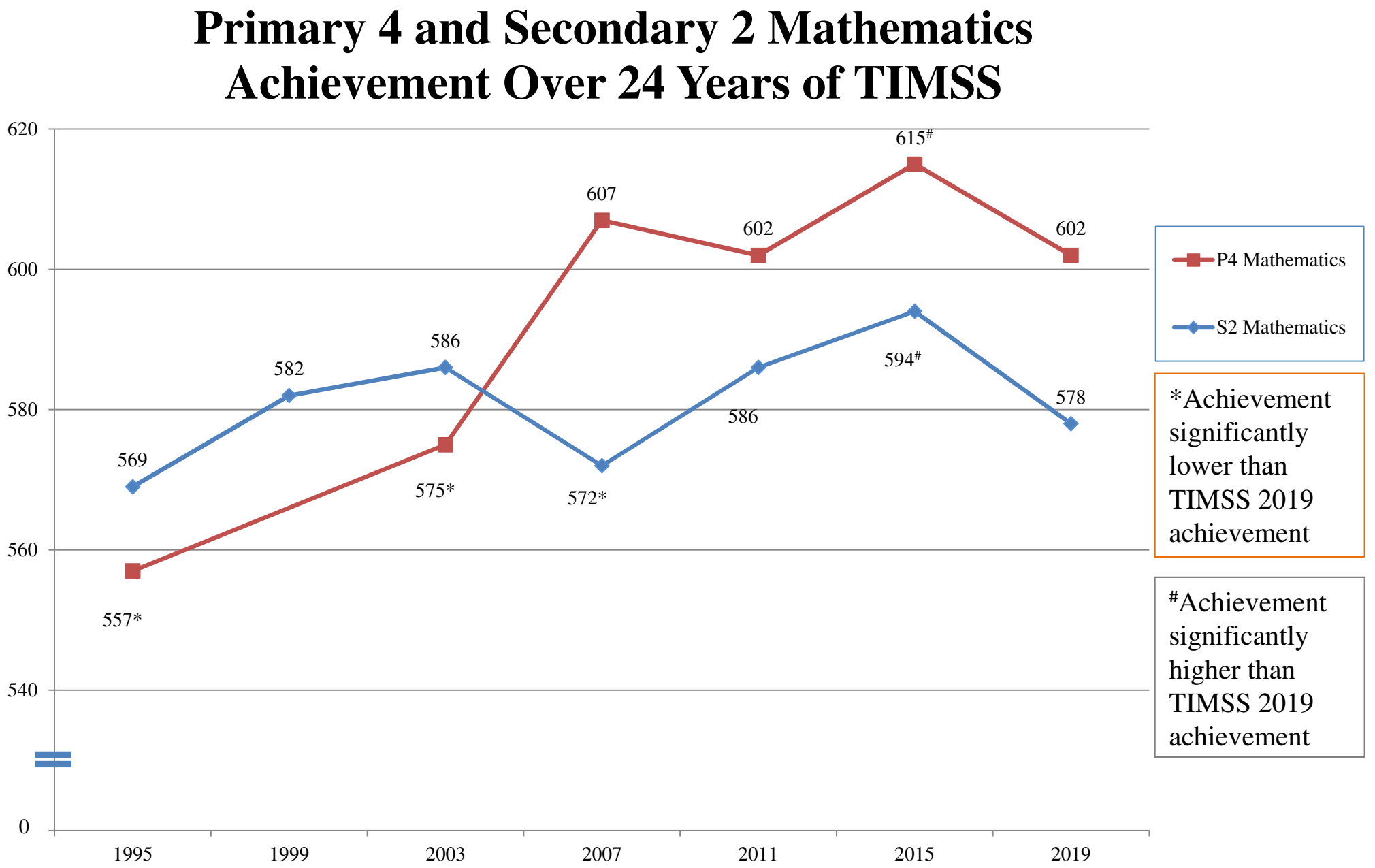


Trends

Grade 8
Mathematics



Hong Kong: Over 24 Years of TIMSS



Grade 4 (maths)

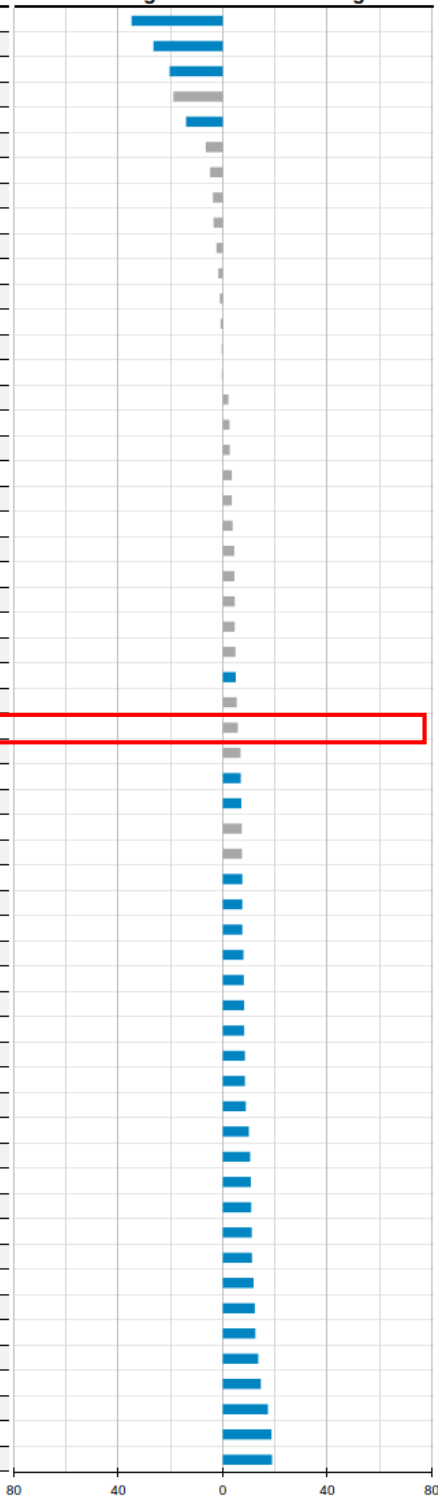
Grade 8 (maths)

Implications for curriculum development: What happened between 2003 and 2007?

5(b) Gender

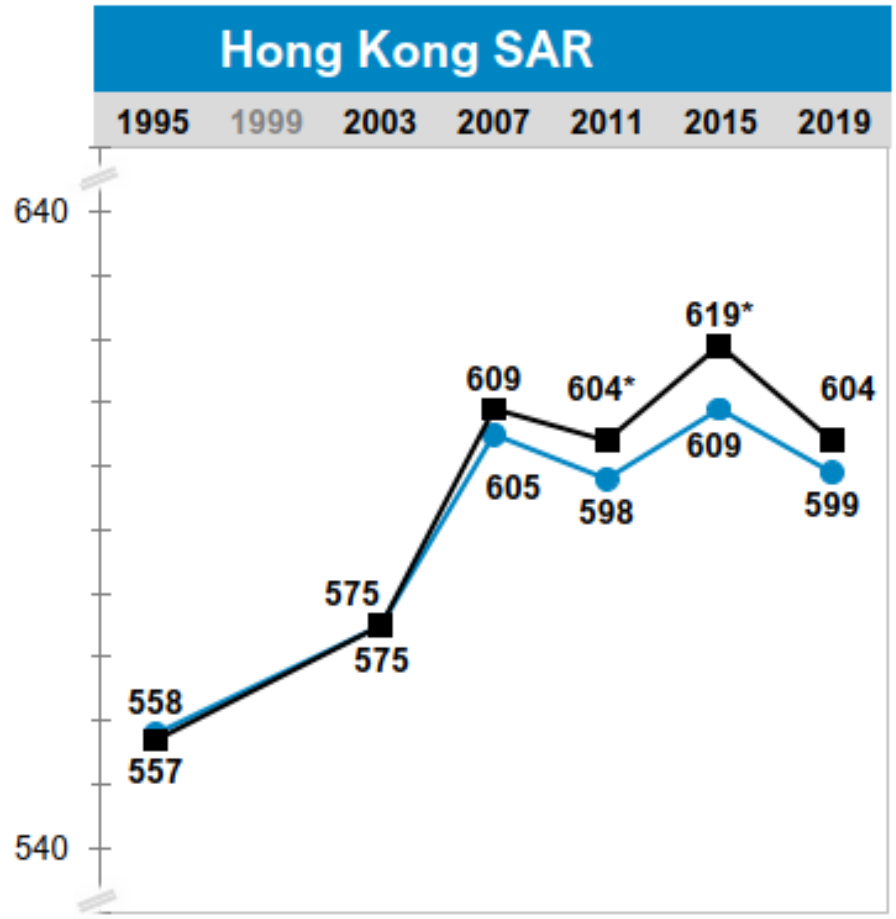
TIMSS 2019
Gender & Mathematics Achievement (Primary 4)

Country	Girls		Boys		Difference (Absolute Value)
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score	
2 ψ Philippines	48 (0.7)	315 (6.6)	52 (0.7)	280 (6.4)	35 (3.7)
2 Saudi Arabia	48 (0.8)	412 (4.9)	52 (0.8)	385 (5.8)	26 (8.1)
South Africa (5)	50 (0.6)	384 (4.0)	50 (0.6)	364 (3.7)	20 (2.9)
2 ψ Pakistan	45 (4.7)	338 (16.4)	55 (4.7)	319 (11.8)	19 (16.0)
Oman	50 (0.7)	438 (3.6)	50 (0.7)	424 (4.4)	14 (2.9)
Kuwait	47 (2.6)	387 (6.0)	53 (2.6)	380 (6.9)	7 (8.9)
Bahrain	49 (1.2)	482 (3.2)	51 (1.2)	477 (3.5)	5 (4.3)
Azerbaijan	47 (0.9)	517 (3.1)	53 (0.9)	514 (3.1)	4 (3.0)
Morocco	49 (0.7)	385 (4.8)	51 (0.7)	382 (4.3)	3 (2.9)
Armenia	48 (0.8)	499 (2.6)	52 (0.8)	497 (3.2)	2 (2.8)
2 Serbia	50 (0.9)	509 (3.4)	50 (0.9)	507 (4.0)	2 (3.9)
Qatar	50 (1.5)	450 (5.1)	50 (1.5)	449 (3.2)	1 (5.2)
Japan	48 (0.5)	593 (2.2)	52 (0.5)	593 (1.9)	1 (2.2)
2 Kazakhstan	49 (0.7)	512 (3.0)	51 (0.7)	512 (2.6)	0 (2.4)
North Macedonia	48 (0.6)	472 (5.9)	52 (0.6)	472 (5.4)	0 (4.0)
Bulgaria	48 (0.9)	514 (4.7)	52 (0.9)	516 (4.6)	2 (3.6)
Finland	49 (0.9)	531 (2.9)	51 (0.9)	533 (2.8)	3 (3.2)
Albania	49 (0.9)	493 (3.8)	51 (0.9)	495 (3.9)	3 (3.6)
† Northern Ireland	50 (1.0)	564 (3.2)	50 (1.0)	568 (3.7)	3 (4.2)
2 Turkey (5)	52 (1.4)	521 (4.5)	48 (1.4)	525 (5.6)	3 (4.9)
Chinese Taipei	48 (0.6)	597 (2.4)	52 (0.6)	601 (2.3)	4 (2.7)
† Norway (5)	48 (0.9)	540 (2.7)	52 (0.9)	545 (2.9)	4 (3.5)
2 Kosovo	49 (1.0)	442 (3.1)	51 (1.0)	447 (3.7)	5 (3.3)
2 Lithuania	49 (0.9)	540 (2.9)	51 (0.9)	544 (3.7)	5 (3.8)
2 Latvia	50 (0.9)	544 (2.9)	50 (0.9)	548 (3.0)	5 (2.7)
Montenegro	47 (0.6)	450 (2.6)	53 (0.6)	455 (2.4)	5 (3.0)
Korea, Rep. of	47 (0.7)	597 (2.3)	53 (0.7)	602 (2.8)	5 (2.5)
2 New Zealand	48 (1.3)	484 (3.7)	52 (1.3)	490 (3.3)	5 (4.6)
† Hong Kong SAR	46 (1.3)	599 (3.5)	54 (1.3)	604 (3.9)	6 (3.3)
Ireland	50 (1.1)	545 (3.2)	50 (1.1)	552 (2.9)	7 (3.7)
† Denmark	50 (0.8)	521 (2.2)	50 (0.8)	528 (2.6)	7 (2.9)
Sweden	50 (1.1)	518 (3.2)	50 (1.1)	525 (3.1)	7 (2.8)
2 England	50 (1.0)	552 (4.0)	50 (1.0)	560 (3.0)	7 (3.8)
Iran, Islamic Rep. of	49 (2.1)	439 (6.4)	51 (2.1)	447 (5.3)	7 (8.8)
Malta	49 (0.7)	505 (2.1)	51 (0.7)	513 (1.9)	7 (2.7)
1 Georgia	49 (0.9)	478 (3.9)	51 (0.9)	486 (4.1)	7 (3.3)
Austria	49 (1.0)	535 (2.8)	51 (1.0)	543 (2.1)	8 (2.9)
3 Singapore	49 (0.5)	621 (4.0)	51 (0.5)	629 (4.2)	8 (2.8)
Poland	49 (0.8)	516 (3.0)	51 (0.8)	524 (3.0)	8 (2.8)
United Arab Emirates	50 (1.1)	477 (2.5)	50 (1.1)	486 (2.3)	8 (3.4)
2 Russian Federation	51 (1.1)	563 (3.6)	49 (1.1)	571 (3.5)	8 (2.5)
≡ Netherlands	49 (1.0)	533 (2.2)	51 (1.0)	542 (3.0)	9 (3.0)
Chile	50 (1.3)	437 (3.4)	50 (1.3)	445 (3.1)	9 (3.7)
Bosnia and Herzegovina	49 (0.7)	447 (2.7)	51 (0.7)	456 (2.8)	9 (2.6)
Australia	49 (0.8)	511 (2.9)	51 (0.8)	521 (3.3)	10 (2.9)
Germany	50 (0.8)	516 (2.8)	50 (0.8)	526 (2.4)	10 (2.5)
† Belgium (Flemish)	51 (0.8)	527 (2.1)	49 (0.8)	538 (2.8)	11 (3.2)
Czech Republic	49 (0.9)	527 (2.7)	51 (0.9)	538 (3.1)	11 (2.9)
2 † United States	49 (0.8)	529 (3.0)	51 (0.8)	540 (2.9)	11 (2.9)
Hungary	48 (1.0)	518 (3.0)	52 (1.0)	529 (3.1)	11 (3.0)
Croatia	50 (1.2)	504 (2.6)	50 (1.2)	515 (2.7)	12 (3.1)
Italy	50 (0.8)	509 (2.7)	50 (0.8)	521 (3.2)	12 (3.4)
2 Slovak Republic	49 (1.0)	503 (3.5)	51 (1.0)	516 (4.2)	12 (3.6)
France	49 (1.0)	478 (3.3)	51 (1.0)	491 (3.5)	14 (3.0)
Spain	47 (0.8)	495 (2.5)	53 (0.8)	509 (2.6)	15 (2.8)
2 Portugal	48 (0.9)	516 (2.9)	52 (0.9)	533 (2.9)	17 (2.6)
Cyprus	52 (0.7)	523 (3.0)	48 (0.7)	542 (3.5)	19 (3.2)
1 2 Canada	49 (0.8)	502 (2.5)	51 (0.8)	521 (2.0)	19 (2.4)
International Average	**49 (0.2)**	**499 (0.5)**	**51 (0.2)**	**503 (0.5)**	



Difference statistically significant
Difference not statistically significant

Gender and Achievement (P4 maths)



TIMSS 2019

No significant difference

5(c) Comparison of Student Achievement in Different Content and Cognitive Domains

- Performance in different strands of mathematics (content strand, e.g., geometry versus statistics; cognitive domain, e.g., reasoning versus knowing), will inform us of the relative strengths and weaknesses of our students in light of the performance of students in another country or internationally
- P4 students are not doing so well in “Reasoning”
- In this modern age when generic skills are much more important than mastery of specific knowledge and skills, perhaps more weight should be given to developing the reasoning abilities in students

Performance of Hong Kong Students in Mathematics Content and Cognitive Domains 2019

Grade 4	Number	Measurement and Geometry	Data
HKSAR	598	608	607

	Knowing	Applying	Reasoning
HKSAR	600	606	596

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Content and Cognitive Domains by Gender (Primary 4 mathematics)

Primary 4	Number (598)			Measurement & Geometry (608)			Data (607)	
	Girls	Boys		Girls	Boys		Girls	Boys
HKSAR	595	600		600	615*		607	607
International	505	509*		500	507*		498	499

Primary 4	Knowing (600)			Applying (606)			Reasoning (596)	
	Girls	Boys		Girls	Boys		Girls	Boys
HKSAR	594	605*		604	608		590	601*
International	500	507*		505	506*		500	507*

*Achievement significantly higher

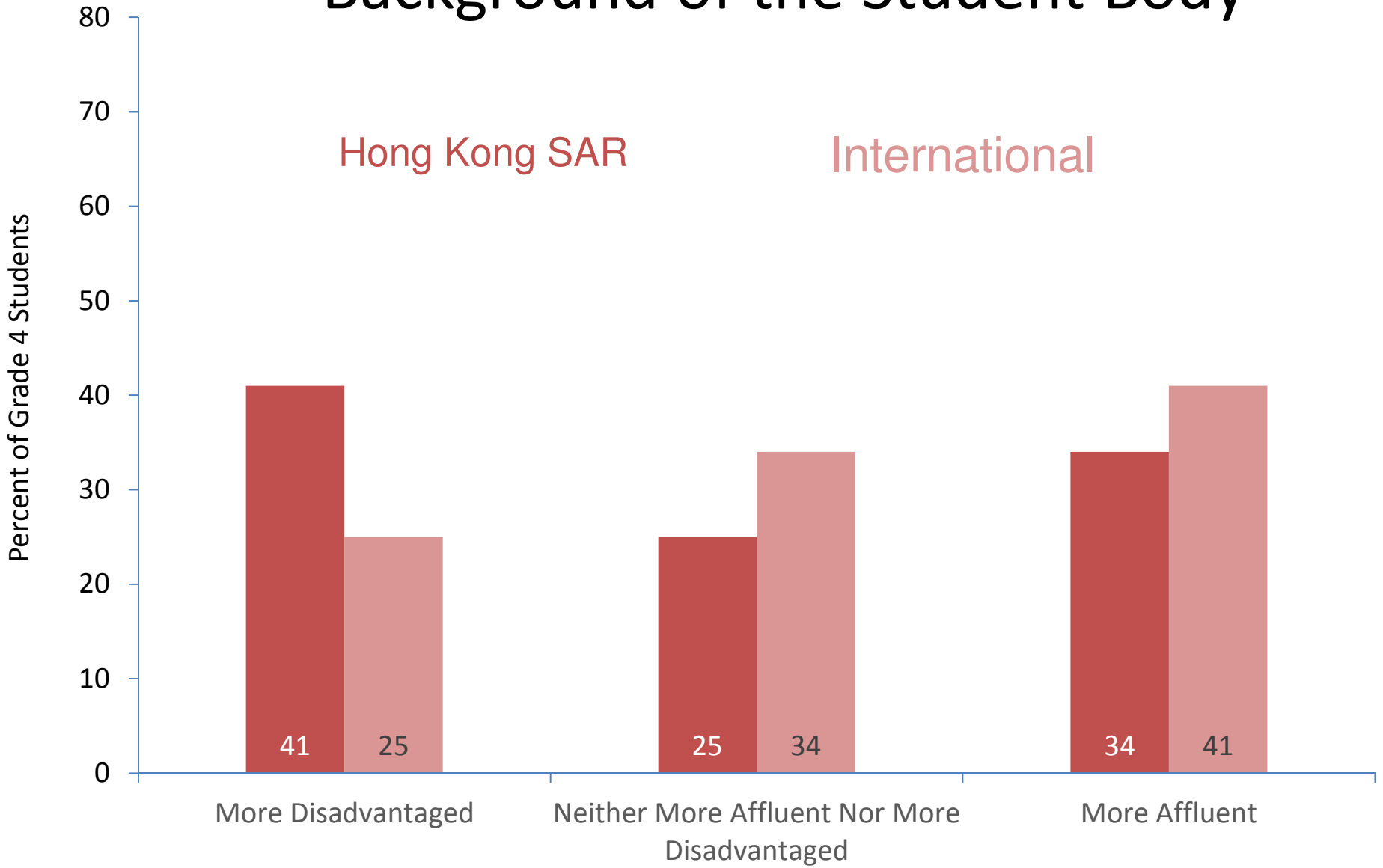
5(d) Background Variables & Achievement

Home Resources for Learning

Primary 4	Many Resources	Some Resources	Few Resources
HKSAR %	27%	67%	6%
International %	17%	75%	8%

Primary 4	Many Resources	Some Resources	Few Resources
HKSAR % (Scale Avg.)	27% (636)	67% (595)	6% (561)
Int'l % (Scale Avg.)	17% (562)	75% (498)	8% (433)

School Composition by Socioeconomic Background of the Student Body



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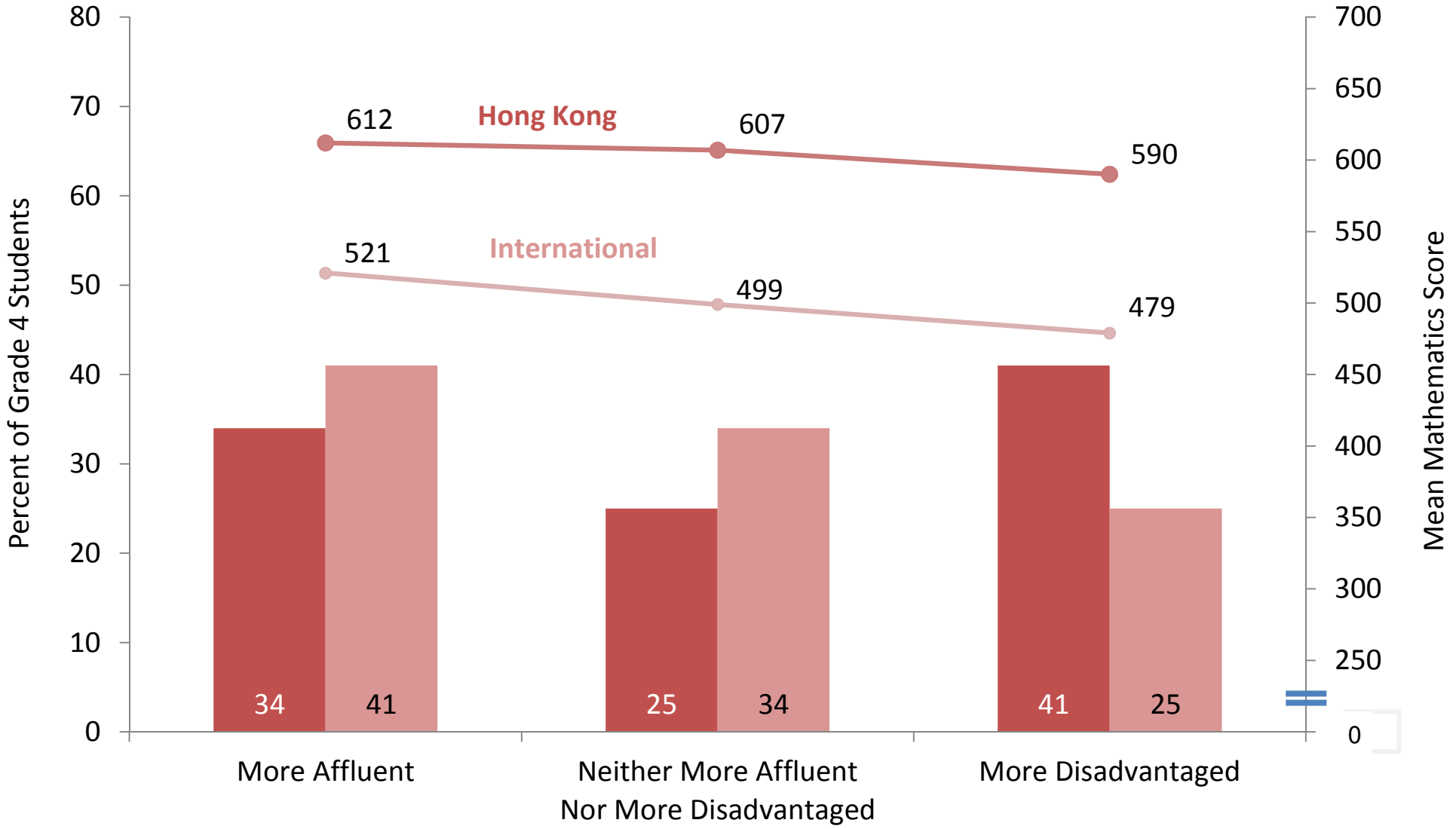
School Composition by Socioeconomic Background of the Student Body



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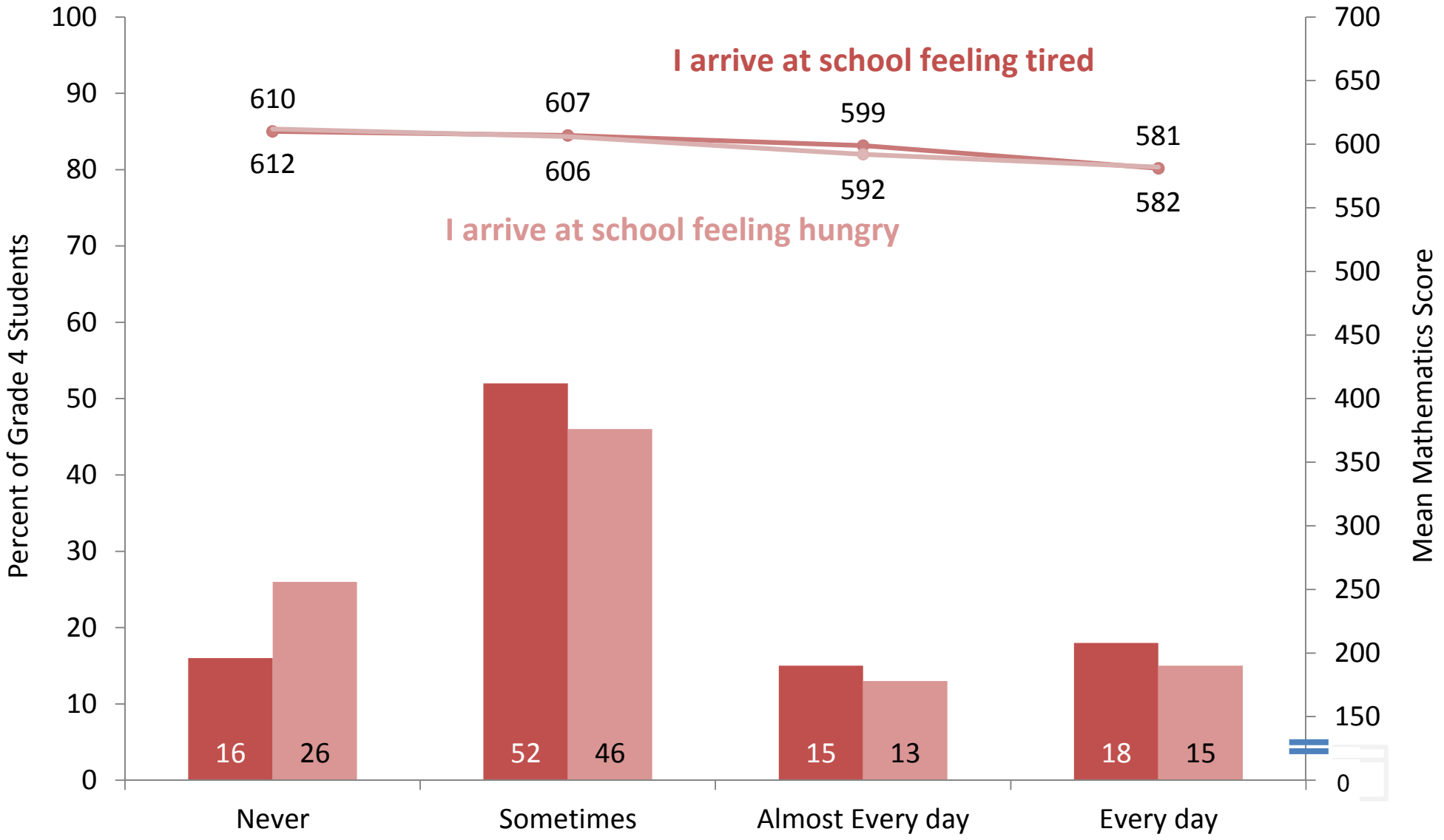
School Composition by Socioeconomic Background of Students (Grade 4)

	More Affluent	Neither More Affluent Nor More Disadvantaged	More Disadvantaged
	%	%	%
Chinese Taipei	25	71	4
Hong Kong SAR	34	25	41
Japan	48	45	8
Korea, Rep. of	26	57	17
Singapore	53	37	10
International Average	41	34	25

School Composition by Socioeconomic Background of Students (Grade 4)

	More Affluent		Neither More Affluent Nor More Disadvantaged		More Disadvantaged	
	%	Scale Scores	%	Scale Scores	%	Scale Scores
Chinese Taipei	25	607	71	599	4	566
Hong Kong SAR	34	612	25	607	41	590
Japan	48	602	45	585	8	583
Korea, Rep. of	26	620	57	594	17	583
Singapore	53	635	37	623	10	584
International Average	41	521	34	499	25	479

Hong Kong Students Arriving at School Feeling Tired or Hungry



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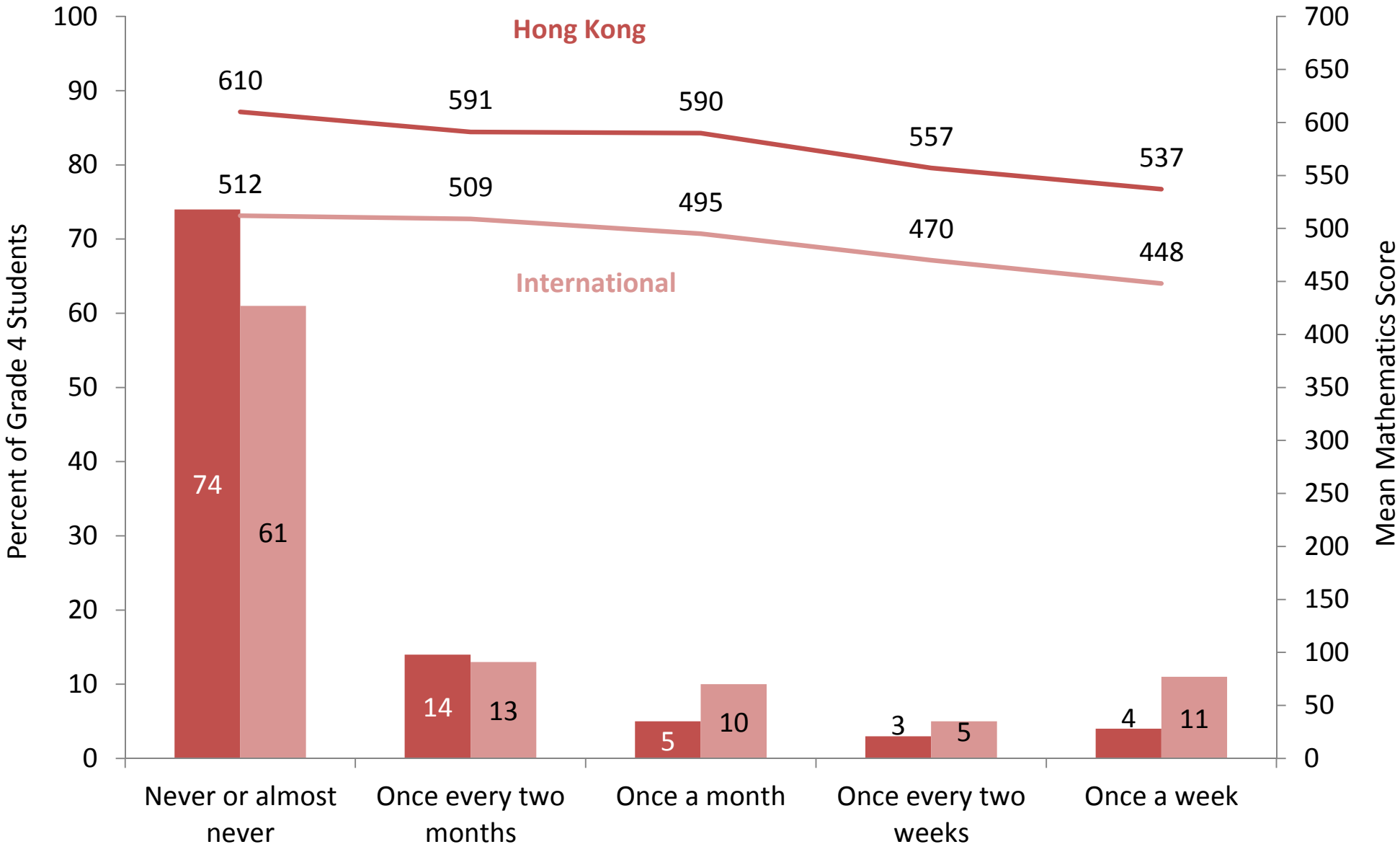
Frequency of Being Absent from School



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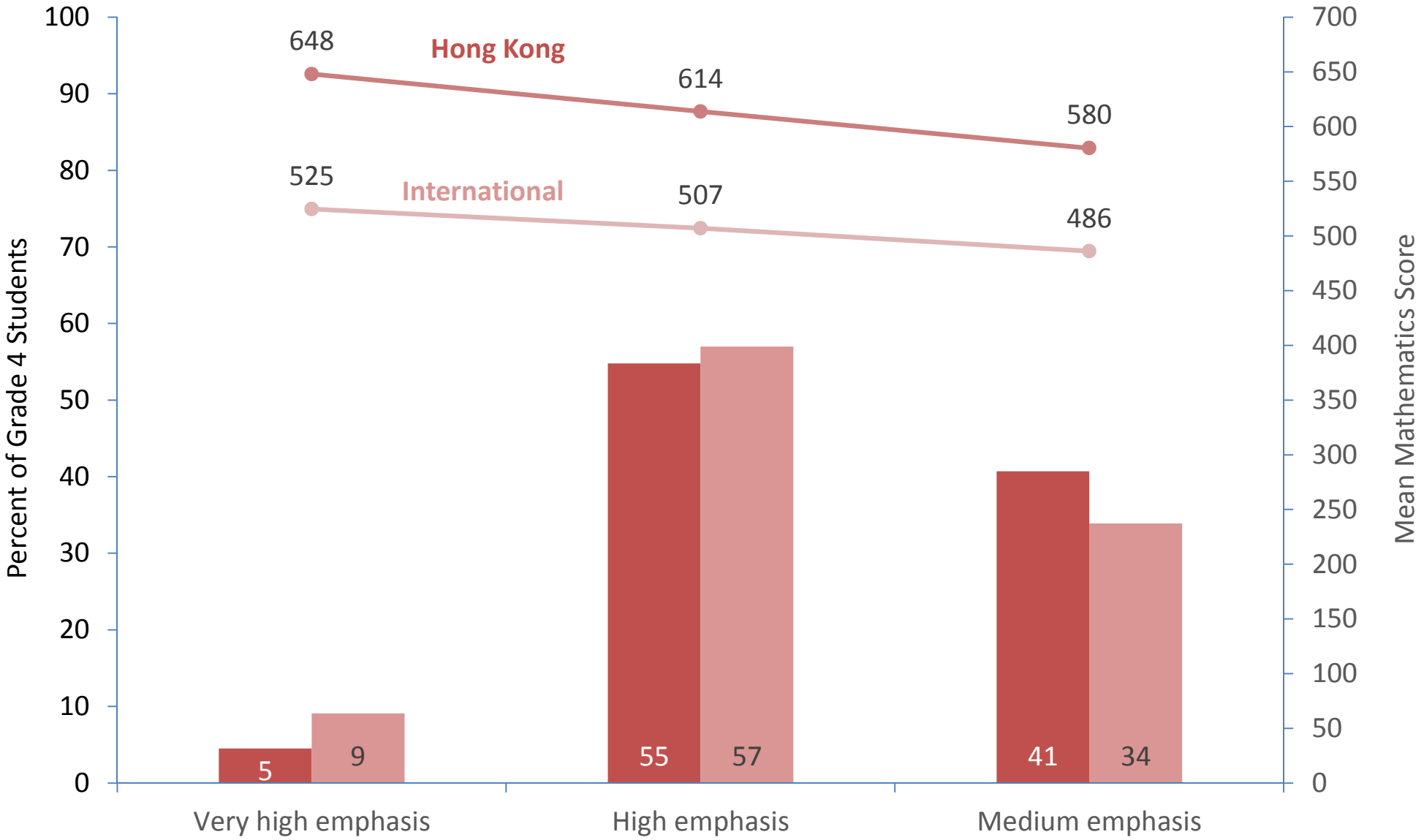
School Emphasis on Academic Success



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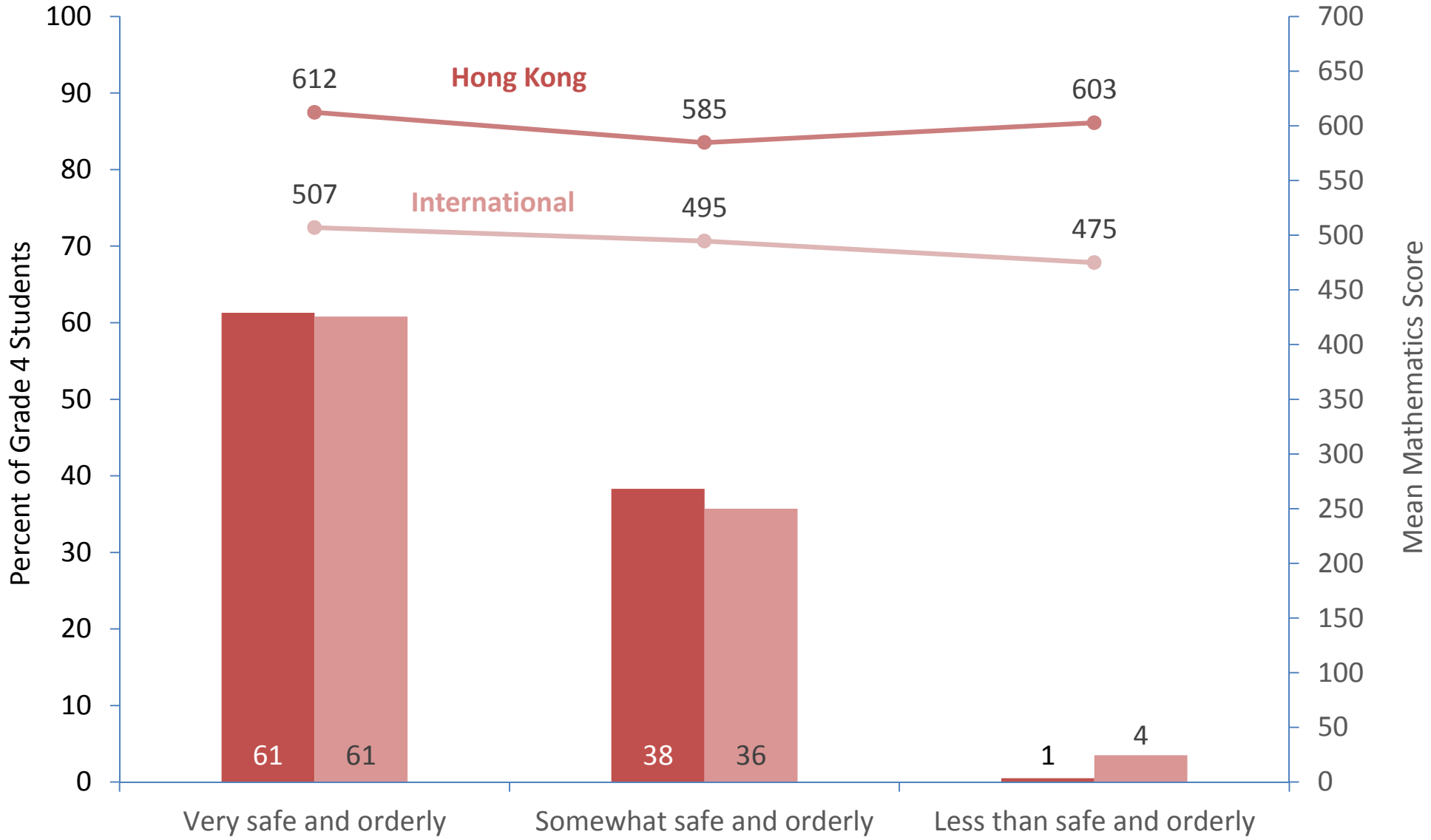
Safe and Orderly School



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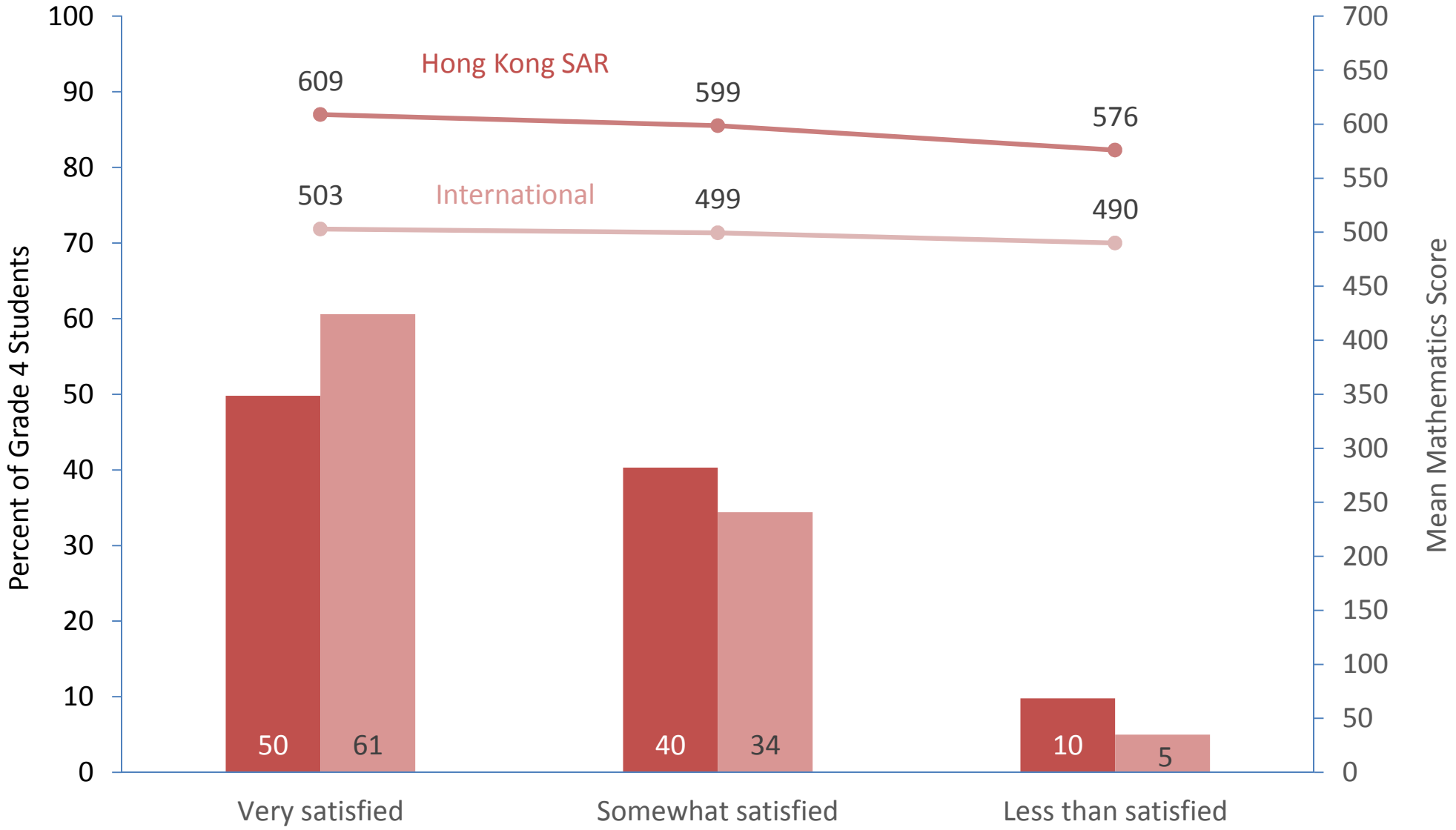
Teachers' Job Satisfaction



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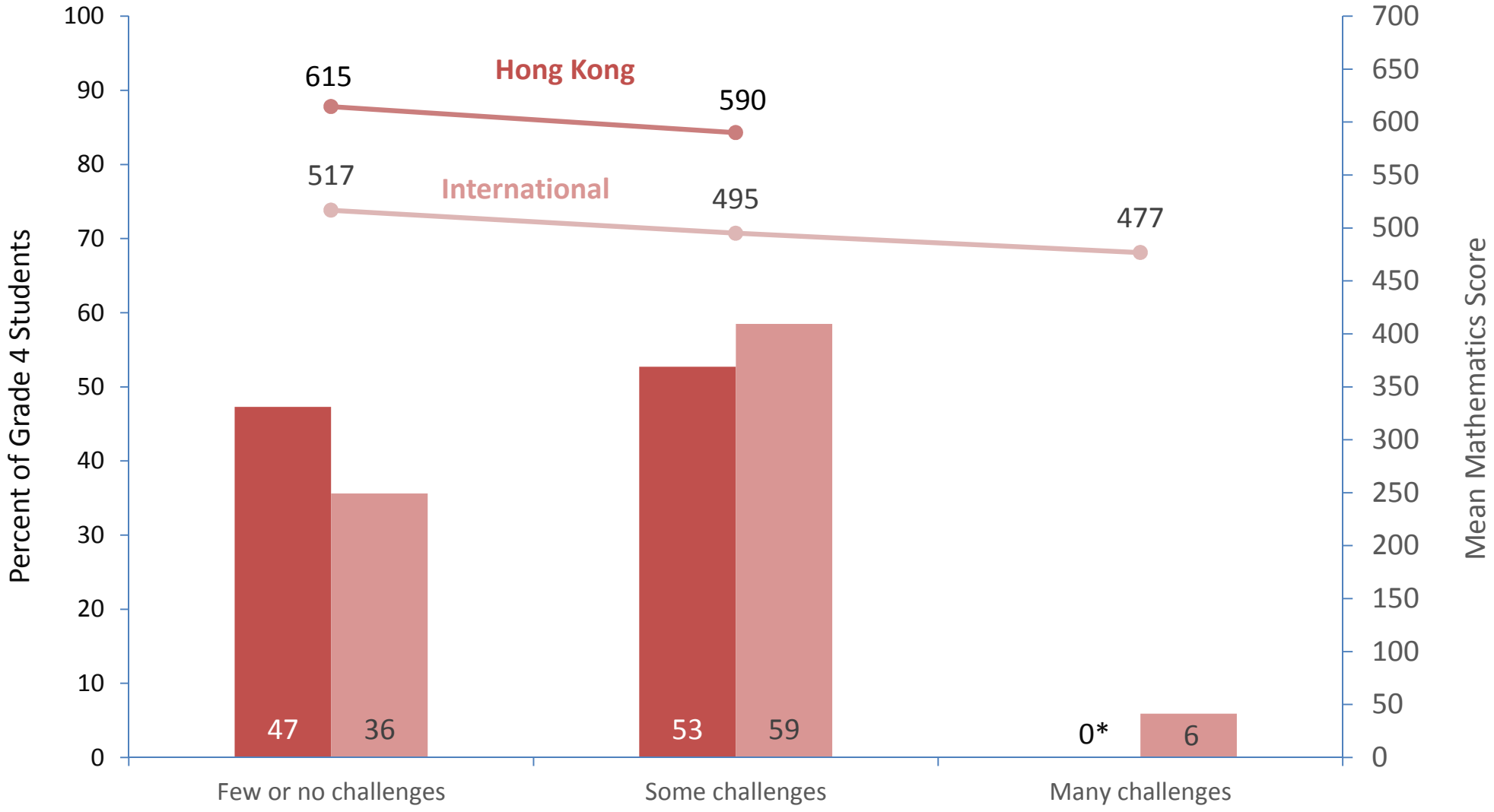
Classroom Teaching Limited by Students Not Ready for Instruction



* % too low for score estimation

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- How often do you usually assign mathematics homework to students in this class? (Grade 4)

	No math homework	Less than once a week	1 or 2 times a week	3 or 4 times a week	Every day
	%	%	%	%	%
Chinese Taipei	0.8	0.3	2.8	24.5	71.5
Hong Kong SAR	0.0	0.0	3.8	3.6	92.6
Japan	7.1	2.3	10.5	21.4	58.7
Korea, Rep. of	25.4	30.4	30.4	13.5	0.3
Singapore	0.5	6.0	24.4	48.3	20.9
International Average	7.3	7.6	25.2	30.5	29.5

- When you assign mathematics homework to the students in this class, about how many minutes do you usually assign? (Grade 4)

	15 minutes or less	16-30 minutes	31-60 minutes	More than 60 minutes	Not Applicable
	%	%	%	%	%
Chinese Taipei	10.9	77.2	11.0	0.0	0.9
Hong Kong SAR	6.0	71.1	22.3	0.6	0.0
Japan	19.9	64.2	8.5	0.0	7.3
Korea, Rep. of	48.7	25.8	0.3	0.0	25.2
Singapore	7.3	67.9	24.0	0.3	0.5
International Average	30.4	50.4	11.0	0.9	7.3

How often do you usually assign mathematics homework to students in this class? (Grade 4)

	No math homework		Less than once a week		1 or 2 times a week		3 or 4 times a week		Every day	
	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores
Chinese Taipei	0.8	574	0.3	608	2.8	594	24.5	597	71.5	601
Hong Kong SAR	0.0	N/A	0.0	N/A	3.8	586	3.6	620	92.6	601
Japan	7.1	595	2.3	616	10.5	594	21.4	587	58.7	594
Korea, Rep. of	25.4	603	30.4	597	30.4	603	13.5	589	0.3	613
Singapore	0.5	642	6.0	601	24.4	626	48.3	627	20.9	629
International Average	7.3	501	7.6	499	25.2	502	30.5	505	29.5	502

- When you assign mathematics homework to the students in this class, about how many minutes do you usually assign? (Grade 4)

	15 minutes or less		16-30 minutes		31-60 minutes		More than 60 minutes		Not Applicable	
	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores
Chinese Taipei	10.9	596	77.2	600	11.0	601	0.0	N/A	0.9	574
Hong Kong SAR	6.0	601	71.1	606	22.3	586	0.6	585	0.0	N/A
Japan	19.9	588	64.2	593	8.5	596	0.0	N/A	7.3	595
Korea, Rep. of	48.7	597	25.8	601	0.3	580	0.0	N/A	25.2	603
Singapore	7.3	606	67.9	626	24.0	631	0.3	620	0.5	642
International Average	30.4	498	50.4	504	11.0	498	0.9	467	7.3	501

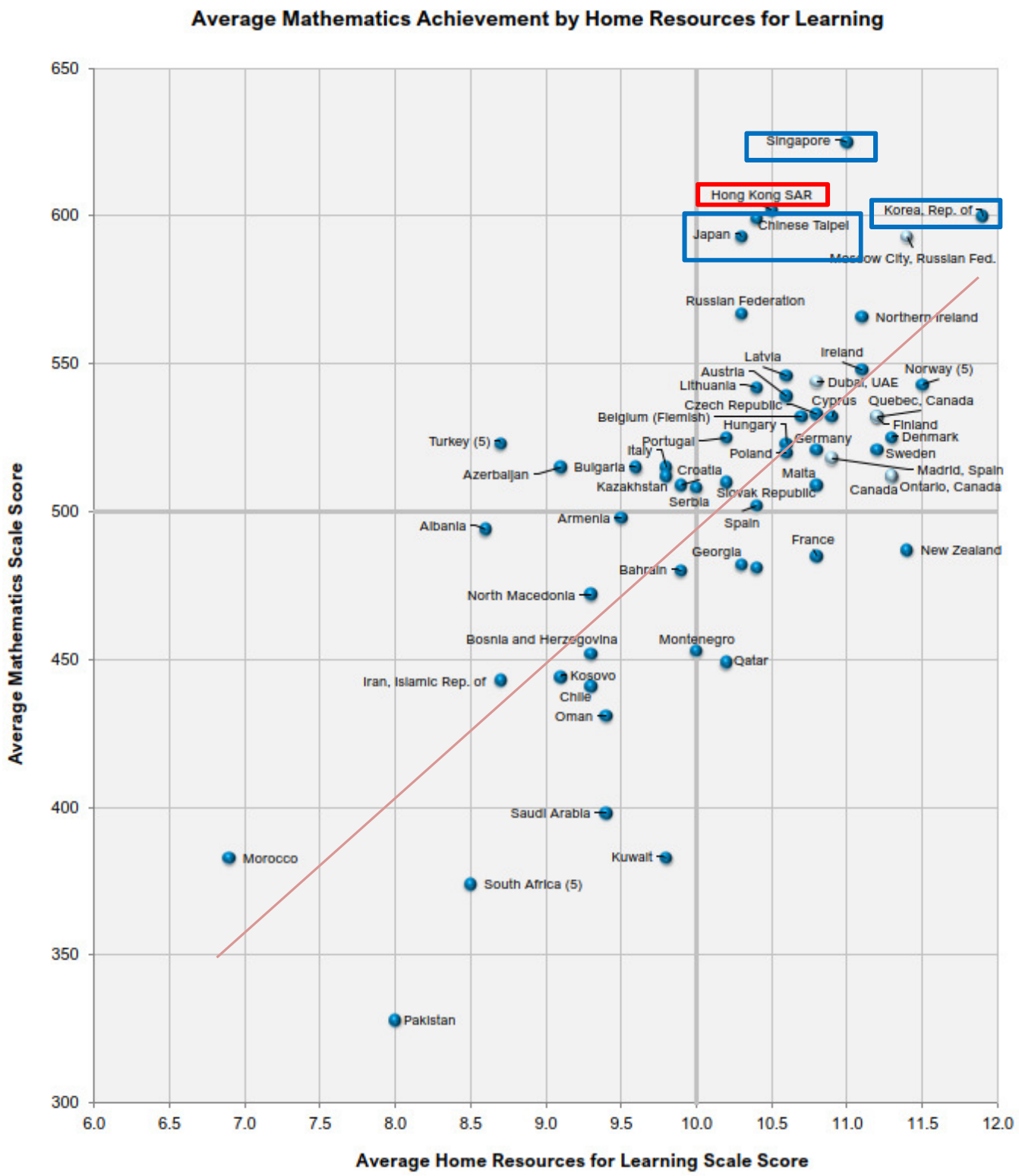
5(e) Efficiency of the Education System

Home Resources for Learning

Primary 4	Many Resources	Some Resources	Few Resources
HKSAR % (Scale Avg.)	27% (636)	67% (595)	6% (561)
Int'l % (Scale Avg.)	17% (562)	75% (498)	8% (433)

Primary 4

Home Educational Resources for Learning Mathematics



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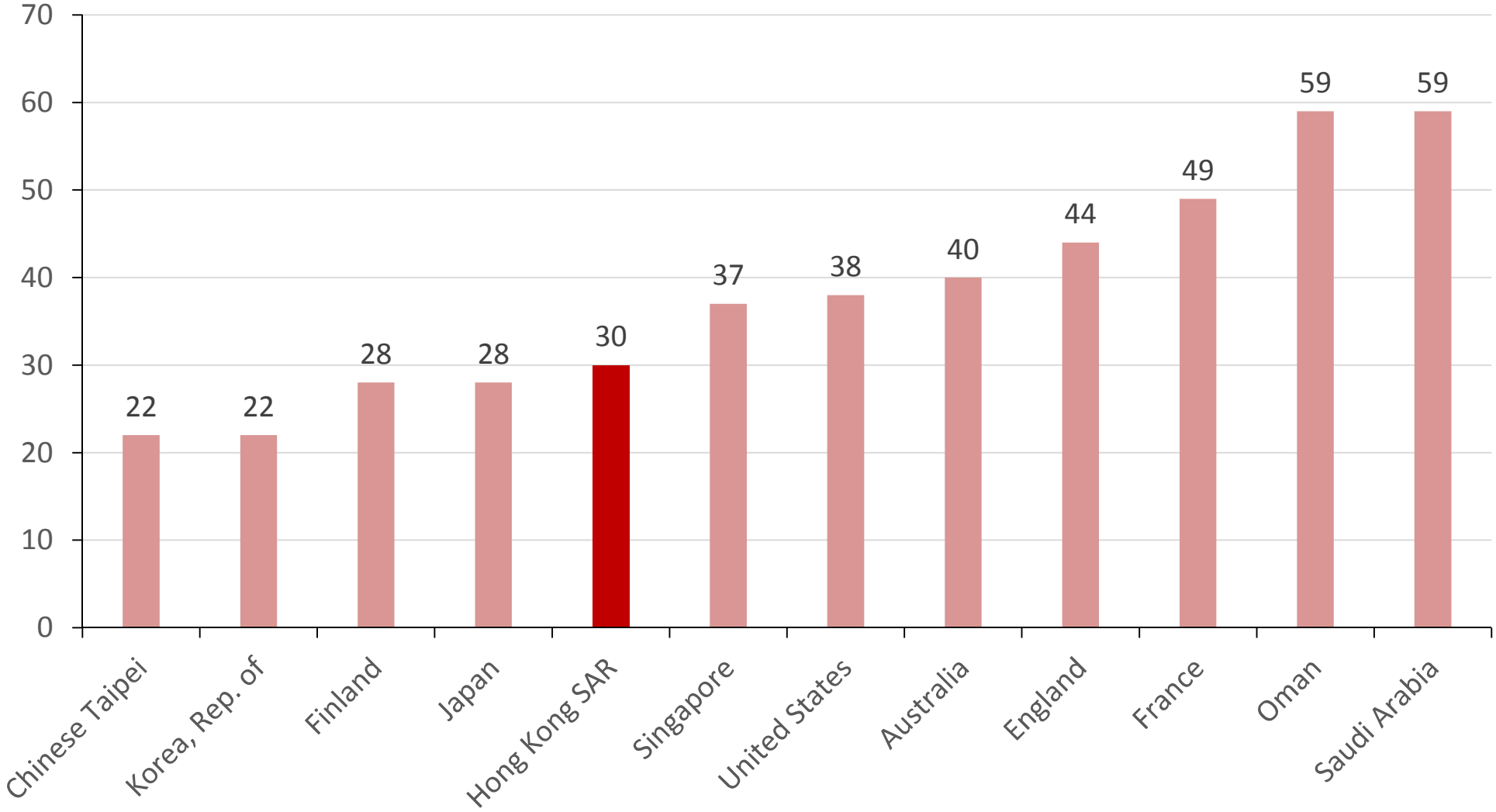
5(f) Attitudes of Students towards Mathematics and Learning

- Students' attitudes are an important component of the attained curriculum, since in all school systems, students' positive attitudes are one of the goals of education
- In this era when life-long learning is so much stressed, some people think that a positive attitude is even more important than attaining high test scores
- A positive attitude will motivate students to continue to learn even after they have left school
- So we should care about students' attitude towards learning, not just their achievement

Grade 4: Students Like Learning Mathematics
(international average = 45%)



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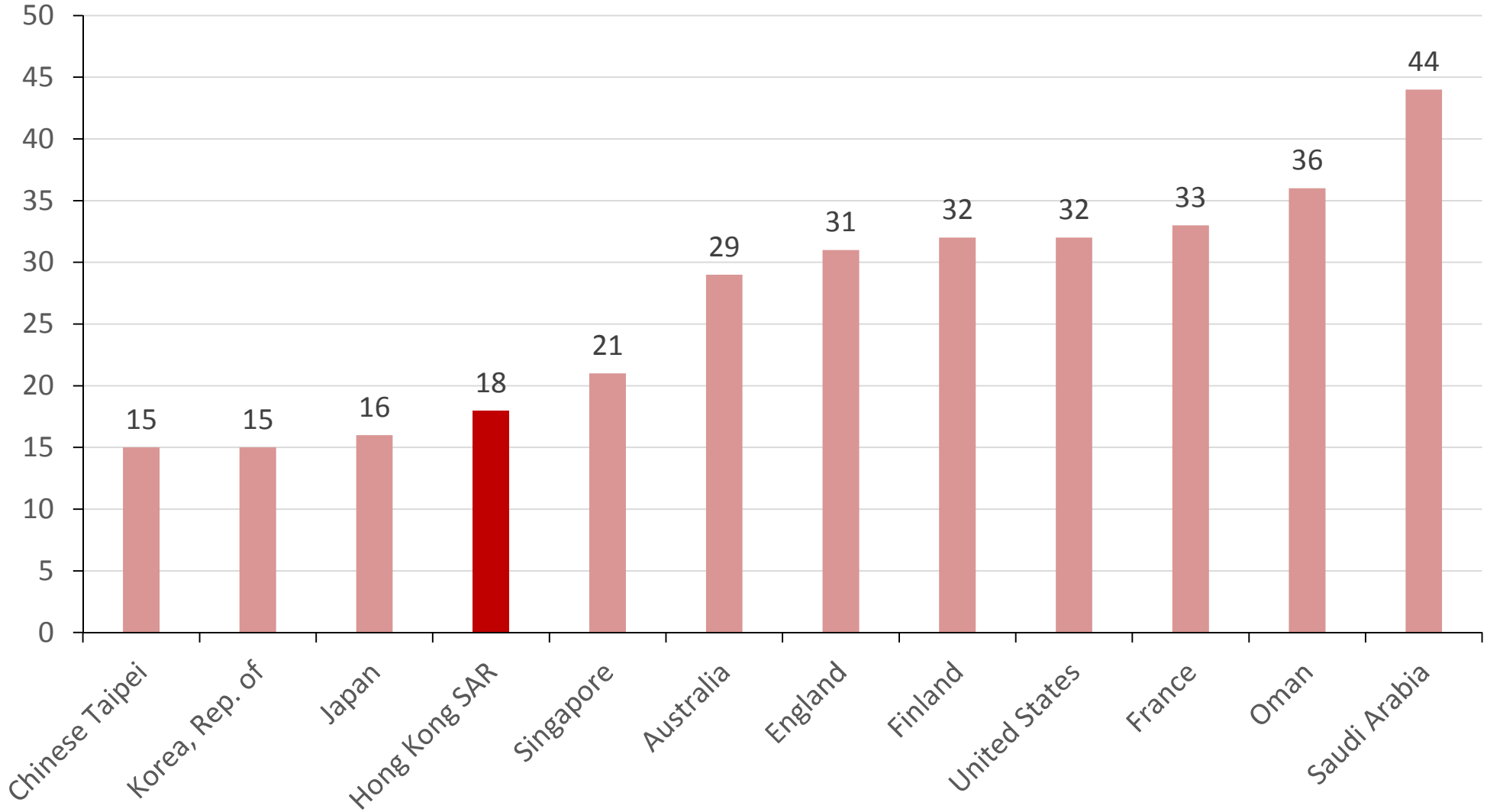
Grade 4: Students Confident in Mathematics
(international average = 32%)



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政策二十一

Attitudinal Results (P4 maths)

Primary 4	Students Very Much Like Learning Mathematics	Students Somewhat Like Learning Mathematics	Students Do Not Like Learning Mathematics
HKSAR %	30%	38%	32%
International %	45%	35%	20%

Primary 4	Students Very Confident in Mathematics	Students Somewhat Confident in Mathematics	Students Not Confident in Mathematics
HKSAR %	18%	43%	39%
International %	32%	44%	23%

Attitudinal Results (P4 maths)

Primary 4	Students Very Much Like Learning Mathematics	Students Somewhat Like Learning Mathematics	Students Do Not Like Learning Mathematics
HKSAR % (Scale Avg.)	30% (626)	38% (596)	32% (585)
Int'l % (Scale Avg.)	45% (520)	35% (491)	20% (479)

Primary 4	Students Very Confident in Mathematics	Students Somewhat Confident in Mathematics	Students Not Confident in Mathematics
HKSAR % (Scale Avg.)	18% (652)	43% (606)	39% (573)
Int'l % (Scale Avg.)	32% (545)	44% (487)	23% (456)

Country	Very Much Like Learning Mathematics		Somewhat Like Learning Mathematics		Do Not Like Learning Mathematics		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Albania	83 (1.2)	504 (3.2)	15 (1.0)	455 (7.6)	2 (0.4)	~ ~	11.8 (0.05)
Kosovo	78 (0.9)	459 (2.7)	20 (0.8)	404 (4.7)	2 (0.3)	~ ~	11.4 (0.04)
Georgia	74 (1.5)	489 (3.7)	22 (1.1)	459 (6.6)	4 (0.6)	446 (11.3)	11.4 (0.06)
Armenia	72 (1.1)	511 (2.6)	23 (1.0)	481 (4.0)	5 (0.4)	465 (5.6)	11.4 (0.05)
Morocco	70 (1.2)	402 (4.1)	25 (1.1)	344 (6.4)	5 (0.4)	326 (10.2)	11.3 (0.05)
Azerbaijan	68 (1.2)	536 (2.3)	27 (1.1)	495 (3.6)	5 (0.4)	477 (7.5)	10.9 (0.05)
Kazakhstan	68 (1.0)	518 (2.6)	28 (1.0)	504 (3.6)	5 (0.5)	494 (6.3)	11.1 (0.05)
Turkey (5)	66 (1.2)	540 (4.1)	25 (0.9)	491 (6.1)	9 (0.6)	495 (7.0)	10.9 (0.05)
North Macedonia	66 (1.3)	495 (5.3)	29 (1.1)	436 (6.8)	5 (0.6)	448 (12.0)	11.0 (0.06)
Montenegro	64 (1.0)	467 (1.9)	25 (0.8)	433 (3.5)	10 (0.6)	427 (5.0)	10.9 (0.04)
Oman	59 (1.2)	455 (4.5)	34 (1.1)	401 (4.7)	7 (0.5)	394 (5.7)	10.8 (0.05)
Iran, Islamic Rep. of	59 (1.4)	457 (3.6)	30 (0.9)	421 (5.2)	11 (0.7)	437 (7.3)	10.8 (0.06)
Saudi Arabia	59 (1.2)	424 (3.6)	30 (1.0)	371 (4.1)	11 (0.8)	370 (8.7)	10.8 (0.05)
Cyprus	56 (1.5)	547 (2.8)	28 (0.9)	522 (3.9)	16 (1.1)	497 (4.9)	10.5 (0.07)
Bahrain	56 (1.4)	494 (2.6)	31 (0.9)	465 (3.2)	13 (0.8)	458 (4.4)	10.6 (0.07)
Bulgaria	54 (1.5)	526 (3.9)	30 (1.1)	508 (5.4)	17 (1.3)	496 (10.1)	10.4 (0.08)
United Arab Emirates	54 (0.7)	503 (1.8)	33 (0.5)	461 (2.3)	13 (0.4)	455 (2.8)	10.5 (0.03)
Portugal	49 (1.3)	542 (2.9)	36 (1.0)	513 (3.1)	15 (0.9)	499 (4.4)	10.3 (0.05)
France	49 (1.0)	499 (3.6)	36 (0.9)	479 (3.9)	15 (0.8)	454 (4.8)	10.2 (0.04)
Bosnia and Herzegovina	49 (1.0)	466 (2.8)	32 (0.6)	443 (3.3)	20 (1.0)	437 (3.4)	10.1 (0.06)
Malta	48 (0.7)	522 (1.7)	34 (0.7)	502 (2.2)	18 (0.7)	488 (3.2)	10.1 (0.03)
Lithuania	47 (1.3)	553 (3.2)	39 (0.9)	538 (3.3)	14 (0.9)	521 (5.7)	10.1 (0.05)
Kuwait	46 (1.6)	416 (6.0)	37 (1.1)	372 (5.5)	17 (1.1)	352 (5.4)	10.2 (0.08)
South Africa (5)	46 (1.5)	415 (3.3)	43 (1.1)	345 (3.7)	12 (0.6)	334 (5.4)	10.3 (0.05)
Italy	45 (1.3)	525 (2.9)	34 (1.1)	511 (3.2)	20 (1.1)	502 (3.5)	10.0 (0.06)
England	44 (1.6)	576 (4.4)	34 (1.1)	549 (4.4)	23 (1.1)	530 (3.8)	9.9 (0.07)
Qatar	43 (1.4)	474 (3.8)	38 (0.9)	434 (4.8)	20 (0.9)	436 (4.9)	10.0 (0.07)
Chile	43 (1.2)	458 (3.2)	39 (0.9)	437 (3.4)	19 (1.0)	418 (4.1)	10.0 (0.05)
Russian Federation	42 (1.1)	579 (4.0)	41 (0.8)	563 (3.5)	17 (0.9)	547 (4.3)	10.0 (0.05)
Austria	40 (1.0)	552 (2.5)	34 (0.8)	538 (2.7)	25 (0.9)	522 (2.9)	9.8 (0.05)
New Zealand	40 (0.9)	503 (3.2)	35 (0.8)	485 (3.6)	25 (0.9)	469 (3.3)	9.8 (0.04)
Australia	40 (1.0)	536 (3.6)	34 (0.9)	516 (3.4)	26 (1.2)	487 (3.6)	9.7 (0.05)
Hungary	38 (1.2)	543 (3.3)	37 (0.9)	517 (3.4)	25 (1.3)	504 (3.4)	9.7 (0.06)
United States	38 (0.9)	559 (2.8)	35 (0.7)	530 (3.7)	27 (0.8)	515 (3.1)	9.7 (0.04)
Canada	38 (0.9)	531 (2.9)	38 (0.8)	508 (2.1)	25 (0.6)	485 (2.5)	9.7 (0.04)
Spain	37 (1.0)	519 (3.5)	39 (0.9)	500 (2.9)	23 (1.1)	484 (2.9)	9.7 (0.04)
Singapore	37 (0.9)	654 (3.5)	40 (0.7)	618 (4.4)	23 (0.8)	594 (4.1)	9.7 (0.04)
Slovak Republic	37 (1.5)	520 (4.4)	39 (1.1)	506 (4.5)	24 (1.0)	500 (3.8)	9.7 (0.06)
Ireland	35 (1.1)	566 (2.9)	37 (1.0)	549 (3.2)	28 (1.1)	529 (3.3)	9.5 (0.05)
Pakistan	35 (3.6)	354 (14.7)	52 (3.2)	318 (11.5)	13 (1.3)	307 (11.5)	9.9 (0.09)
Serbia	35 (1.3)	526 (4.4)	40 (1.1)	505 (3.3)	26 (1.4)	490 (5.1)	9.6 (0.07)
Sweden	34 (1.6)	530 (4.5)	37 (1.1)	523 (3.3)	29 (1.6)	511 (3.2)	9.5 (0.08)
Germany	33 (1.0)	544 (3.1)	38 (1.0)	522 (2.8)	29 (1.2)	503 (3.1)	9.5 (0.05)
Belgium (Flemish)	33 (1.0)	547 (2.8)	39 (0.9)	531 (2.3)	28 (1.0)	518 (2.8)	9.4 (0.04)
Czech Republic	32 (1.2)	553 (3.6)	39 (1.1)	532 (3.2)	28 (1.2)	514 (3.2)	9.4 (0.05)
Latvia	32 (1.2)	565 (3.5)	40 (1.1)	549 (2.7)	28 (1.3)	521 (3.7)	9.5 (0.05)
Norway (5)	32 (1.4)	558 (3.4)	39 (1.1)	541 (3.4)	29 (1.3)	533 (3.4)	9.4 (0.07)
Philippines	32 (1.8)	362 (6.7)	53 (1.3)	278 (6.0)	16 (0.9)	242 (6.8)	9.8 (0.07)
Northern Ireland	31 (1.2)	589 (4.0)	39 (1.1)	572 (3.6)	30 (1.2)	535 (3.8)	9.4 (0.05)
Hong Kong SAR	30 (1.3)	626 (4.9)	38 (1.2)	596 (3.9)	32 (1.4)	585 (3.9)	9.3 (0.06)
Netherlands	30 (1.3)	553 (2.9)	39 (0.8)	536 (2.6)	32 (1.2)	524 (3.2)	9.3 (0.06)
Poland	28 (1.0)	544 (3.4)	41 (0.8)	517 (3.1)	31 (1.2)	505 (3.4)	9.2 (0.05)
Japan	28 (1.0)	622 (2.4)	45 (0.9)	591 (2.2)	27 (1.2)	568 (2.8)	9.4 (0.05)
Denmark	28 (1.2)	543 (3.3)	41 (1.1)	525 (2.9)	31 (1.1)	510 (3.0)	9.2 (0.05)
Finland	28 (0.9)	546 (3.8)	41 (0.7)	535 (2.8)	31 (0.9)	518 (3.2)	9.2 (0.04)
Croatia	25 (1.6)	534 (2.9)	40 (1.4)	506 (3.1)	35 (1.5)	497 (3.1)	9.1 (0.07)
Korea, Rep. of	22 (0.9)	631 (3.2)	38 (1.1)	607 (3.0)	40 (1.1)	576 (2.9)	8.9 (0.04)
Chinese Taipei	22 (0.9)	624 (3.4)	38 (0.9)	603 (2.8)	41 (1.1)	582 (2.2)	8.9 (0.05)
International Average	45 (0.2)	520 (0.5)	35 (0.1)	491 (0.6)	20 (0.1)	479 (0.7)	

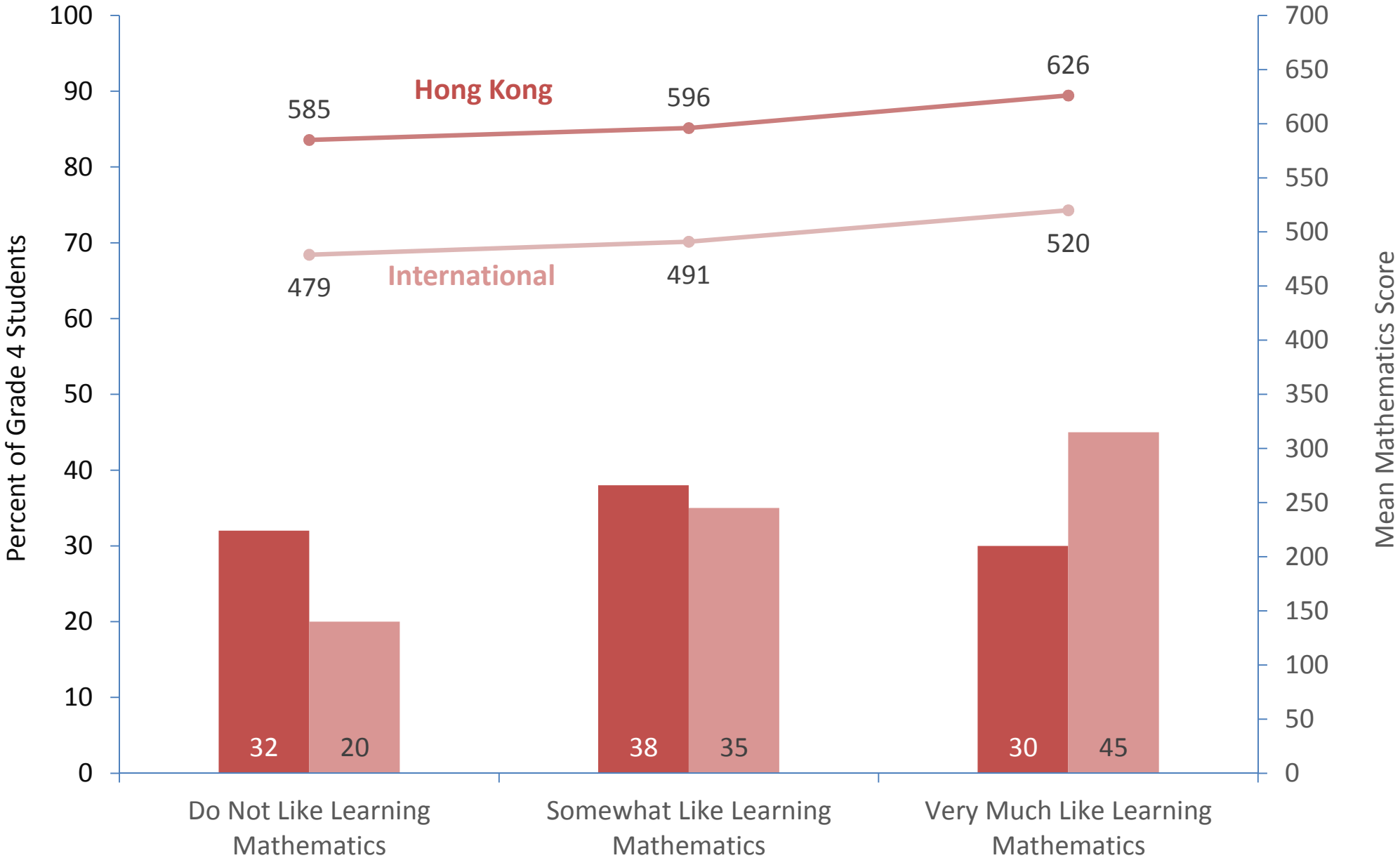
Primary 4

Students Like Learning Mathematics Scale

Country	Very Confident in Mathematics		Somewhat Confident in Mathematics		Not Confident in Mathematics		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Montenegro	52 (0.9)	485 (2.2)	35 (0.9)	431 (2.6)	14 (0.5)	394 (4.7)	11.1 (0.04)
Albania	52 (1.4)	524 (3.1)	37 (1.1)	476 (4.0)	12 (0.8)	426 (6.9)	11.0 (0.07)
Kosovo	51 (1.0)	473 (3.1)	38 (1.1)	430 (3.4)	11 (0.7)	381 (7.1)	11.0 (0.04)
North Macedonia	49 (1.5)	513 (5.1)	36 (1.3)	455 (6.0)	15 (0.9)	401 (7.7)	10.9 (0.06)
Cyprus	48 (1.2)	568 (2.7)	37 (0.9)	512 (2.8)	14 (0.8)	468 (4.6)	10.8 (0.06)
Azerbaijan	44 (1.3)	553 (2.8)	41 (1.1)	504 (3.2)	15 (0.8)	480 (3.9)	10.7 (0.05)
Bulgaria	44 (1.2)	553 (3.7)	37 (1.0)	506 (4.0)	19 (1.4)	455 (8.1)	10.5 (0.09)
Saudi Arabia	44 (1.2)	440 (3.6)	39 (0.9)	385 (3.7)	17 (0.8)	342 (6.1)	10.6 (0.05)
Armenia	43 (1.1)	528 (2.9)	40 (0.8)	492 (3.0)	17 (0.7)	459 (4.3)	10.6 (0.05)
Bosnia and Herzegovina	42 (0.9)	486 (2.6)	37 (0.7)	441 (3.0)	21 (0.8)	410 (3.0)	10.5 (0.05)
Bahrain	42 (1.4)	504 (3.1)	40 (1.0)	471 (2.8)	18 (1.0)	446 (3.3)	10.5 (0.07)
Kazakhstan	41 (1.4)	532 (2.8)	47 (1.2)	503 (2.9)	12 (0.7)	487 (4.8)	10.6 (0.06)
Georgia	40 (1.3)	511 (4.0)	44 (1.2)	472 (4.1)	16 (0.9)	431 (6.3)	10.4 (0.06)
Austria	39 (0.9)	573 (2.0)	40 (0.9)	531 (2.4)	20 (0.8)	493 (3.5)	10.3 (0.04)
Netherlands	38 (1.0)	574 (2.7)	41 (1.1)	529 (2.3)	21 (0.9)	488 (2.8)	10.3 (0.05)
Morocco	37 (1.2)	425 (4.3)	48 (1.1)	370 (5.7)	16 (0.8)	336 (6.7)	10.4 (0.05)
Norway (5)	37 (1.1)	581 (3.1)	46 (1.2)	534 (2.6)	18 (0.8)	496 (4.3)	10.3 (0.05)
Sweden	37 (1.3)	551 (3.6)	48 (1.1)	513 (3.2)	15 (0.8)	479 (4.1)	10.2 (0.06)
Hungary	36 (1.0)	571 (2.6)	42 (0.9)	512 (2.9)	22 (0.9)	468 (3.8)	10.2 (0.05)
Oman	36 (1.2)	479 (5.2)	46 (0.9)	418 (4.1)	18 (0.9)	378 (4.2)	10.3 (0.05)
Turkey (5)	34 (1.0)	575 (4.2)	42 (0.7)	513 (4.7)	23 (0.9)	468 (5.9)	10.1 (0.05)
Italy	34 (1.1)	537 (3.4)	46 (1.1)	513 (2.8)	20 (1.0)	483 (3.4)	10.2 (0.05)
Serbia	34 (1.2)	555 (3.4)	45 (1.2)	500 (3.7)	21 (1.2)	450 (4.5)	10.1 (0.07)
Iran, Islamic Rep. of	34 (1.1)	480 (4.7)	46 (1.1)	435 (4.1)	20 (1.2)	406 (6.1)	10.2 (0.06)
Germany	33 (0.9)	565 (2.7)	43 (1.0)	518 (2.4)	23 (1.1)	477 (3.1)	10.0 (0.04)
United Arab Emirates	33 (0.6)	514 (1.9)	44 (0.5)	478 (2.0)	22 (0.5)	448 (2.7)	10.2 (0.03)
Malta	33 (0.7)	547 (2.0)	41 (0.9)	504 (2.1)	26 (0.7)	468 (2.5)	10.0 (0.03)
France	33 (0.9)	524 (3.5)	46 (1.0)	483 (3.5)	21 (0.8)	428 (3.9)	10.0 (0.04)
Ireland	33 (0.7)	585 (3.0)	45 (1.0)	545 (3.0)	22 (0.9)	503 (3.3)	10.0 (0.03)
United States	32 (0.8)	587 (2.6)	42 (0.6)	533 (2.4)	26 (0.7)	482 (3.3)	10.0 (0.04)
Finland	32 (0.9)	573 (2.5)	50 (0.9)	524 (2.7)	17 (0.7)	481 (3.4)	10.1 (0.03)
Canada	32 (0.5)	555 (2.4)	45 (0.6)	506 (2.3)	24 (0.6)	464 (2.2)	10.0 (0.03)
England	31 (1.2)	607 (4.5)	45 (1.0)	549 (3.7)	24 (1.0)	506 (4.2)	9.9 (0.05)
Kuwait	31 (1.5)	432 (5.4)	44 (1.2)	383 (5.4)	25 (1.1)	347 (5.6)	10.0 (0.06)
Slovak Republic	31 (1.1)	550 (3.4)	47 (1.1)	506 (3.7)	22 (0.9)	463 (4.5)	9.9 (0.05)
Belgium (Flemish)	30 (0.7)	573 (2.3)	45 (0.9)	529 (2.3)	25 (0.8)	489 (2.7)	9.9 (0.03)
Croatia	30 (1.4)	550 (2.7)	50 (1.1)	503 (2.6)	20 (1.0)	467 (3.7)	10.0 (0.06)
Lithuania	29 (1.0)	590 (3.6)	51 (1.0)	535 (3.0)	20 (0.9)	492 (4.0)	9.9 (0.04)
Northern Ireland	29 (1.0)	613 (3.8)	45 (1.0)	569 (3.2)	26 (0.8)	510 (3.8)	9.8 (0.04)
Denmark	29 (0.9)	569 (2.8)	49 (1.1)	521 (2.6)	23 (0.8)	478 (2.8)	9.8 (0.03)
Australia	29 (0.8)	568 (3.4)	46 (0.8)	513 (3.2)	25 (0.9)	465 (3.2)	9.9 (0.04)
Qatar	28 (1.2)	491 (4.3)	43 (0.9)	447 (4.4)	28 (0.9)	418 (4.2)	9.9 (0.05)
Spain	27 (0.7)	550 (2.5)	43 (0.7)	502 (2.5)	30 (0.7)	463 (2.8)	9.7 (0.03)
Russian Federation	24 (0.9)	603 (3.4)	46 (1.1)	571 (3.1)	30 (1.1)	533 (4.4)	9.6 (0.04)
Latvia	23 (0.9)	595 (3.0)	45 (0.9)	551 (2.6)	31 (0.9)	503 (3.5)	9.5 (0.04)
Poland	23 (0.8)	571 (3.5)	47 (0.9)	526 (2.7)	30 (1.0)	476 (2.8)	9.5 (0.04)
Czech Republic	23 (1.0)	577 (3.5)	49 (0.8)	539 (2.6)	29 (1.0)	492 (3.2)	9.5 (0.04)
Portugal	22 (0.9)	580 (2.8)	43 (1.0)	532 (3.1)	36 (1.2)	485 (2.7)	9.5 (0.05)
Chile	22 (0.8)	495 (3.3)	46 (0.9)	441 (2.9)	33 (0.9)	411 (3.4)	9.5 (0.04)
Singapore	21 (0.9)	683 (2.9)	42 (0.8)	637 (3.9)	37 (1.2)	579 (3.4)	9.3 (0.05)
New Zealand	20 (0.6)	546 (3.6)	49 (0.9)	492 (2.6)	31 (0.9)	446 (3.2)	9.4 (0.03)
Hong Kong SAR	18 (0.8)	652 (4.2)	43 (1.1)	606 (3.6)	39 (1.2)	573 (3.7)	9.2 (0.05)
Pakistan	18 (3.1)	374 (19.2)	56 (2.2)	328 (10.5)	26 (2.3)	302 (12.6)	9.7 (0.17)
South Africa (5)	17 (0.7)	456 (4.9)	53 (0.5)	371 (3.6)	31 (0.9)	340 (3.7)	9.4 (0.03)
Japan	16 (0.6)	646 (3.3)	53 (0.9)	601 (2.0)	32 (0.9)	554 (2.3)	9.2 (0.03)
Chinese Taipei	15 (0.7)	650 (3.5)	41 (1.0)	610 (2.6)	44 (1.0)	572 (2.4)	9.0 (0.03)
Korea, Rep. of	15 (0.7)	651 (2.6)	49 (1.1)	614 (2.5)	36 (0.9)	559 (2.7)	9.2 (0.03)
Philippines	8 (0.7)	403 (9.9)	56 (1.0)	306 (6.0)	36 (1.2)	269 (6.7)	9.0 (0.04)
International Average	**32 (0.1)**	**545 (0.6)**	**44 (0.1)**	**497 (0.5)**	**23 (0.1)**	**456 (0.6)**	

Primary 4

Students Confident in Mathematics Scale



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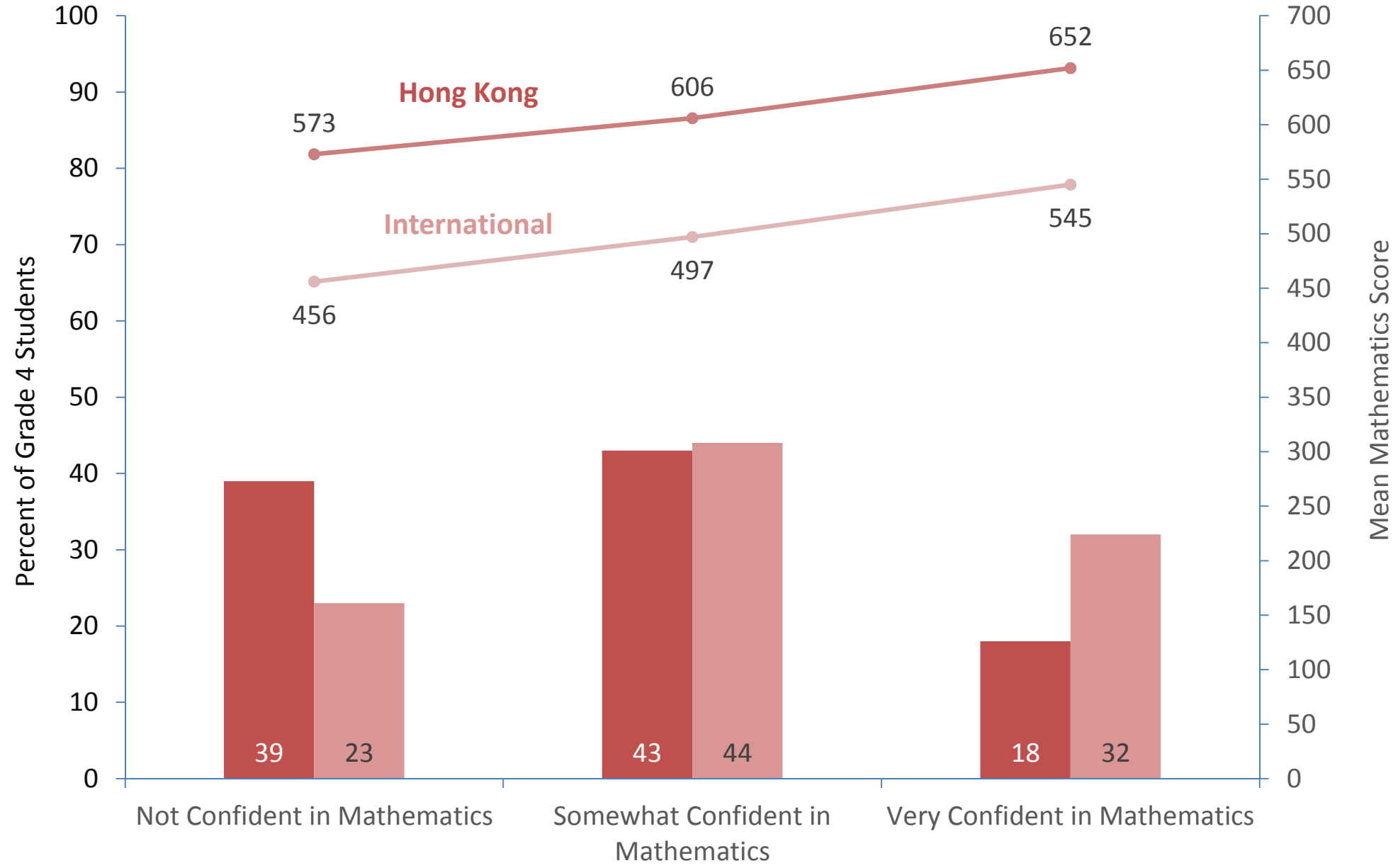
IEA

Policy 21
政策二十一



Faculty of Education
The University of Hong Kong
香 港 大 學 教 育 學 院

IEA

Policy 21
政策二十一

Attitudes of Students from Grade 4 to Grade 8

	Primary 4 (HKSAR %)			Secondary 2 (HKSAR %)
Students Very Much Like Learning Mathematics	35%		→	15%
Students Very Confident in Mathematics	19%		→	10%
Students Strongly Value Mathematics	N.A.			19%

- TIMSS 2019 Primary 4 students generally like learning mathematics more than Secondary 2 students
- They are also more confident in learning mathematics than Secondary 2 students

What Price Have Hong Kong Paid for High Achievement?

Students' physical health?

Students' interest and development of hobbies?

Students' enjoyment of school life?

Students' enjoyment of family life?

6. Implication of TIMSS for Teaching and Learning

6(a) What can teachers do to inculcate students' positive attitudes?

- Students might not have realized the importance of mathematics in their everyday life and future career
- Although students might do well already, they feel that they have not met the expectations of schools/teachers/parents
- What can be done?

→ Encouragement and positive feedback

→ Let students know about the need of mathematics in different jobs

6(b) How to Use TIMSS Data for School Improvement

School report

國際數學與科學趨勢研究 (TIMSS) 2019
學校報告：整體數理成績表現

數學科

學校名稱： [redacted]　　**(學校編號：** [redacted]**)**
班別： 2018-19 學年小四年級 4E 班　　**(班級編號：** [redacted]**)**
聯絡老師： [redacted]

第一部份：貴校參與學生整體表現

	數學科整體表現	學科範疇*			認知範疇*		
		數	度量與幾何	數據	知識	應用	推理
TIMSS 2019 香港參與學校的平均水平	602	598	608	607	600	606	596
貴校參與班別的平均表現	**682**	**681**	**686**	**685**	**679**	**688**	**691**

*TIMSS 測試結構分兩個範疇：學科範疇 (Content Dimension) 和認知範疇 (Cognitive Dimension)。學科範疇是針對數學科和科學科裡不同領域 (Domains) 的評估，而認知範疇則觀察學生在處理學科題目時的思考過程。每一條題目包含一個學科領域和一個認知領域。

數學科的學科領域 (Content Domains of Mathematics)：

- 數 (Number)
- 度量與幾何 (Measurement and Geometry)
- 數據 (Data)

數學科的認知領域 (Cognitive Domains of Mathematics)：

- 知識 (Knowing) – 學生對數學事實 (facts)、概念 (concepts)、工具 (tools) 和步驟 (procedures) 的知識
- 應用 (Applying) – 在處理問題時，學生運用知識和概念理解 (conceptual understanding) 的能力
- 推理 (Reasoning) – 超越學科上的常規問題 (routine problems)，學生解答複雜 (complex)、不常見 (unfamiliar) 和多重步驟 (multi-step) 的難題

*「國際數學與科學趨勢研究 2019」的數學科量尺平均分數 (TIMSS Scale Average) 為 500, 標準差為 100。

第二部份：貴校參與學生對學習數學的態度及相關表現

	喜歡學習數學					
	很喜歡		喜歡		不喜歡	
	%	表現	%	表現	%	表現
TIMSS 2019 香港參與學校的平均水平	30	626	38	596	32	585
貴校參與班別的平均表現	**25**	**705**	**41**	**670**	**34**	**681**

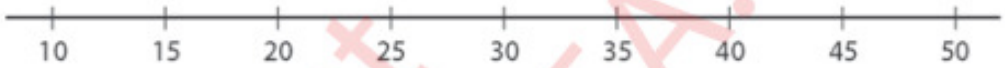
	學習數學的信心					
	很有信心		有信心		沒有信心	
	%	表現	%	表現	%	表現
TIMSS 2019 香港參與學校的平均水平	18	652	43	606	39	573
貴校參與班別的平均表現	**28**	**708**	**38**	**688**	**34**	**655**

6(c) Use of the Item Scores for Professional Development of Teachers

- Do you think the following item is difficult for Hong Kong students? (from T15)

ID: M061265A	Mathematics Grade 4	Block_Seq: M02_08

Elisa and Ken are playing a game on a number line. Each move must be either to the right or to the left.



A. Elisa begins at 27 and moves 10 units. She ends on 17. Which other point could she have ended on?

Answer: _____

Content Domain

Geometric Shapes and Measures

Topic Area

Points, Lines, and Angles

Cognitive Domain

Applying

Geometric Shapes and Measures / Applying (M02_08A)

- Internationally, 37.8% of the students got this item correct
- 70.0% of the Japanese students got this correct
- Guess what percentage of P4 students in Hong Kong got this item correct?

Geometric Shapes and Measures / Applying (M02_08A)

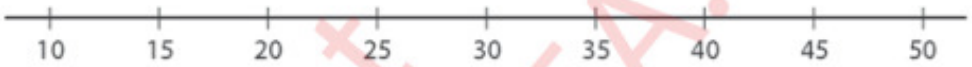
	10	79	V1	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	31.0	67.9	31.0	1.0	0.2	28.3	33.1
CHINESE TAIPEI	31.2	64.2	31.2	4.6	0.0	26.8	35.0
JAPAN	70.0	27.2	70.0	2.8	0.0	73.0	67.1
KOREA	43.0	54.1	43.0	2.4	0.5	42.1	43.9
SINGAPORE	60.6	38.2	60.6	1.2	0.0	61.2	60.0
INT'L AVG	37.8	53.5	37.8	7.4	1.3	35.6	40.0

- HK < Japan, Korea, Singapore and Int'l Avg.

Do you think the following item is difficult for Hong Kong students? (from T15)

ID: M061265B	Mathematics Grade 4	Block_Seq: M02_08

Elisa and Ken are playing a game on a number line. Each move must be either to the right or to the left.



A. Elisa begins at 27 and moves 10 units. She ends on 17. Which other point could she have ended on?

Answer: _____

B. Ken begins at 35 and moves 13 units to the left. Then, his next move is 2 units. Which point could he have ended on?

Ⓐ 22
Ⓑ 24
Ⓒ 48
Ⓓ 50

Content Domain

Geometric Shapes and Measures

Topic Area

Points, Lines, and Angles

Cognitive Domain

Applying

Maximum Points

1

Key

B

Geometric Shapes and Measures / Applying (M02_08B)

- Internationally, 35.4% of the students got this item correct
- 76.4% of the Japanese students got this correct
- Guess what percentage of P4 students in Hong Kong got this item correct?

Geometric Shapes and Measures / Applying (M02_08B)

	A	B	C	D	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	22.0	44.6	10.0	23.0	0.2	0.2	42.5	46.2
CHINESE TAIPEI	22.0	**52.3**	5.8	18.5	1.5	0.0	49.5	54.6
JAPAN	9.2	**76.4**	6.1	6.0	1.9	0.4	75.9	76.8
KOREA	20.8	**54.7**	3.3	18.9	1.6	0.7	55.7	53.8
SINGAPORE	17.3	**56.2**	8.4	17.8	0.2	0.1	54.7	57.6
INT'L AVG	22.9	**35.4**	14.4	22.1	3.3	1.9	33.9	36.8

- HK < Chinese Taipei, Japan, Korea, Singapore

Discussion on Item M02_08B

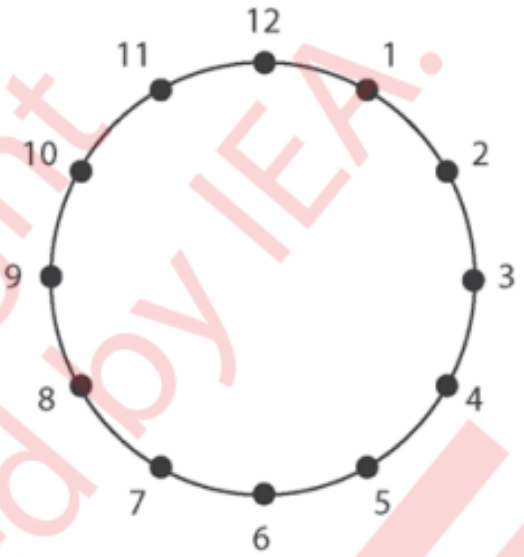
- Why did Hong Kong students do relatively poorer in this item?
- What weaknesses and misconceptions are reflected in the performance?
- What teaching-learning strategies would you suggest other teachers to adopt in order to avoid these weaknesses and misconceptions?

Another Example:

- Do you think the following item is difficult for Hong Kong students?

ID: M041302B	Mathematics Grade 4	Block_Seq: M01_06

B. In the circle, draw a triangle with all sides the same length.



What points did you connect? _____

Content Domain

Geometric Shapes and Measures

Topic Area

Two- and Three-dimensional Shapes

Cognitive Domain

Reasoning

Maximum Points

1

Geometric Shapes and Measures / Reasoning (M01_06B)

- Internationally, 57.6% of the students got this item correct
- 75.7% of the Korean students got this correct
- Guess what percentage of P4 students in Hong Kong got this item correct?

Geometric Shapes and Measures / Reasoning (M01_06B)

	10	70	71	72	79	V1	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	59.1	13.2	2.5	21.5	3.7	59.1	0.0	0.0	56.4	**61.5**
CHINESE TAIPEI	**63.2**	1.6	0.4	27.8	6.1	63.2	0.8	0.0	**67.2**	59.8
JAPAN	**73.3**	7.2	2.9	9.1	7.0	73.3	0.4	0.0	**78.0**	68.4
KOREA	**75.7**	2.9	1.2	15.1	5.1	75.7	0.0	0.0	**81.1**	70.5
SINGAPORE	**64.5**	6.6	2.2	14.8	11.8	64.5	0.1	0.0	**66.3**	62.9
INT'L AVG	**57.6**	4.6	1.3	16.8	17.1	57.6	2.0	0.5	**60.3**	55.1

- HK < Chinese Taipei, Japan, Korea, Singapore / Gender

Discussion on Item M01_06B

- Why did Hong Kong students do relatively better or poorer in this item?
- What weaknesses and misconceptions are reflected in the performance?
- What teaching-learning strategies would you suggest other teachers to adopt in order to avoid these weaknesses and misconceptions?

6(d) How TIMSS Informs Teaching and Learning

Two-digit Diagnostic Codes

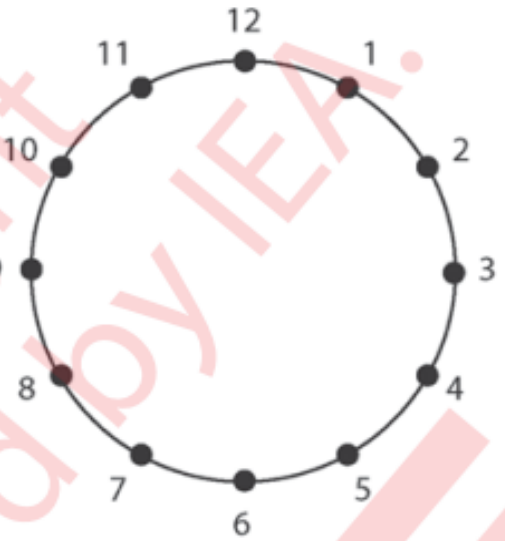
- In the scoring of open-ended items of the TIMSS test, a two-digit scoring code is used, the first digit records the marks given to that item (partial correct answers are reflected by the marks awarded), while the second digit categories how the student arrives at the right or wrong answer
- The second digit will inform us of the typical way the item is solved in a country or a school, and more importantly typical misconceptions concerning that item
- These are extremely useful information for teachers

Two-digit Diagnostic Codes

- Example from T15: M01_06B (Geometric Shapes & Measure / Reasoning)

ID: M041302B	Mathematics Grade 4	Block_Seq: M01_06

B. In the circle, draw a triangle with all sides the same length.



What points did you connect? _____

Content Domain

Geometric Shapes and Measures

Topic Area

Two- and Three-dimensional Shapes

Cognitive Domain

Reasoning

Maximum Points

1

❖T15: M01_06B (Geometric Shapes & Measures / Reasoning)

ID: **M041302B**	Mathematics Grade 4	Block_Seq: M01_06

Code	Response	Item: M041302B
	Correct Response	
10	Equilateral triangle drawn through 12-4-8-12, 1-5-9-1, 2-6-10-2, or 3-7-11-3. (Accept 12-4-8 for 12-4-8-12. Accept a sentence giving the same information.)	
	Incorrect Response	
70	Equilateral triangle drawn, but path not described or incorrectly described	
71	Path correctly described but equilateral triangle not drawn or incorrectly drawn	
72	Any other triangle drawn	
79	Other incorrect (including crossed out, erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

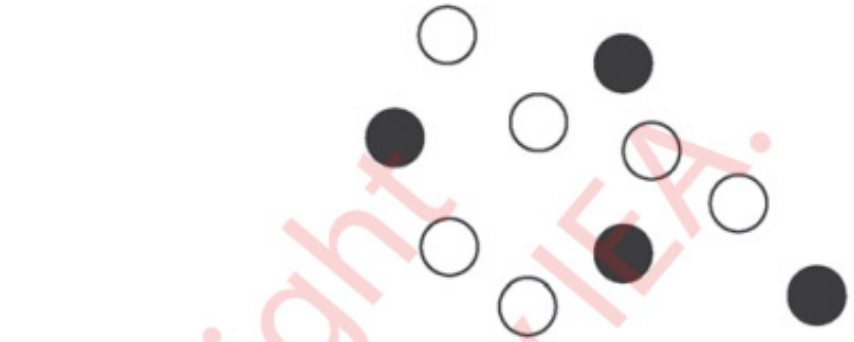
T15: M01_06B (Geometric Shapes & Measures / Reasoning)

	10	70	71	72	79	V1	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	59.1	13.2	2.5	21.5	3.7	59.1	0.0	0.0	56.4	**61.5**
CHINESE TAIPEI	**63.2**	1.6	0.4	27.8	6.1	63.2	0.8	0.0	**67.2**	59.8
JAPAN	**73.3**	7.2	2.9	9.1	7.0	73.3	0.4	0.0	**78.0**	68.4
KOREA	**75.7**	2.9	1.2	15.1	5.1	75.7	0.0	0.0	**81.1**	70.5
SINGAPORE	**64.5**	6.6	2.2	14.8	11.8	64.5	0.1	0.0	**66.3**	62.9
INT'L AVG	**57.6**	4.6	1.3	16.8	17.1	57.6	2.0	0.5	**60.3**	55.1

Another Example:

- T15: M07_04 (Number / Knowing)

ID: M041059	Mathematics Grade 4	Block_Seq: M07_04



What FRACTION of this set of 10 circles is black?

Answer: _____

M041059

Content Domain

Number

Topic Area

Fractions and Decimals

Cognitive Domain

Knowing

Maximum Points

1

❖T15: M07_04 (Number / Knowing)

ID: **M041059**	Mathematics Grade 4	Block_Seq: M07_04

Code	Response	Item: M041059
	Correct Response	
10	$\frac{4}{10}$ (do not accept 4 out of 10)	
11	$\frac{2}{5}$, 0.4 or equivalent other than $\frac{4}{10}$	
	Incorrect Response	
70	$\frac{6}{10}$ or equivalent	
71	$\frac{4}{6}$ or equivalent	
72	4	
79	Other incorrect (including crossed out, erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

❖T15: M07_04 (Number / Knowing)

	10	11	70	71	72	79	V1	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	42.2	52.4	0.0	1.3	0.0	4.1	94.6	0.0	0.0	94.9	94.3
CHINESE TAIPEI	92.9	0.2	0.2	2.0	0.4	3.7	93.1	0.6	0.0	95.1	91.3
JAPAN	84.4	1.0	0.3	2.6	3.8	7.4	85.4	0.5	0.0	87.4	83.6
KOREA	90.9	1.0	0.0	1.6	2.6	3.6	91.9	0.3	0.0	93.1	90.6
SINGAPORE	33.2	57.8	0.3	0.8	1.4	6.3	91.0	0.2	0.0	92.7	89.3
INT'L AVG	51.5	3.8	0.3	3.4	15.9	19.4	55.3	5.4	0.3	57.6	53.1

Primary 4 – M01_04

ID: M041087	Mathematics Grade 4	Block_Seq: M01_04

M041087

Add:

0.36 + 0.77

Answer: _____

Content Domain

Number

Topic Area

Fractions and Decimals

Cognitive Domain

Knowing

Maximum Points

1

Primary 4 – M01_04

ID: **M041087**	Mathematics Grade 4	Block_Seq: M01_04

Code	Response	Item: M041087
	Correct Response	
10	1.13	
	Incorrect Response	
70	113	
71	0.113	
79	Other incorrect (including crossed out, erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

7. Conclusion

- TIMSS is NOT a competition, it's a research study
- As a large, quantitative cross-national comparative study, it has its limitations
- The TIMSS research team has tried its best to overcome the limitations in ensuring the accuracy of the data
- The goal of TIMSS is to provide the best data to help improve mathematics and science teaching and learning
- But in education, we do not only need data, we also need wisdom!

Coming Soon: TIMSS Workshops for Teachers in December 2021

- International reports of TIMSS 2019 may be downloaded at:
  - → https://timss.bc.edu
  - → http://timssandpirls.bc.edu

- Enquiries concerning TIMSS 2019:
  - → Professor Frederick Leung – 2859-2355 / frederickleung@hku.hk

- HKIEA Centre Website:
  - → www.fe.hku.hk/hkiea

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香 港 大 學 教 育 學 院

IEA

Policy 21
政策二十一

Thank you very much for your attention!

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IEA

Policy 21
政策二十一