TIMSS 2019 Webinar:

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

Frederick K.S. Leung
Kintoy Professor in Mathematics Education
The University of Hong Kong

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

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Policy 21
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

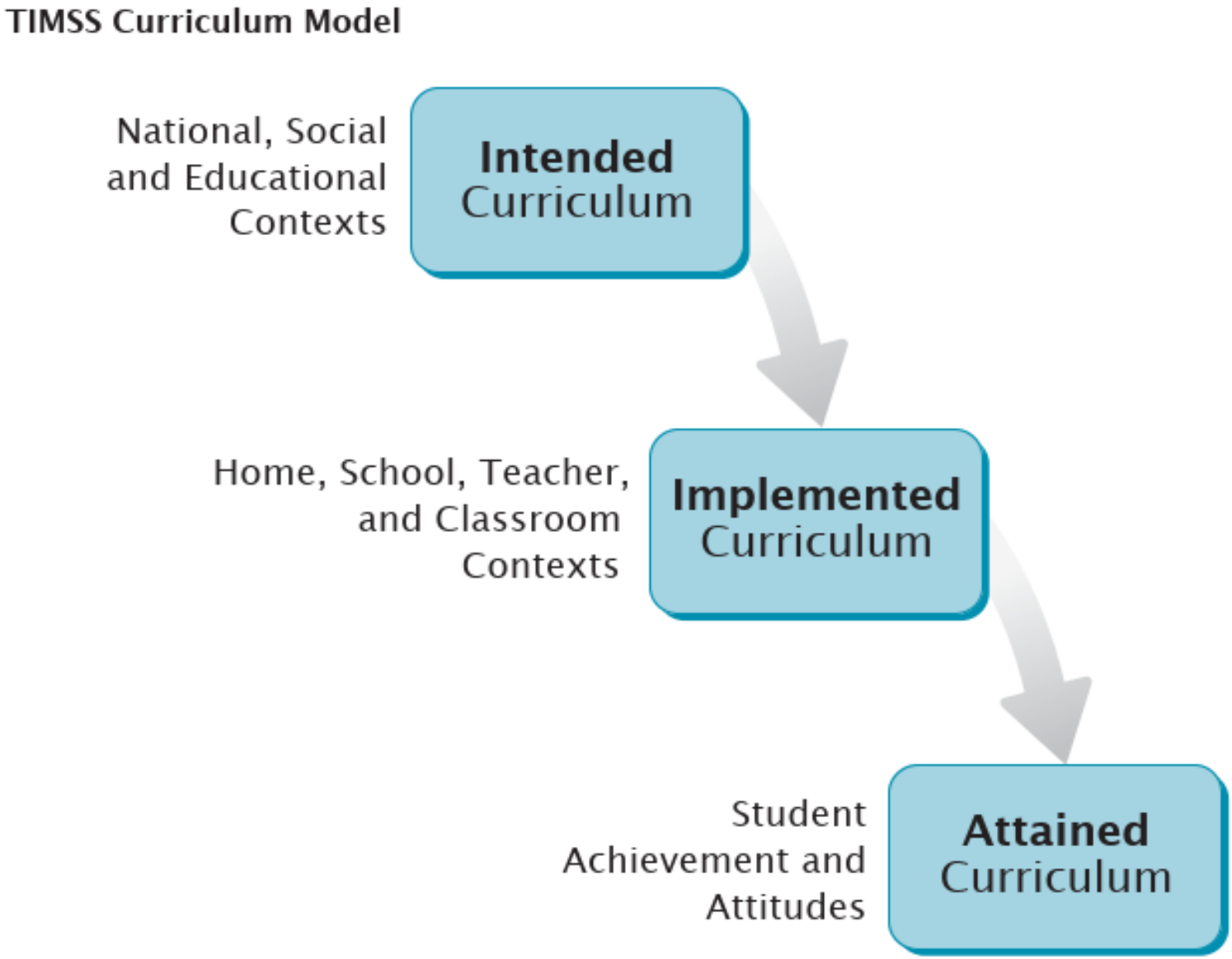
Countries/Regions Participating in TIMSS 2019

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 8)	
Number (30%)	Integers (10%)
	Fractions and decimals (10%)
	Ratio, proportion, and percent (10%)
Algebra (30%)	Expressions, operations, and equations (20%)
	Relationships and functions (10%)
Geometry (20%)	Geometric shapes and measurements (20%)
Data and probability (20%)	Data (15%)
	Probability (5%)

Cognitive Domain

Cognitive domain (Grade 8)	
Knowing (35%)	Recall, recognize, classify/order, compute, retrieve, measure
Applying (40%)	Determine, represent/model, implement
Reasoning (25%)	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 (Secondary 2)					
Mathematics	eTIMSS		Bridge		Significant?
	Scale scores	s.e.	Scale scores	s.e.	
1 Chinese Taipei	612	2.7	618	5.4	n.s.
2 Hong Kong SAR	578	4.1	581	6.9	n.s.
3 Korea	607	2.8	613	3.6	n.s.
4 Singapore	616	4.0	630^	6.5	Sign.* (0.05)
International Avg.	517	0.8	519	1.5	n.s.

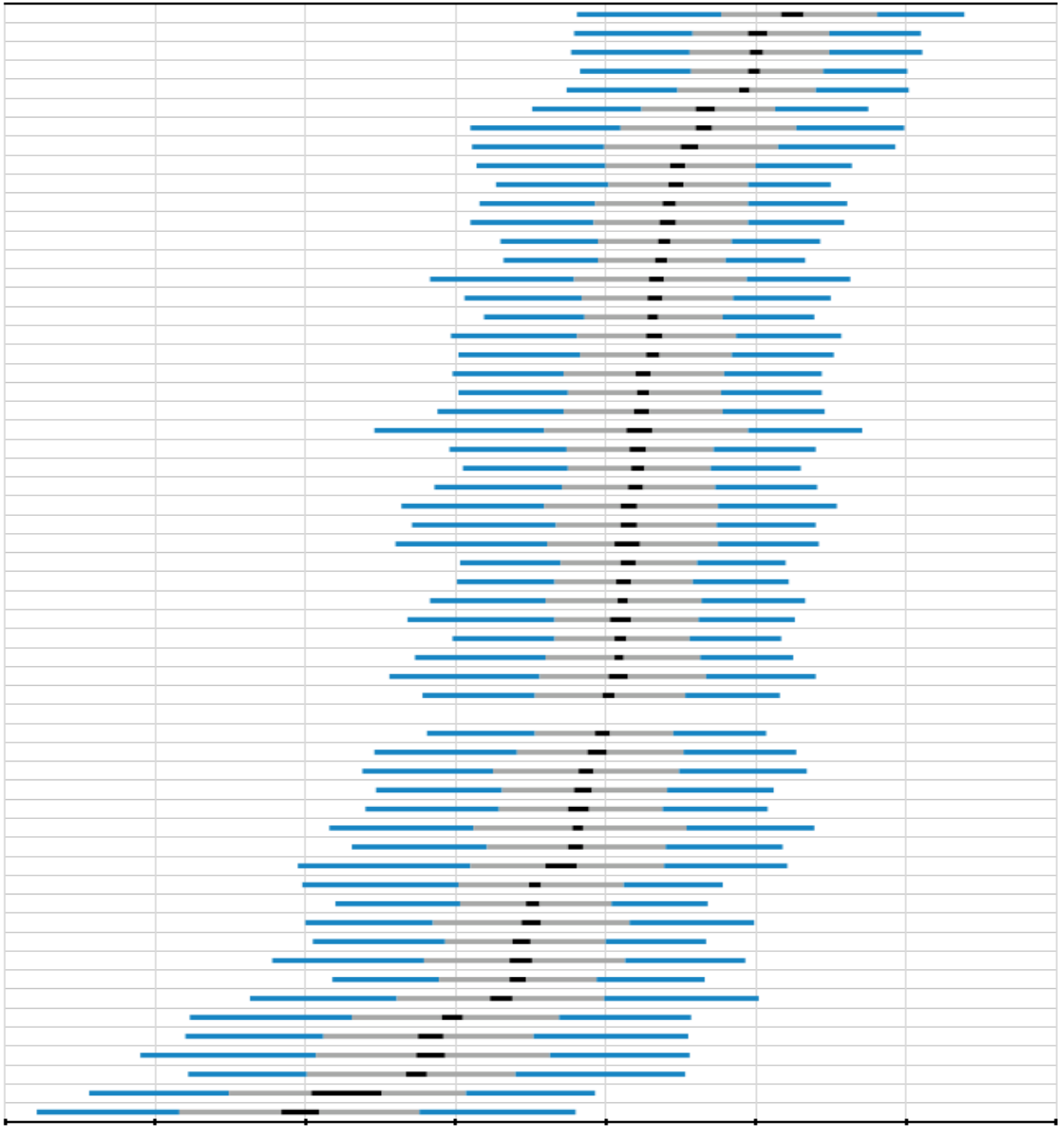
2. Achievement of Hong Kong Students in TIMSS 2019

Exhibit 1.1: Average Mathematics Achievement and Scale Score Distributions

IEA TIMSS 2019

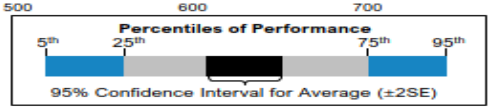
Country	Average Scale Score	
³ Singapore	625 (3.9)	▲
† Hong Kong SAR	602 (3.3)	▲
Korea, Rep. of	600 (2.2)	▲
Chinese Taipei	599 (1.9)	▲
Japan	593 (1.8)	▲
² Russian Federation	567 (3.3)	▲
† Northern Ireland	566 (2.7)	▲
² England	556 (3.0)	▲
Ireland	548 (2.5)	▲
² Latvia	546 (2.6)	▲
† Norway (5)	543 (2.2)	▲
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)	▲
¹² 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)	▽
²ψ Pakistan	328 (12.0)	▽
²ψ 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)	▲	
Ξ 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

Percentiles of Performance

5th 25th 75th 95th

95% Confidence Interval for Average (±2SE)

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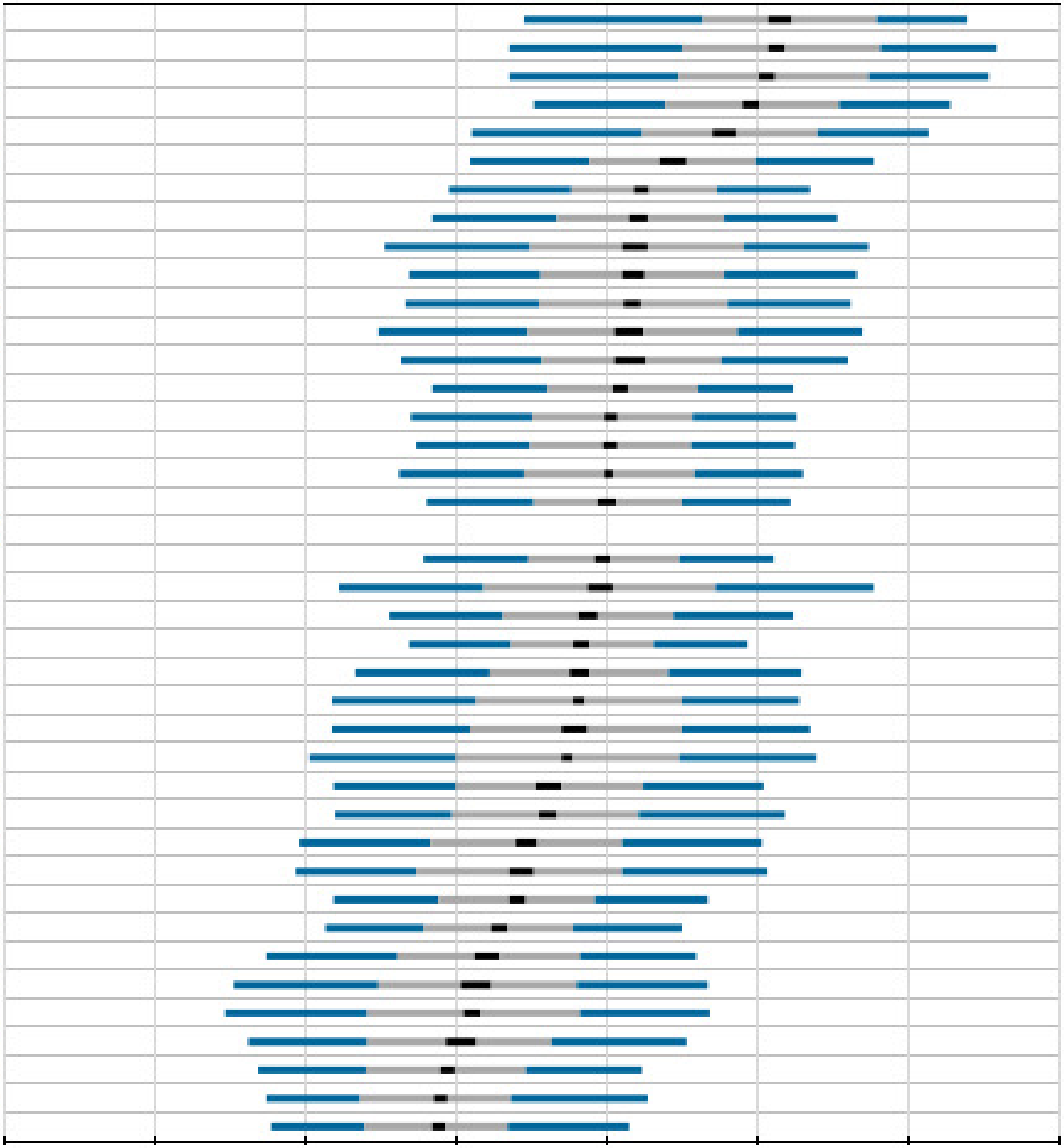
Exhibit 3.1: Average Mathematics Achievement and Scale Score Distributions

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)	▽
[9] 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)		

▲ Average significantly higher than the centerpoint of the TIMSS scale

▽ Average significantly lower than the centerpoint of the TIMSS scale

Percentiles of Performance
5th 25th 75th 95th
95% Confidence Interval for Average (±2SE)

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International Benchmark - Grade 8

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

- Summary of the four levels of benchmarks:

Low International Benchmark	
400	*Students have some knowledge of whole numbers and basic graphs.*

Intermediate International Benchmark	
475	*Students can apply basic mathematical knowledge in a variety of situations.* They can solve problems involving whole numbers, negative numbers, fractions, decimals, and ratios. Students have some basic knowledge about properties of two-dimensional shapes. They can read and interpret data in graphs and have some rudimentary knowledge of probability.

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

Grade 8 – International Benchmark

High International Benchmark

550 *Students can apply their understanding and knowledge in a variety of relatively complex situations.* They can solve problems with fractions, decimals, ratios, and proportions. Students at this level show basic procedural knowledge related to algebraic expressions and equations. They can solve a variety of problems with angles, including problems involving triangles, parallel lines, rectangles, and congruent and similar figures. Students can interpret data in a variety of graphs and solve simple problems involving outcomes and probabilities.

Advanced International Benchmark

625 *Students can apply and reason in a variety of problem situations, solve linear equations, and make generalizations.* They can solve a variety of fraction, proportion, and percent problems and justify their conclusions. They can understand linear functions and algebraic expressions. Students can use their knowledge of geometric figures to solve a wide range of problems involving angles, area, and surface area. They can calculate means and medians, and understand how changing data points can impact the mean. Students can interpret a wide variety of data displays to draw and justify conclusions, and solve multistep problems. They can solve problems involving expected values.

Grade 8 – International Benchmark

- Low International Benchmark (400)

No items at the eighth grade anchored at the Low level in TIMSS 2019. However, TIMSS 2015 indicated that students at this level have an elementary understanding of whole numbers. They could match tables to bar graphs and pictographs.

Example of a Low Benchmark Item (from T15) – Grade 8

Country	Percent Correct
2 Singapore	96 (0.6) ▲
Hong Kong SAR	95 (0.9) ▲
Korea, Rep. of	95 (0.9) ▲
Chinese Taipei	95 (0.9) ▲
Japan	93 (1.1) ▲
England	92 (1.2) ▲
Slovenia	90 (1.4) ▲
Ireland	90 (1.2) ▲
2 Lithuania	89 (1.5) ▲
Australia	87 (1.3) ▲
Hungary	86 (1.7) ▲
1 † Canada	86 (1.3) ▲
† New Zealand	85 (1.4) ▲
2 Italy	85 (1.7) ▲
† United States	84 (1.0) ▲
Norway (9)	84 (1.8) ▲
Russian Federation	84 (1.8) ▲
Malta	83 (1.5) ▲
1 2 Georgia	81 (2.1)
Thailand	81 (1.9)
United Arab Emirates	79 (0.9)
3 Israel	78 (1.5)
International Avg.	**78 (0.3)**
Sweden	78 (1.8)
Bahrain	75 (1.9)
Malaysia	75 (1.6)
Turkey	75 (2.4)
Kazakhstan	73 (2.0) ▼
Iran, Islamic Rep. of	70 (1.8) ▼
Chile	70 (1.9) ▼
Qatar	69 (1.8) ▼
Kuwait	66 (2.1) ▼
Lebanon	64 (2.6) ▼

Content Domain: Data and Chance
Cognitive Domain: Knowing
Description: Identifies the table that matches the information shown in a pictograph

The pictogram shows how many pizzas a shop sold in four months.

One of these tables shows the same information, which one?

Ⓐ

Month	Pizzas Sold
January	60
February	80
March	60
April	60

●

Month	Pizzas Sold
January	70
February	80
March	60
April	70

Ⓒ

Month	Pizzas Sold
January	70
February	140
March	60
April	70

Ⓓ

Month	Pizzas Sold
January	60
February	80
March	70
April	60

Grade 8 – International Benchmark

- Intermediate International Benchmark (475)

Students at this level can solve problems involving whole numbers, negative numbers, fractions, decimals, and ratios.

Students have some basic knowledge about properties of two-dimensional shapes.

Students can read and interpret data presented in tables, bar graphs, and line graphs. They have some rudimentary knowledge of probability.

❖ Example of an Intermediate Benchmark Item – Grade 8

Country	Percent Full Credit	
Finland	85 (1.5)	▲
† Norway (9)	82 (2.0)	▲
Chinese Taipei	82 (1.5)	▲
England	82 (1.6)	▲
Japan	81 (1.6)	▲
2 Singapore	80 (2.0)	▲
Ireland	80 (1.7)	▲
† Hong Kong SAR	80 (2.0)	▲
2 Sweden	80 (2.1)	▲
Korea, Rep. of	80 (1.9)	▲
Australia	79 (1.8)	▲
Hungary	76 (2.4)	▲
† United States	70 (1.7)	▲
† New Zealand	69 (2.5)	▲
Lithuania	68 (2.3)	▲
3 Israel	67 (1.9)	▲
Cyprus	65 (1.9)	▲
France	63 (2.3)	▲
2 Russian Federation	61 (3.1)	
Portugal	61 (2.8)	
International Average	**59 (0.3)**	
Italy	57 (2.5)	
Romania	55 (2.4)	
United Arab Emirates	53 (1.2)	▽
Turkey	52 (1.9)	▽
Bahrain	51 (2.2)	▽
Qatar	47 (2.4)	▽
Chile	46 (2.4)	▽
2 Kazakhstan	45 (2.7)	▽
1 Georgia	44 (2.6)	▽
Malaysia	43 (1.6)	▽

Content Domain: Number

Cognitive Domain: Knowing

Description: Solves a word problem involving subtraction of negative numbers

On Thursday, the lowest temperature in City X was 6 °C and the lowest temperature in City Y was –3 °C. What was the difference between the lowest temperatures in the cities?

Answer: 9 °C

The answer shown illustrates the type of response that would receive full credit (1 point).

Grade 8 – International Benchmark

❖ High International Benchmark (550)

Students can solve problems with fractions, decimals, ratios, and proportions.

Students at this level show basic procedural knowledge related to algebraic expressions. They can simplify expressions with integers. They can evaluate a variety of expressions and formulas, including those with exponents. They can identify algebraic expressions that represent real world situations. Students can identify the solutions of linear equations, a pair of simultaneous linear equations in two variables, and identify the values that satisfy two inequalities. They can determine a specific term of a numerical or geometric pattern.

Students can solve a variety of problems with angles, including problems involving triangles, parallel lines, rectangles, and congruent and similar figures. They can identify points in the Cartesian plane to draw lines and shapes. They can visualize rectangular solids.

Students can interpret data from pie charts, line graphs, and bar graphs to solve problems and provide explanations. They can calculate means. They can solve simple problems involving outcomes and probabilities.

❖ Example of a High Benchmark Item – Grade 8

Country	Percent Full Credit	
2 Singapore	73 (2.1)	▲
Chinese Taipei	66 (2.0)	▲
† Hong Kong SAR	66 (2.3)	▲
2 Russian Federation	60 (2.6)	▲
Korea, Rep. of	55 (2.3)	▲
Ireland	48 (2.4)	▲
Lithuania	48 (2.4)	▲
2 Kazakhstan	47 (2.7)	▲
3 Israel	46 (2.4)	▲
Japan	44 (1.9)	▲
† United States	43 (2.3)	▲
Hungary	43 (2.5)	▲
Romania	41 (2.3)	▲
England	40 (2.9)	
Cyprus	39 (1.9)	▲
Australia	37 (2.1)	
United Arab Emirates	36 (1.2)	
International Average	**35 (0.3)**	
Italy	35 (2.7)	
1 Georgia	34 (2.6)	
Portugal	34 (2.3)	
Turkey	32 (2.2)	
Bahrain	31 (1.7)	
Oman	28 (1.7)	▽
Qatar	28 (2.1)	▽
Lebanon	27 (2.0)	▽
2 Egypt	27 (2.0)	▽
Finland	25 (1.8)	▽
France	23 (2.0)	▽
† Norway (9)	23 (1.9)	▽

Content Domain: Algebra

Cognitive Domain: Applying

Description: Solves a word problem involving evaluating a formula with exponents

The stopping distance (d) meters depends on the speed (v) meters per second of the car when the brakes are applied. A formula for calculating this distance is:

$$d = \frac{2v + v^2}{20}$$

What is the stopping distance when $v = 20$?

$d =$ 22 m

The answer shown illustrates the type of response that would receive full credit (1 point).

Grade 8 – International Benchmark

❖ Advanced International Benchmark (625)

Students can solve a variety of fraction, proportion, and percent problems and justify their conclusions. They can reason with different representations of numbers in abstract and multistep problems.

Students can construct and solve linear equations in one or two variables. They can identify properties of linear functions from tables, graphs, and equations, including slopes and *y* -intercepts. Students can express generalizations either algebraically or in words, such as expressing the n^{th} term in number patterns. They can simplify algebraic expressions.

Students can use their knowledge of geometric figures to solve a wide range of problems. They can solve a variety of problems about area and surface area, and use the Pythagorean theorem to find the side length of a triangle. Students can use their knowledge of the relationships between geometric figures, parallel lines, and angles to solve problems on the coordinate plane.

Students can calculate means and medians, and understand how changing data points can impact the mean. Students can interpret a wide variety of data displays to draw and justify conclusions, and solve multi-step problems. They can solve problems involving expected values.

❖ Example of an Advanced Benchmark Item – Grade 8

Country	Percent Full Credit	
Chinese Taipei	53 (2.0)	▲
Korea, Rep. of	52 (2.3)	▲
Japan	47 (2.1)	▲
2 Singapore	46 (2.1)	▲
Bahrain	30 (1.6)	▲
Cyprus	28 (2.3)	▲
2 Russian Federation	26 (2.5)	▲
† Hong Kong SAR	24 (2.8)	▲
Ireland	23 (2.1)	▲
Hungary	22 (1.9)	▲
3 Israel	22 (2.2)	
England	22 (2.8)	
Australia	21 (1.8)	
2 Kazakhstan	19 (1.9)	
International Average	**18 (0.3)**	
Turkey	18 (1.8)	
Iran, Islamic Rep. of	17 (1.9)	
† United States	17 (1.4)	
Romania	17 (1.8)	
† New Zealand	16 (1.1)	
Lithuania	16 (1.8)	
United Arab Emirates	14 (1.0)	▽
Portugal	14 (1.8)	▽
2 Sweden	13 (1.8)	▽
Finland	13 (1.4)	▽
† Norway (9)	10 (1.4)	▽
France	10 (1.4)	▽
2 Egypt	10 (1.3)	▽

Content Domain: Number

Cognitive Domain: Reasoning

Description: Solves a multistep problem involving addition and subtraction of fractions

In the square below:

- The numbers in each row add to 1,
- The numbers in each column add to 1, and
- The numbers in both diagonals add to 1.

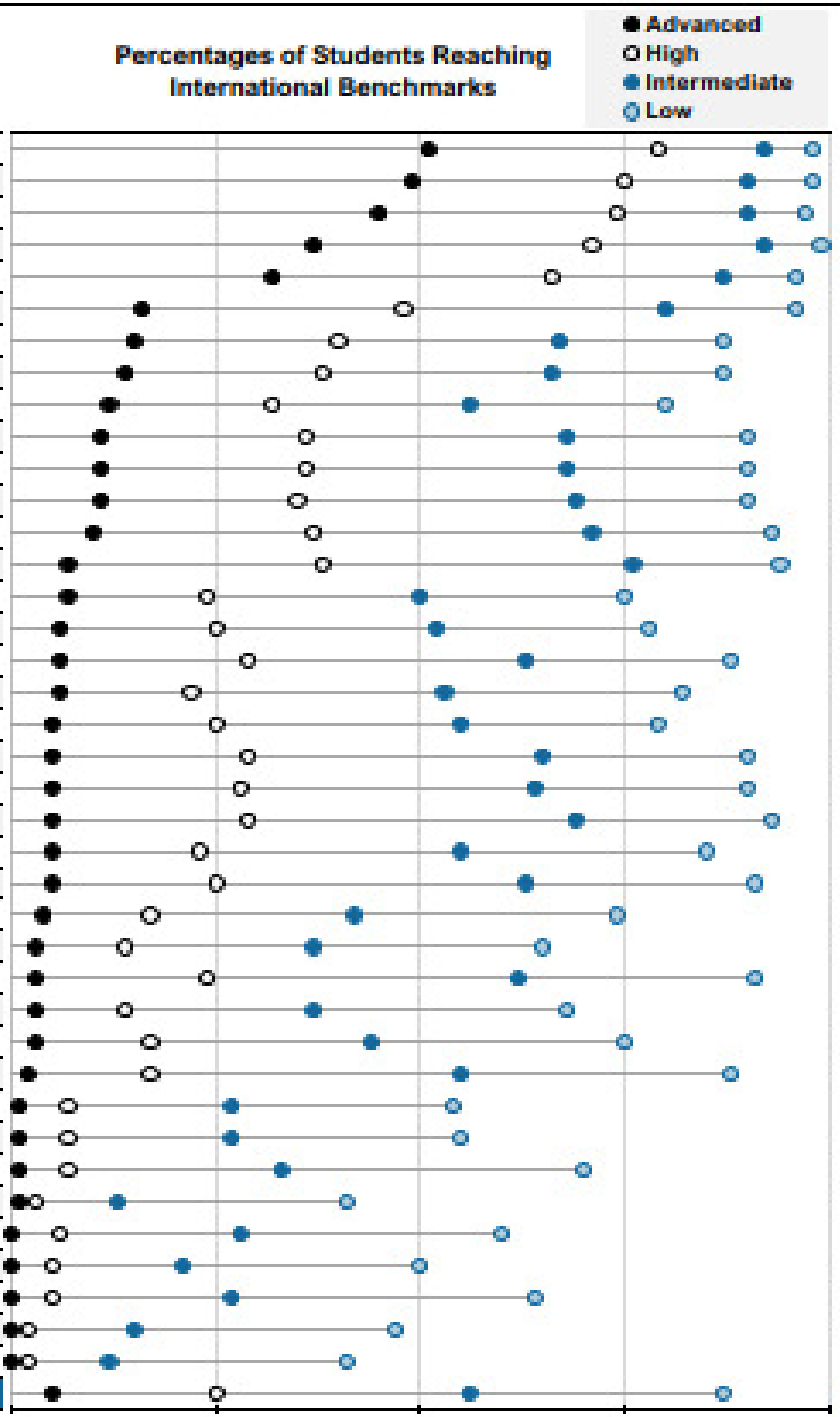
$\frac{8}{15}$		$\frac{2}{5}$
$\frac{1}{5}$	X	

What is the value of X?

$X = \frac{5}{15}$

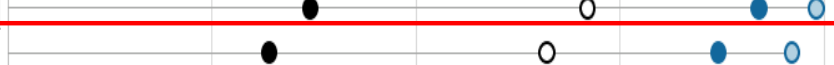
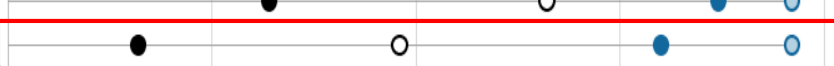
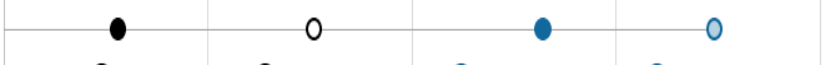
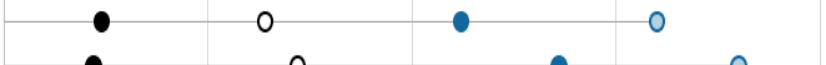
The answer shown illustrates the type of response that would receive full credit (1 point).

Exhibit 3.8: Percentages of Students Reaching International Benchmarks of Mathematics Achievement



Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
[2] Singapore	51 (2.2)	79 (2.0)	92 (1.1)	98 (0.4)
Chinese Taipei	49 (1.3)	75 (0.9)	90 (0.6)	98 (0.3)
Korea, Rep. of	45 (1.3)	74 (0.9)	90 (0.8)	97 (0.4)
Japan	37 (1.4)	71 (1.1)	92 (0.6)	99 (0.2)
† Hong Kong SAR	32 (1.9)	66 (1.8)	87 (1.4)	96 (0.9)
[2] Russian Federation	16 (1.5)	48 (2.4)	80 (2.0)	96 (0.7)
[3] Israel	15 (1.7)	40 (2.2)	67 (1.8)	87 (1.0)
† United States	14 (1.2)	38 (1.9)	66 (1.9)	87 (1.4)
Turkey	12 (0.9)	32 (1.6)	56 (1.6)	80 (1.4)
Australia	11 (1.4)	36 (1.8)	68 (1.5)	90 (0.8)
Hungary	11 (1.1)	36 (1.4)	68 (1.4)	90 (0.9)
England	11 (1.5)	35 (2.3)	69 (2.2)	90 (1.6)
Lithuania	10 (1.1)	37 (1.7)	71 (1.2)	93 (0.7)
Ireland	7 (0.8)	38 (1.6)	76 (1.3)	94 (0.8)
United Arab Emirates	7 (0.4)	24 (0.7)	50 (0.9)	75 (0.7)
Romania	6 (0.9)	25 (1.6)	52 (1.9)	78 (1.5)
Cyprus	6 (0.5)	29 (1.1)	63 (1.1)	88 (0.8)
† New Zealand	6 (0.5)	22 (1.1)	53 (1.6)	82 (1.4)
Bahrain	5 (0.4)	25 (0.8)	55 (0.9)	79 (0.8)
† Norway (9)	5 (0.6)	29 (1.2)	65 (1.5)	90 (0.8)
[2] Sweden	5 (0.6)	28 (1.3)	64 (1.3)	90 (0.9)
Finland	5 (0.5)	29 (1.2)	69 (1.4)	93 (0.9)
[2] Kazakhstan	5 (0.7)	23 (1.6)	55 (1.8)	85 (1.2)
Portugal	5 (0.6)	25 (1.5)	63 (1.7)	91 (1.1)
Malaysia	4 (0.3)	17 (0.7)	42 (1.6)	74 (1.7)
¶ Qatar	3 (0.7)	14 (1.5)	37 (1.9)	65 (1.5)
Italy	3 (0.5)	24 (1.4)	62 (1.7)	91 (0.9)
Iran, Islamic Rep. of	3 (0.7)	14 (1.4)	37 (1.6)	68 (1.4)
[1] Georgia	3 (0.8)	17 (1.6)	44 (2.0)	75 (1.8)
France	2 (0.3)	17 (1.2)	55 (1.5)	88 (0.8)
¶ Oman	1 (0.2)	7 (0.6)	27 (1.0)	54 (1.2)
[2] ¶ Egypt	1 (0.3)	7 (1.1)	27 (2.0)	55 (2.3)
¶ Chile	1 (0.2)	7 (0.8)	33 (1.5)	70 (1.7)
※ South Africa (9)	1 (0.1)	3 (0.3)	13 (0.7)	41 (1.3)
¶ Jordan	0 (0.2)	6 (0.7)	28 (1.7)	60 (2.1)
¶ Kuwait	0 (0.1)	5 (0.9)	21 (1.9)	50 (2.3)
Lebanon	0 (0.2)	5 (0.6)	27 (1.7)	64 (1.7)
[2] ¶ Saudi Arabia	0 (0.1)	2 (0.3)	15 (0.8)	47 (1.6)
¶ Morocco	0 (0.1)	2 (0.4)	12 (0.9)	41 (1.2)
International Median	**5**	**25**	**56**	**87**

International Benchmarks (S2 maths) (first 15 countries)

Country	Percentages of Students Reaching International Benchmarks (● Advanced ○ High ● Intermediate ○ Low)	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
2 Singapore		51 (2.2)	79 (2.0)	92 (1.1)	98 (0.4)
Chinese Taipei		49 (1.3)	75 (0.9)	90 (0.6)	98 (0.3)
Korea, Rep. of		45 (1.3)	74 (0.9)	90 (0.8)	97 (0.4)
Japan		37 (1.4)	71 (1.1)	92 (0.6)	99 (0.2)
† Hong Kong SAR		32 (1.9)	66 (1.8)	87 (1.4)	96 (0.9)
2 Russian Federation		16 (1.5)	48 (2.4)	80 (2.0)	96 (0.7)
3 Israel		15 (1.7)	40 (2.2)	67 (1.8)	87 (1.0)
† United States		14 (1.2)	38 (1.9)	66 (1.9)	87 (1.4)
Turkey		12 (0.9)	32 (1.6)	56 (1.6)	80 (1.4)
Australia		11 (1.4)	36 (1.8)	68 (1.5)	90 (0.8)
Hungary		11 (1.1)	36 (1.4)	68 (1.4)	90 (0.9)
England		11 (1.5)	35 (2.3)	69 (2.2)	90 (1.6)
Lithuania		10 (1.1)	37 (1.7)	71 (1.2)	93 (0.7)
Ireland		7 (0.8)	38 (1.6)	76 (1.3)	94 (0.8)
United Arab Emirates		7 (0.4)	24 (0.7)	50 (0.9)	75 (0.7)
International Median		**5**	**25**	**56**	**87**

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

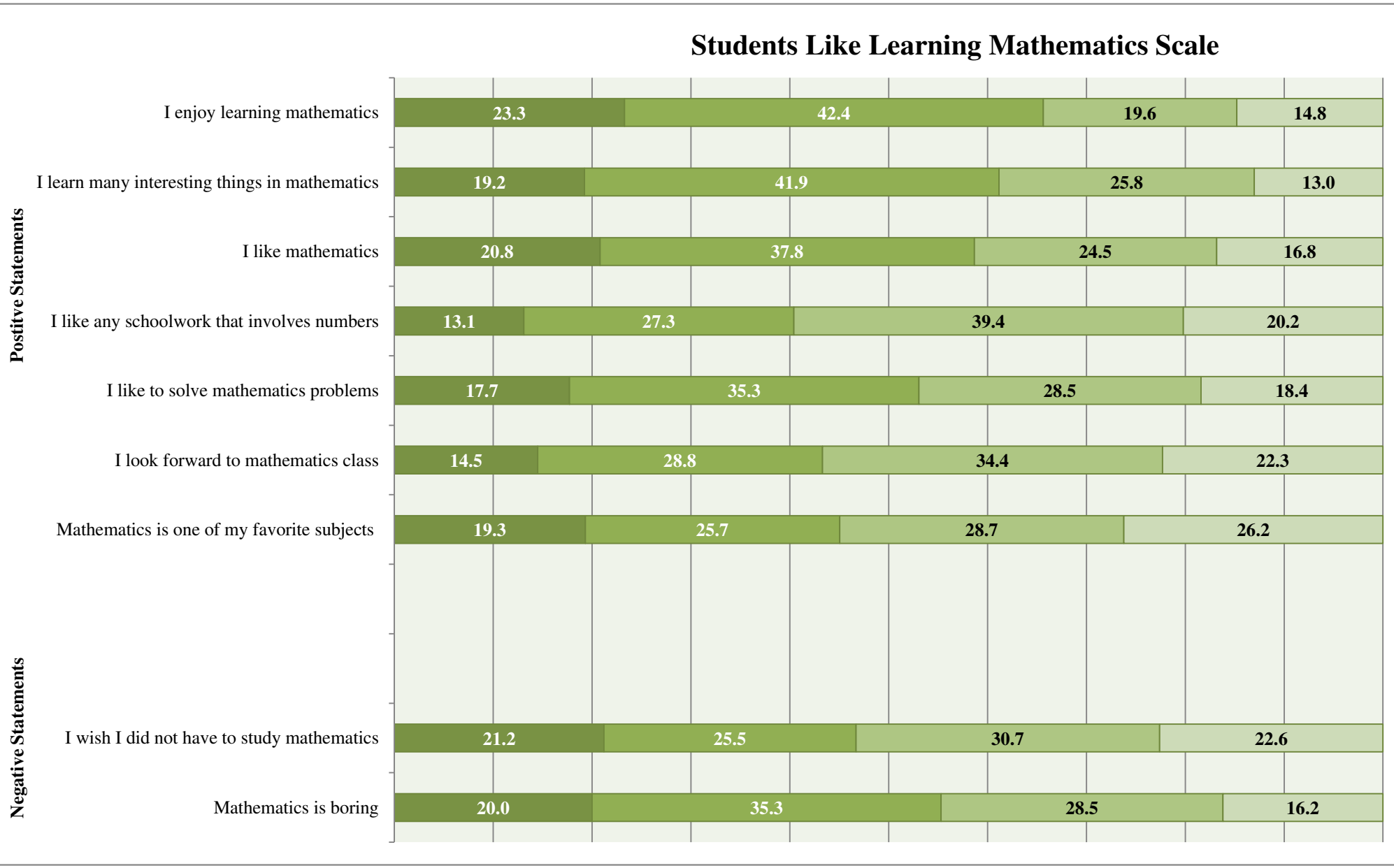
- Like learning math
- Confidence in math
- Value (Grade 8 only)

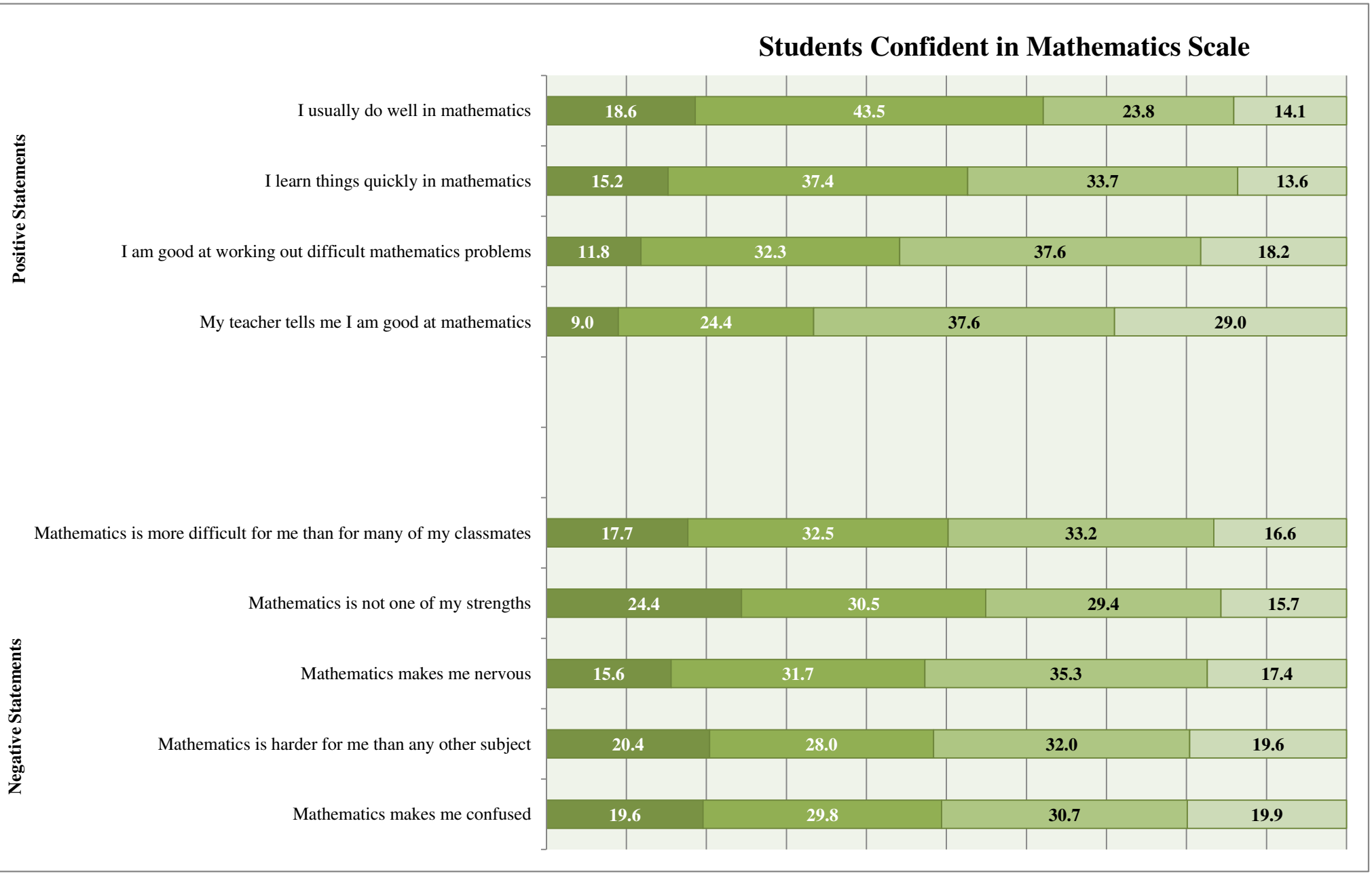
1) I usually do well in mathematics - - - - - - - - - - -
2) Mathematics is more difficult for me than for many of my classmates [R] - - - - - - - - - - - - - - - -
3) Mathematics is not one of my strengths [R] - - - -
4) I learn things quickly in mathematics - - - - - - - -
5) Mathematics makes me nervous [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 - - - - -


Students Like Learning Mathematics Scale
Postitve Statements
Negative Statements
I enjoy learning mathematics
23.3
42.4
19.6
14.8
I learn many interesting things in mathematics
19.2
41.9
25.8
13.0
I like mathematics
20.8
37.8
24.5
16.8
I like any schoolwork that involves numbers
13.1
27.3
39.4
20.2
I like to solve mathematics problems
17.7
35.3
28.5
18.4
I look forward to mathematics class
14.5
28.8
34.4
22.3
Mathematics is one of my favorite subjects
19.3
25.7
28.7
26.2
I wish I did not have to study mathematics
21.2
25.5
30.7
22.6
Mathematics is boring
20.0
35.3
28.5
16.2


Students Confident in Mathematics Scale
Positive Statements
Negative Statements
I usually do well in mathematics
18.6
43.5
23.8
14.1
I learn things quickly in mathematics
15.2
37.4
33.7
13.6
I am good at working out difficult mathematics problems
11.8
32.3
37.6
18.2
My teacher tells me I am good at mathematics
9.0
24.4
37.6
29.0
Mathematics is more difficult for me than for many of my classmates
17.7
32.5
33.2
16.6
Mathematics is not one of my strengths
24.4
30.5
29.4
15.7
Mathematics makes me nervous
15.6
31.7
35.3
17.4
Mathematics is harder for me than any other subject
20.4
28.0
32.0
19.6
Mathematics makes me confused
19.6
29.8
30.7
19.9

Students Value Mathematics Scale

Attitudinal Results (S2 maths)

Secondary 2	Students Very Much Like Learning Mathematics	Students Somewhat Like Learning Mathematics	Students Do Not Like Learning Mathematics
HKSAR %	13%	39%	48%
International %	20%	39%	41%

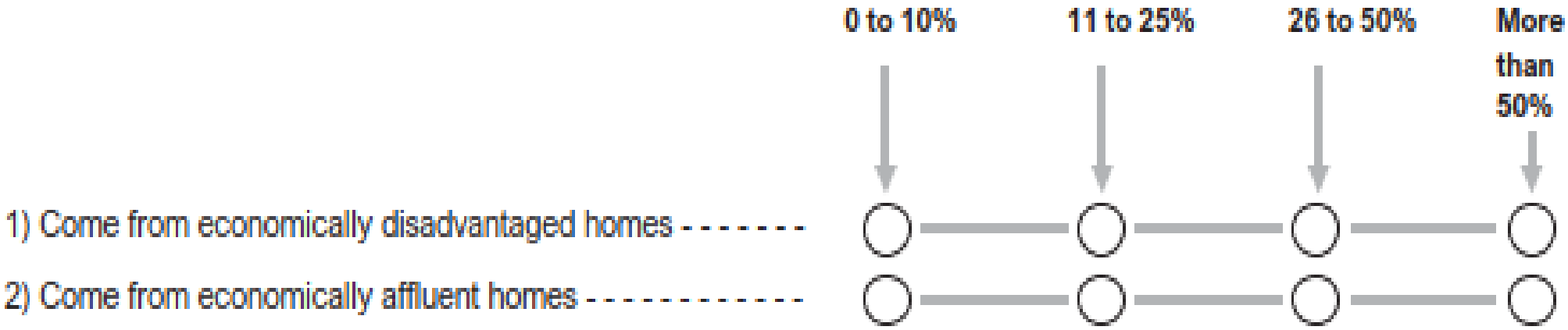
Secondary 2	Students Very Confident in Mathematics	Students Somewhat Confident in Mathematics	Students Not Confident in Mathematics
HKSAR %	9%	37%	54%
International %	15%	42%	44%

Secondary 2	Students Strongly Value Mathematics	Students Somewhat Value Mathematics	Students Do Not Value Mathematics
HKSAR %	18%	54%	28%
International %	37%	47%	16%

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?

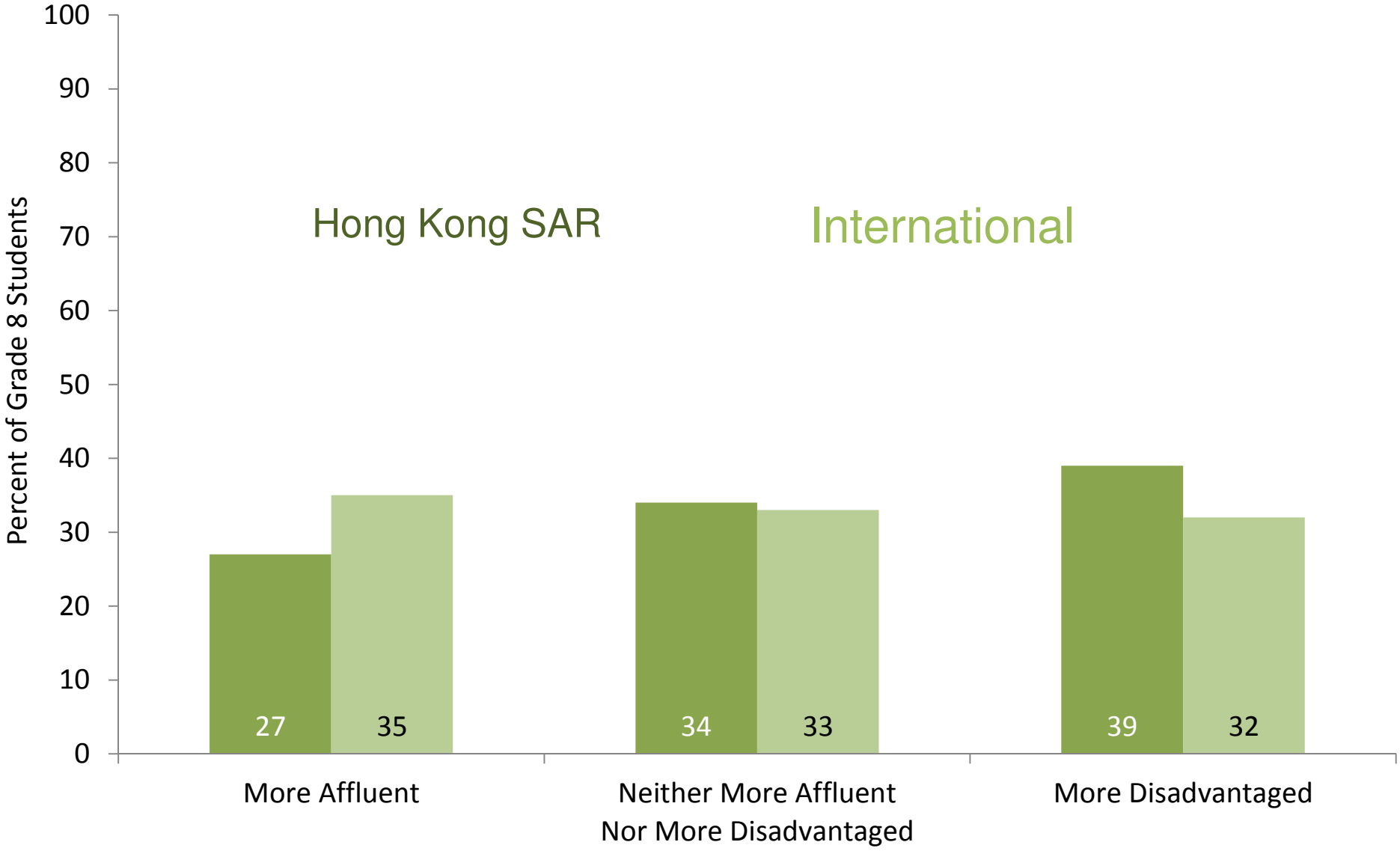


More Affluent: Schools where more than 25% of the student body comes from economically affluent homes and not more than 25% from economically disadvantaged homes

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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Policy 21
政策二十一

School Composition by Socioeconomic Background of Students (Grade 8)

	More Affluent	Neither More Affluent Nor More Disadvantaged	More Disadvantaged
	%	%	%
Chinese Taipei	14	66	20
Hong Kong SAR	27	34	39
Japan	52	36	12
Korea, Rep. of	23	48	29
Singapore	43	46	10
International Average	35	33	32

Home Resources for Learning

Secondary 2	Many Resources	Some Resources	Few Resources
HKSAR %	13%	74%	13%
International %	14%	73%	13%

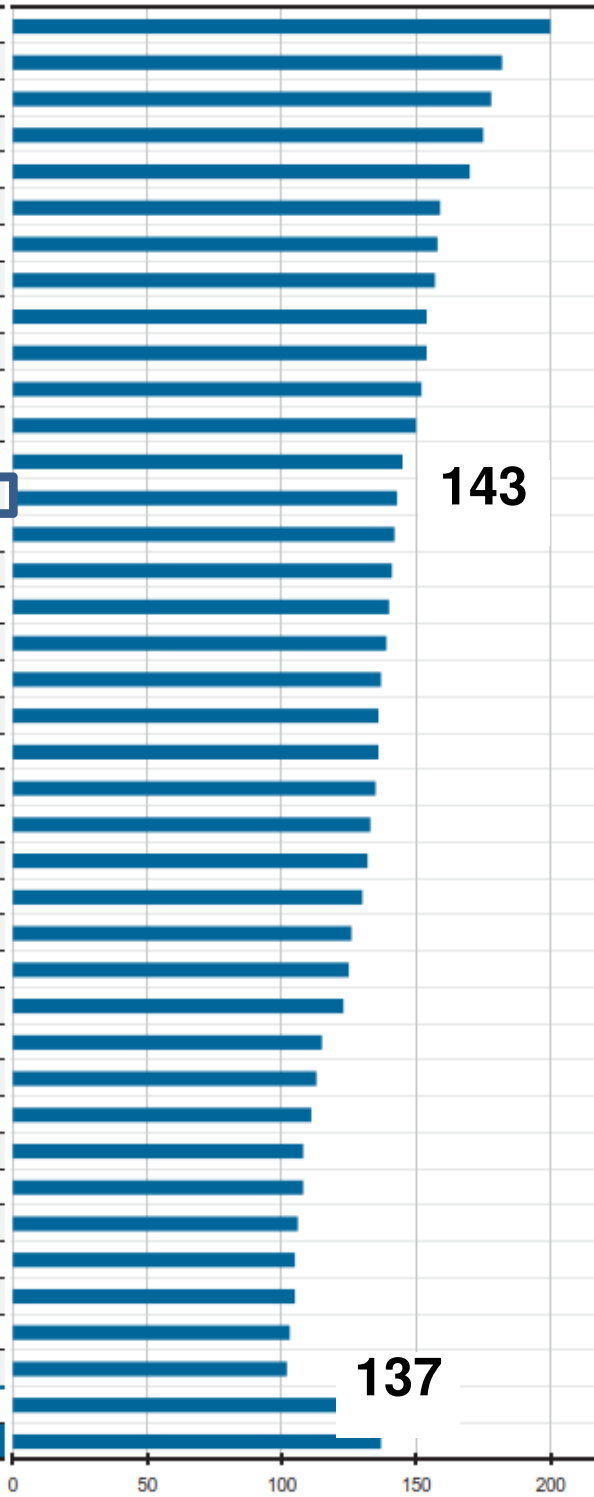
Class Size

Class Size and Achievement (Grade 8)	
	% of students (s.e.)
1-19 students	11 (2.6)
20-32 students	65 (3.9)
33 or more students	24 (3.3)

Hours for instruction Grade 8

Country	Total Instructional Hours per Year	Hours per Year for Mathematics Instruction
Chile	1221 (20.5)	r 200 (6.1)
South Africa (9)	s 1212 (13.5)	s 182 (2.7)
Oman	r 1056 (18.9)	r 178 (4.1)
United Arab Emirates	r 1094 (2.7)	s 175 (1.9)
Lebanon	960 (7.3)	170 (3.8)
Bahrain	1115 (0.6)	159 (1.6)
Israel	1118 (13.6)	r 158 (3.2)
Chinese Taipei	1137 (12.3)	157 (1.7)
United States	1148 (9.9)	r 154 (3.3)
Qatar	1090 (9.9)	r 154 (5.8)
Morocco	r 1341 (30.8)	r 152 (3.4)
Turkey	1009 (27.5)	150 (6.4)
Italy	1065 (11.2)	145 (2.8)
Hong Kong SAR	999 (12.6)	143 (4.7)
Russian Federation	868 (13.3)	142 (3.6)
Australia	1013 (6.8)	r 141 (2.4)
Jordan	1020 (13.0)	140 (3.6)
Kuwait	r 982 (21.2)	r 139 (4.1)
New Zealand	r 967 (10.2)	r 137 (2.5)
Egypt	s 1110 (34.6)	s 136 (3.3)
Saudi Arabia	r 1069 (18.9)	r 136 (6.9)
Singapore	1053 (0.0)	135 (2.6)
Romania	926 (19.8)	133 (4.3)
Portugal	1138 (31.4)	132 (3.5)
Malaysia	1165 (18.7)	130 (2.5)
Lithuania	918 (12.6)	126 (2.2)
France	r 1112 (19.3)	s 125 (3.2)
Kazakhstan	886 (15.7)	123 (3.1)
Hungary	899 (11.5)	115 (2.3)
Georgia	850 (14.5)	113 (2.1)
Finland	912 (9.4)	111 (1.9)
Norway (9)	r 949 (8.2)	s 108 (2.2)
Ireland	973 (4.7)	r 108 (1.3)
Korea, Rep. of	933 (10.7)	106 (2.6)
Sweden	r 926 (11.4)	105 (1.6)
Japan	1018 (3.0)	105 (1.0)
Iran, Islamic Rep. of	768 (8.1)	103 (2.6)
Cyprus	r 882 (1.0)	s 102 (2.3)
England	s 995 (13.3)	x 128 (4.9)
International Average	**1023 (2.5)**	**137 (0.6)**

Benchmarking Participants



- How often do you usually assign mathematics homework to students in this class? (Grade 8)

	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	3.3	26.8	32.2	37.0
Hong Kong SAR	1.0	4.8	40.8	26.8	26.7
Japan	11.6	23.3	41.7	16.5	6.9
Korea, Rep. of	23.4	38.2	28.0	8.0	2.3
Singapore	1.2	4.2	49.0	37.0	8.6
International Average	7.7	8.0	31.1	28.6	24.6

- When you assign mathematics homework to the students in this class, about how many minutes do you usually assign? (Grade 8)

	15 minutes or less	16-30 minutes	31-60 minutes	61-90 minutes	More than 90 minutes	Not Applicable
	%	%	%	%	%	%
Chinese Taipei	8.2	50.4	37.2	2.8	0.6	0.8
Hong Kong SAR	3.8	61.7	32.2	1.3	0.0	1.0
Japan	25.2	39.8	18.2	0.7	4.5	11.7
Korea, Rep. of	26.4	35.0	15.0	0.3	0.0	23.3
Singapore	3.6	39.5	50.7	4.9	0.0	1.2
International Average	23.5	44.0	21.4	2.7	0.7	7.7

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 8)	
	% of students (s.e.)
1-19 students	11 (2.6)
20-32 students	65 (3.9)
33 or more students	24 (3.3)

Class Size and Achievement (Grade 8)		
	% of students (s.e.)	Scale scores (s.e.)
1-19 students	11 (2.6)	560 (18.6)
20-32 students	65 (3.9)	568 (6.6)
33 or more students	24 (3.3)	613 (8.9)

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)
United States	26 (2.6)	521 (4.1)	69 (2.8)	533 (3.3)	5 (1.3)	522 (8.0)

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

Exhibit 3.1: Average Mathematics Achievement and Scale Score Distributions

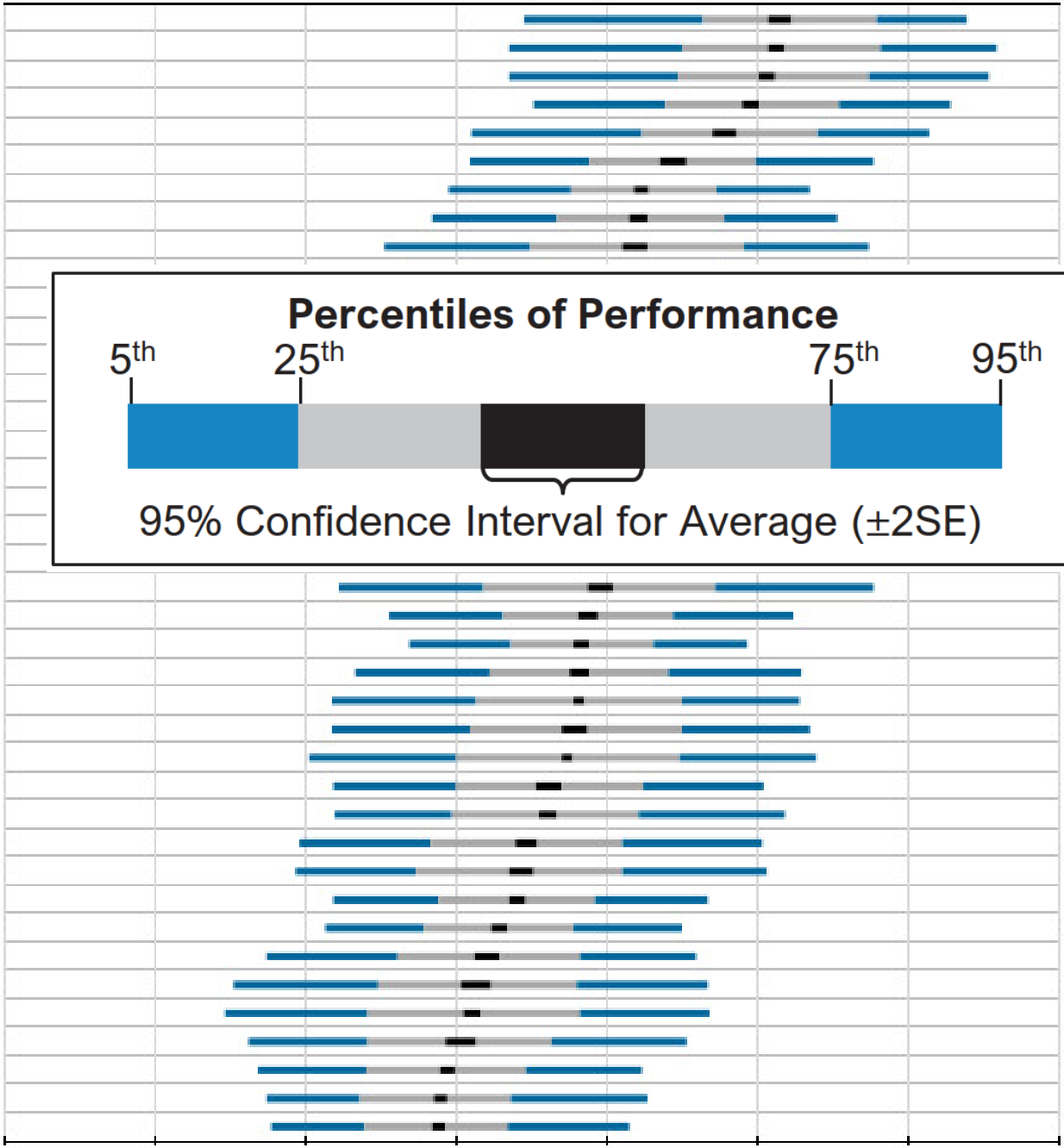
IEA TIMSS 2019

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)	▽
[9] South Africa (9)	389 (2.3)	▽
[9] Morocco	388 (2.3)	▽

578

500

Mathematics Achievement Distribution

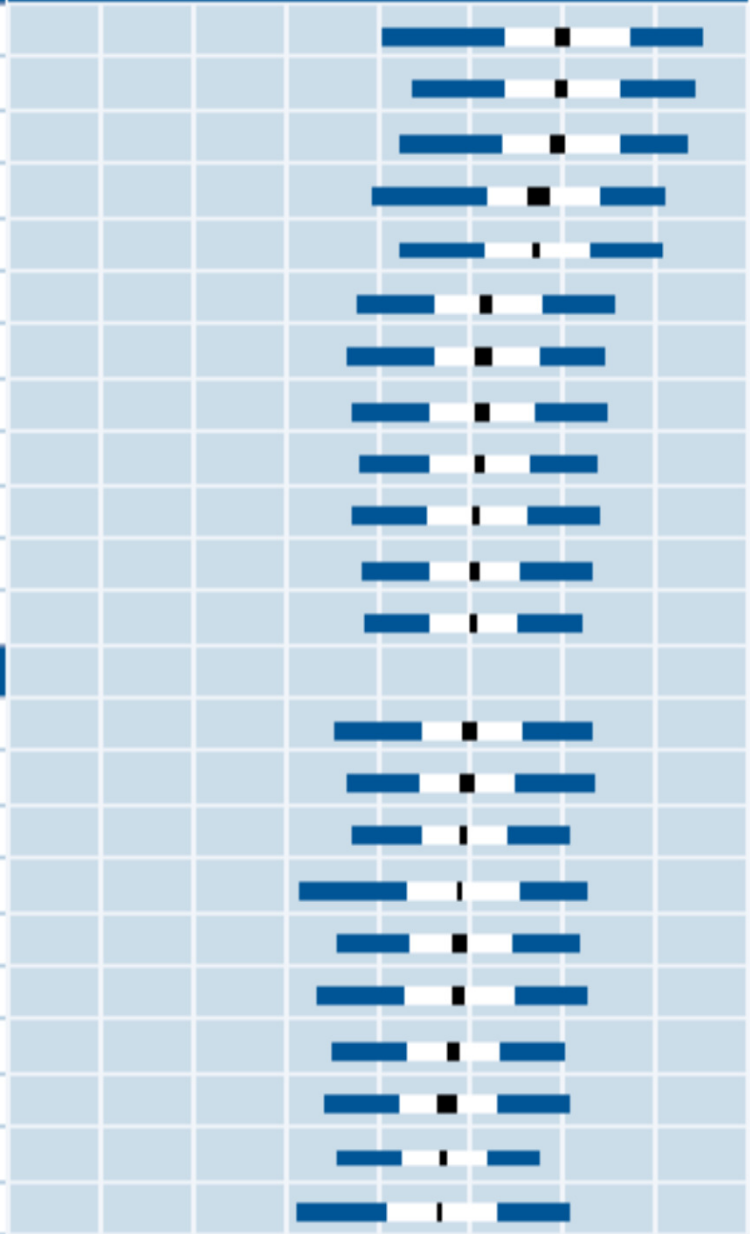


e.g., Singapore TIMSS 2003 and 2007

- 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	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 These Studies?

- 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?

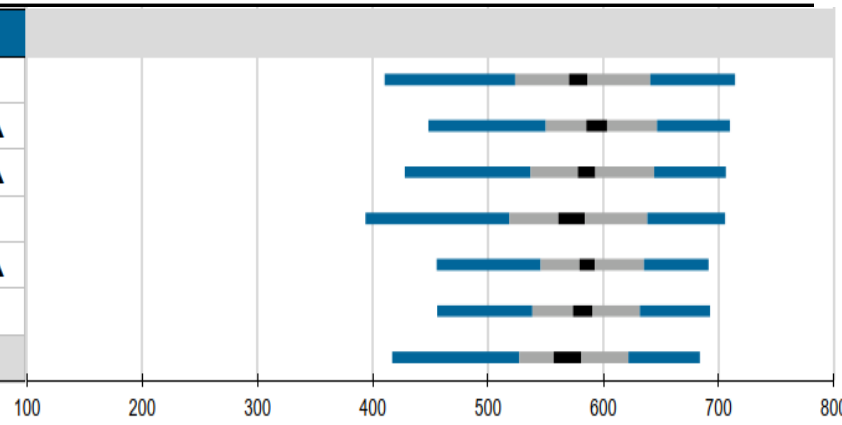
5(a) Trend of Student Achievements

- 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 (Secondary 2)

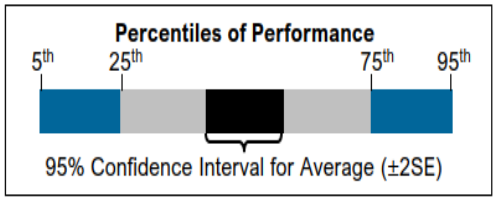
Country	Average Scale Score	Differences Between Years					
		2015	2011	2007	2003	1999	1995
Hong Kong SAR							
† 2019	578 (4.1)	-16 ▽	-7	6	-8	-4	9
2015	594 (4.6)		9	22 ▲	8	12	25 ▲
2011	586 (3.9)			13	0	4	17 ▲
† 2007	572 (5.9)				-14 ▽	-10	4
† 2003	586 (3.4)					4	17 ▲
† 1999	582 (4.3)						13
1995	569 (6.1)						

Mathematics Achievement Distribution



▲ Average from more recent year significantly higher

▽ Average from more recent year significantly lower



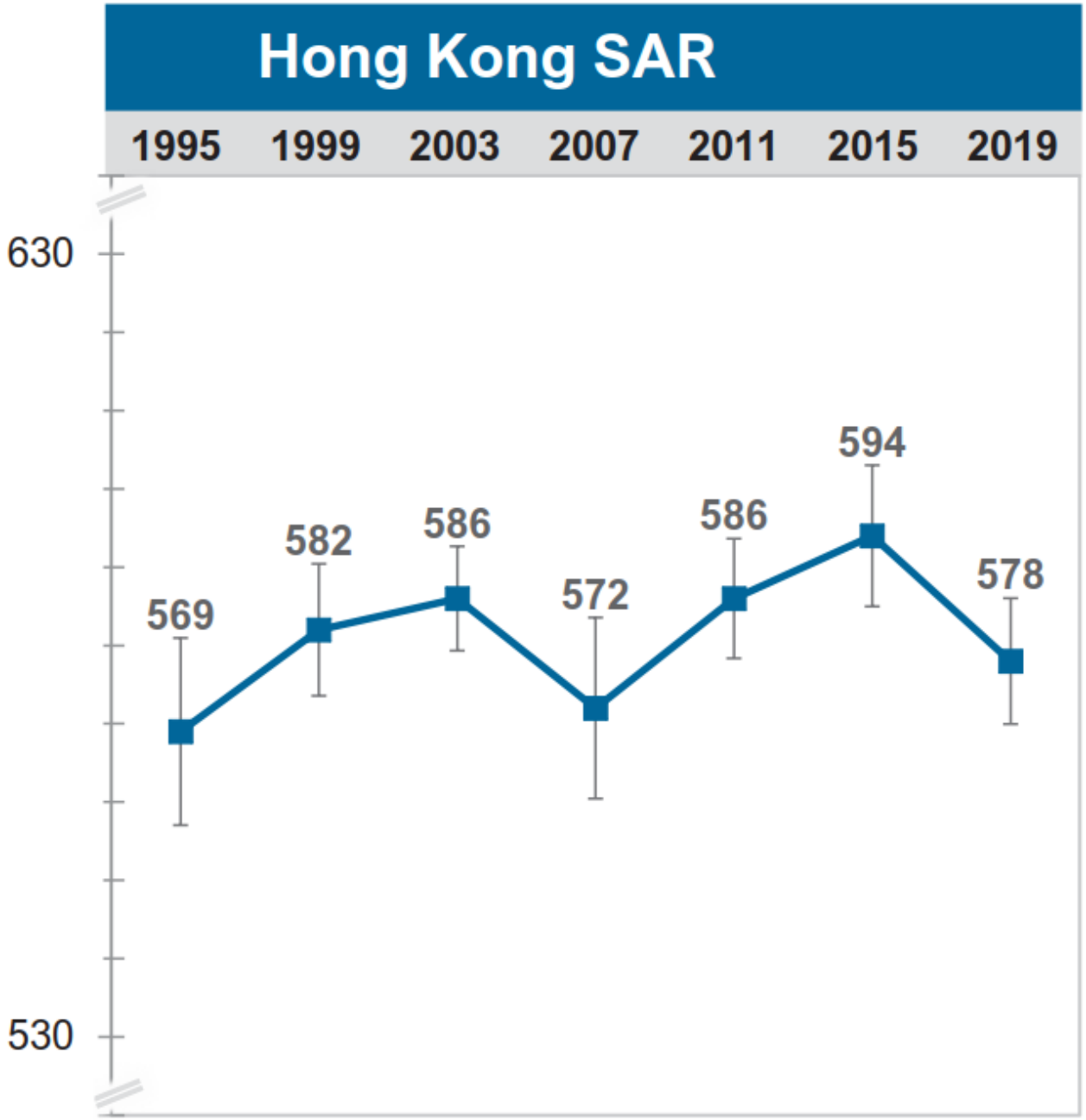
Faculty of Education
The University of Hong Kong
香 港 大 學 教 育 學 院

IEA

Policy 21
政策二十一

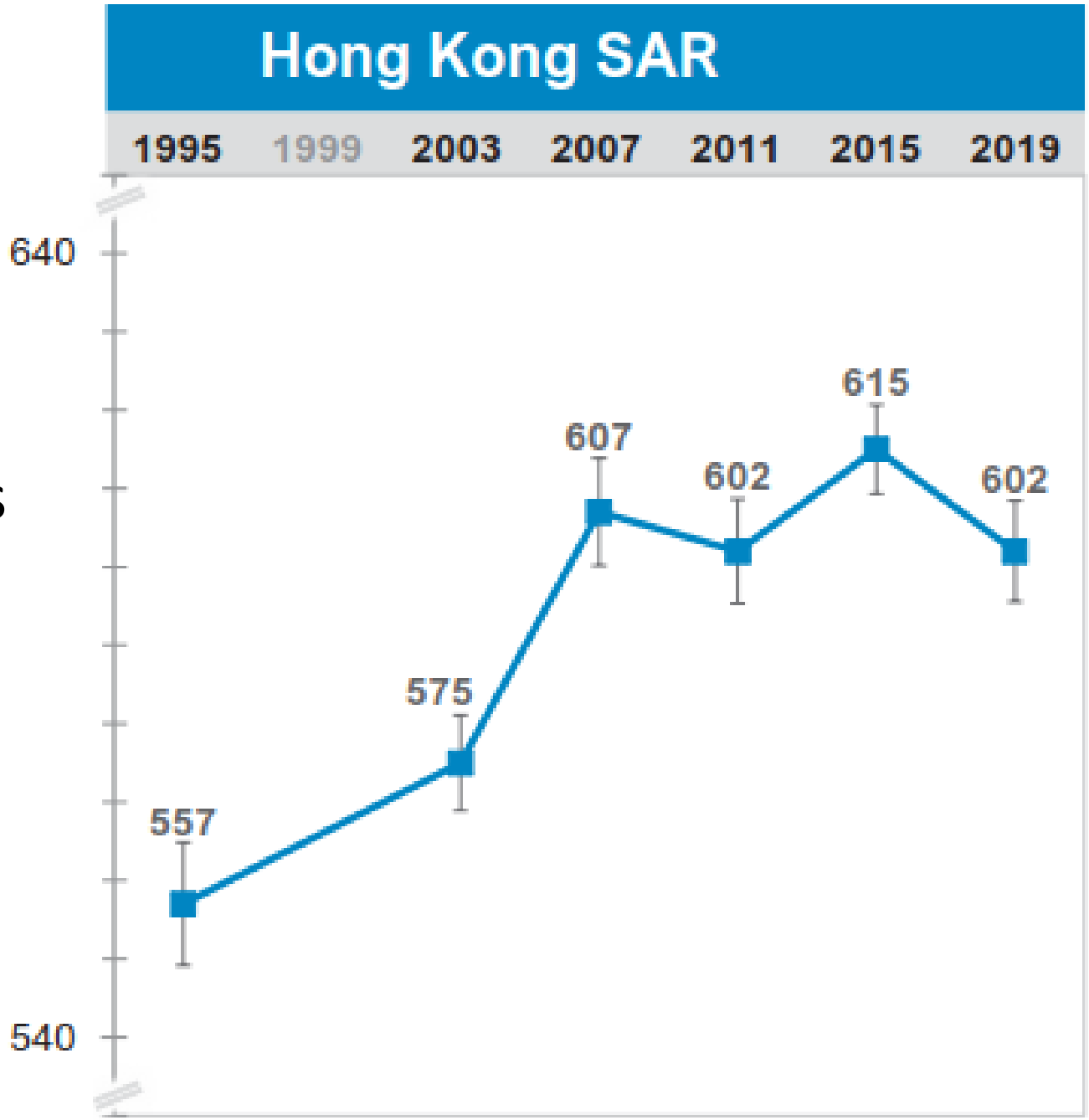
Trends

Grade 8
Mathematics

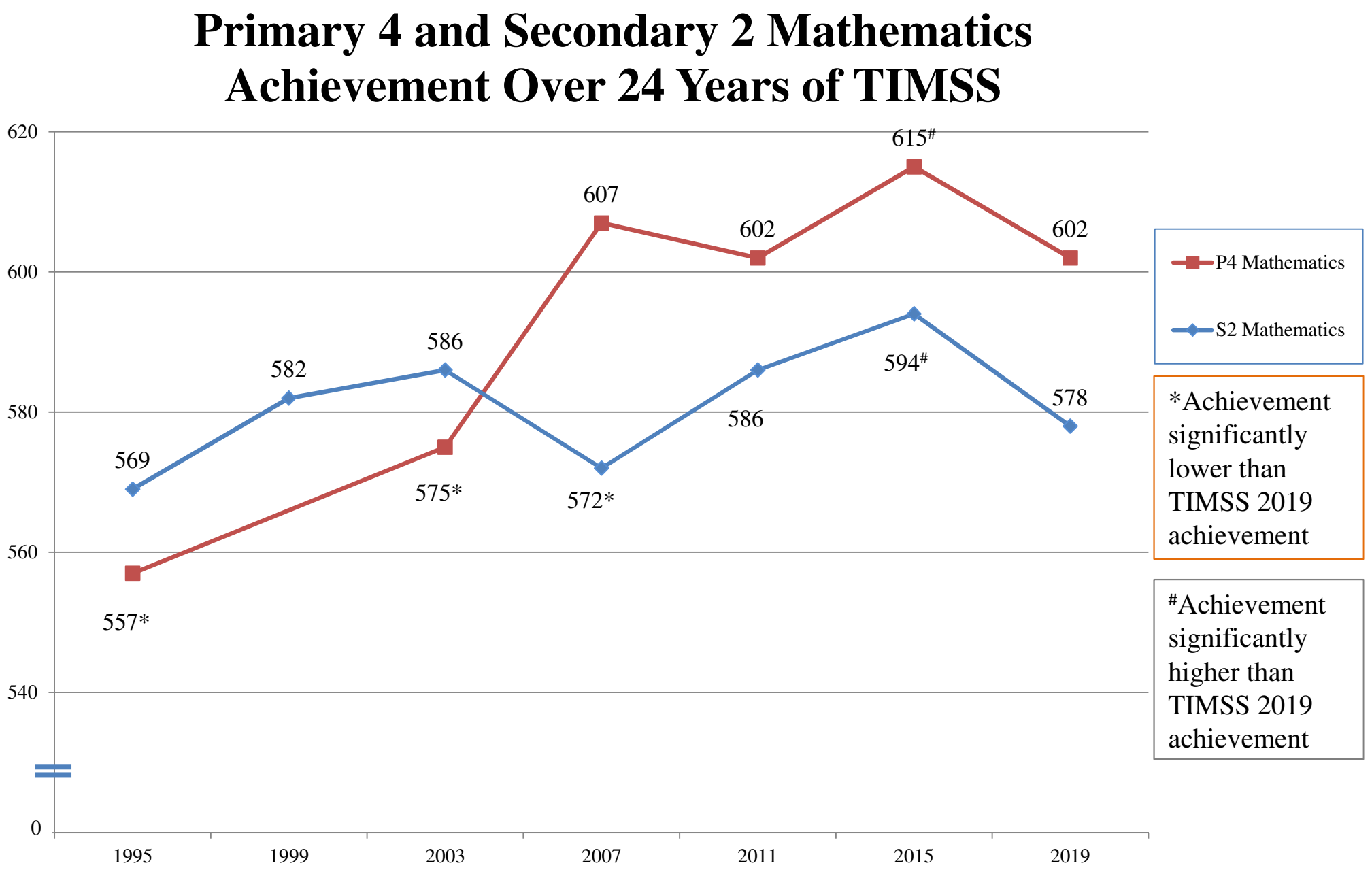


Trends

Grade 4
Mathematics



Hong Kong: Over 24 Years of TIMSS



Grade 4 (maths)

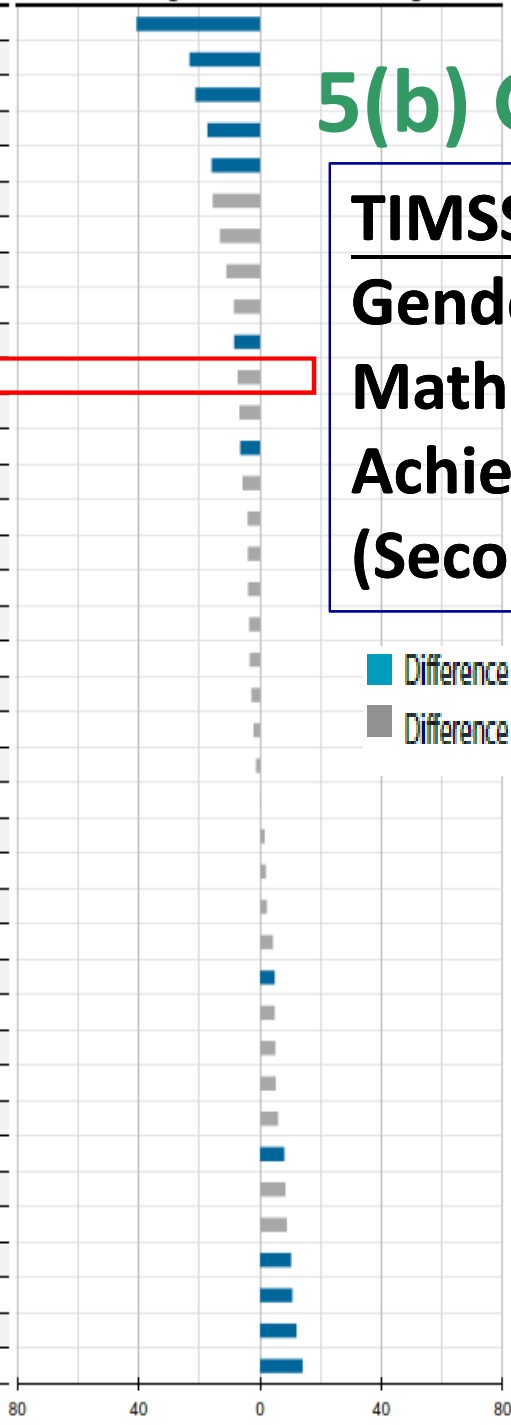
Grade 8 (maths)

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

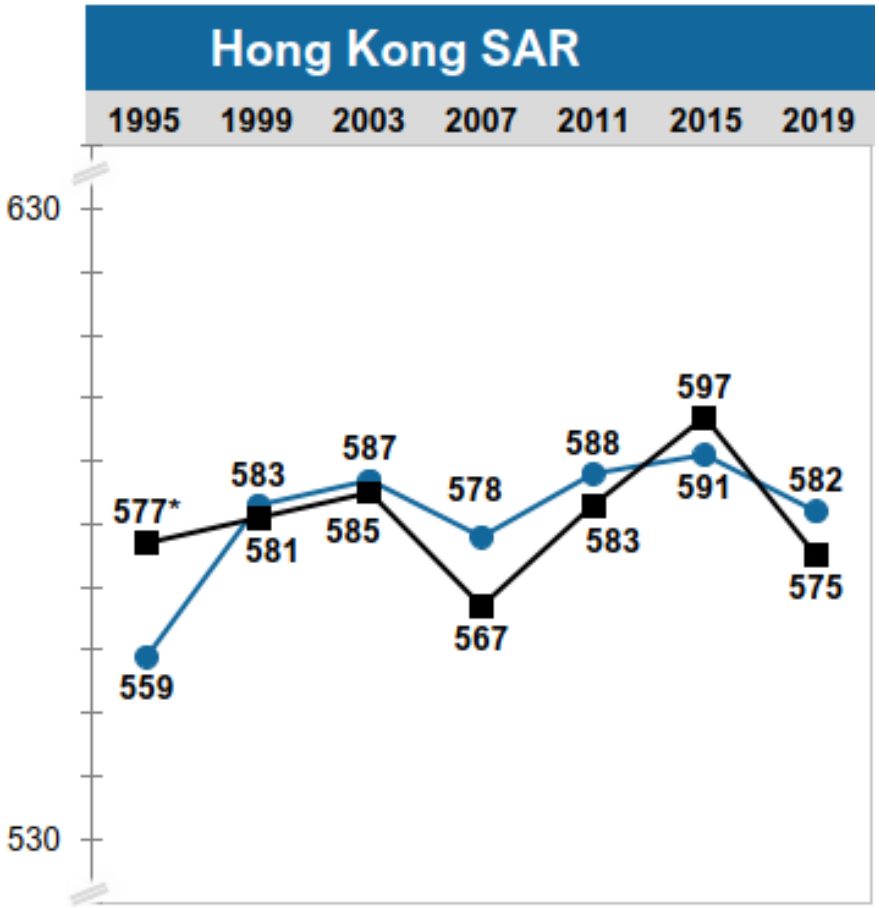
5(b) Gender

TIMSS 2019 Gender & Mathematics Achievement (Secondary 2)

Country	Girls		Boys		Difference (Absolute Value)
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score	
Ψ Oman	48 (1.1)	432 (3.3)	52 (1.1)	391 (4.0)	41 (4.8)
Ψ Jordan	48 (3.4)	432 (3.8)	52 (3.4)	409 (6.4)	23 (6.7)
Bahrain	49 (0.9)	492 (2.4)	51 (0.9)	471 (2.2)	21 (3.0)
2 Ψ Saudi Arabia	49 (0.9)	403 (3.4)	51 (0.9)	385 (3.4)	17 (4.5)
Romania	51 (0.9)	487 (4.6)	49 (0.9)	471 (4.7)	16 (3.8)
2 Ψ Egypt	55 (2.0)	420 (5.3)	45 (2.0)	404 (7.9)	16 (8.1)
Iran, Islamic Rep. of	47 (1.3)	453 (5.0)	53 (1.3)	440 (5.6)	13 (7.6)
Turkey	50 (1.3)	501 (4.4)	50 (1.3)	490 (5.8)	11 (5.7)
Ψ Kuwait	53 (2.2)	407 (5.4)	47 (2.2)	398 (7.9)	9 (8.8)
Malaysia	51 (1.1)	465 (3.0)	49 (1.1)	456 (4.1)	9 (3.4)
† Hong Kong SAR	46 (2.1)	582 (4.9)	54 (2.1)	575 (5.4)	7 (6.5)
Ψ Qatar	50 (2.4)	447 (5.0)	50 (2.4)	440 (5.4)	7 (6.6)
ж South Africa (9)	52 (0.6)	393 (2.4)	48 (0.6)	386 (2.5)	6 (2.1)
United Arab Emirates	48 (1.8)	476 (3.4)	52 (1.8)	471 (3.4)	6 (5.6)
Finland	48 (0.8)	511 (2.6)	52 (0.8)	507 (3.2)	4 (2.8)
Cyprus	49 (0.6)	503 (2.1)	51 (0.6)	499 (2.3)	4 (3.0)
2 Kazakhstan	49 (1.1)	490 (3.9)	51 (1.1)	486 (3.7)	4 (3.8)
† United States	49 (0.9)	517 (4.0)	51 (0.9)	514 (6.1)	4 (3.9)
2 Singapore	49 (0.7)	617 (4.6)	51 (0.7)	614 (4.4)	3 (4.2)
2 Sweden	49 (0.9)	504 (3.0)	51 (0.9)	501 (2.9)	3 (3.1)
Chinese Taipei	50 (0.9)	614 (3.1)	50 (0.9)	611 (3.2)	2 (3.3)
Ireland	49 (1.1)	524 (2.9)	51 (1.1)	523 (3.4)	1 (3.5)
† Norway (9)	49 (0.7)	503 (2.7)	51 (0.7)	503 (3.0)	0 (3.2)
England	53 (1.9)	514 (5.6)	47 (1.9)	516 (7.2)	2 (7.3)
Lithuania	50 (1.0)	519 (2.8)	50 (1.0)	521 (3.7)	2 (2.9)
Japan	52 (1.0)	593 (2.9)	48 (1.0)	595 (3.2)	2 (2.8)
Australia	49 (1.5)	515 (3.6)	51 (1.5)	519 (5.5)	4 (5.4)
Ψ Morocco	50 (0.7)	386 (2.5)	50 (0.7)	391 (2.6)	5 (2.2)
2 Russian Federation	48 (1.0)	541 (4.8)	52 (1.0)	546 (4.9)	5 (3.4)
Korea, Rep. of	48 (1.4)	604 (3.4)	52 (1.4)	609 (3.1)	5 (3.4)
Lebanon	49 (1.4)	427 (3.5)	51 (1.4)	432 (3.3)	5 (3.5)
† New Zealand	48 (2.1)	478 (3.6)	52 (2.1)	484 (4.7)	6 (5.2)
France	49 (0.8)	478 (2.5)	51 (0.8)	487 (3.1)	8 (2.7)
1 Georgia	48 (1.2)	457 (4.5)	52 (1.2)	465 (5.2)	8 (4.5)
Ψ Chile	49 (1.6)	436 (3.5)	51 (1.6)	445 (3.8)	9 (4.6)
Portugal	50 (1.1)	495 (3.3)	50 (1.1)	505 (3.9)	10 (3.4)
3 Israel	52 (1.7)	514 (4.3)	48 (1.7)	525 (5.3)	11 (4.6)
Italy	50 (1.0)	491 (3.0)	50 (1.0)	504 (3.3)	12 (3.0)
Hungary	50 (0.9)	510 (3.2)	50 (0.9)	524 (3.6)	14 (3.5)
International Average	**50 (0.2)**	**491 (0.6)**	**50 (0.2)**	**488 (0.7)**	



Gender and Achievement (S2 maths)



TIMSS 2019

No significant difference

5(c) Comparison of Performance in Different Strands and Areas of the Curriculum

- 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
- Hong Kong S2 students are not doing too well in the domain of "Data Display"
- As Statistics is becoming more important in the contemporary world, it is important to lay a solid foundation on the basic concepts of Statistics from the early stages

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

Grade 8	Number	Algebra	Geometry	Data and Probability
HKSAR	570	584	596	563

	Knowing	Applying	Reasoning
HKSAR	580	575	582

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Content and Cognitive Domains by Gender (Secondary 2 Mathematics)

Secondary 2	Number (570)		Algebra (584)		Geometry (596)		Data & Probability (563)	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
HKSAR	570	569	588	580	602	591	571*	555
International	493	497*	503*	493	499*	495	490	489

Secondary 2	Knowing (580)		Applying (575)		Reasoning (582)	
	Girls	Boys	Girls	Boys	Girls	Boys
HKSAR	584	577	580	572	584	580
International	498*	494	496	495	500*	496

*Achievement significantly higher

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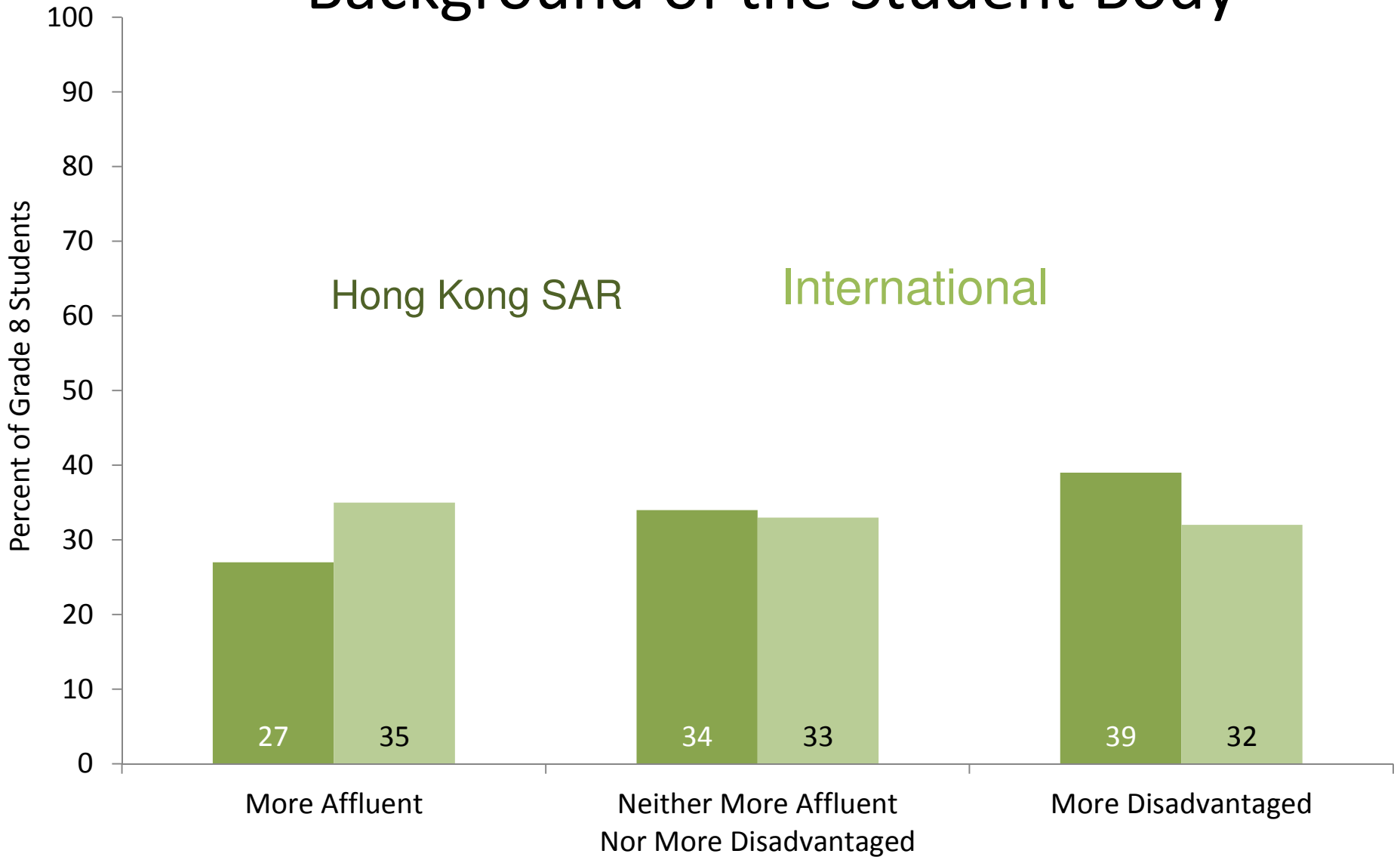
5(d) Background Variables & Achievement

Home Resources for Learning

Secondary 2	Many Resources	Some Resources	Few Resources
HKSAR %	13%	74%	13%
International %	14%	73%	13%

Secondary 2	Many Resources	Some Resources	Few Resources
HKSAR % (Scale Avg.)	13% (625)	74% (577)	13% (540)
Int'l % (Scale Avg.)	14% (546)	73% (488)	13% (433)

School Composition by Socioeconomic Background of the Student Body



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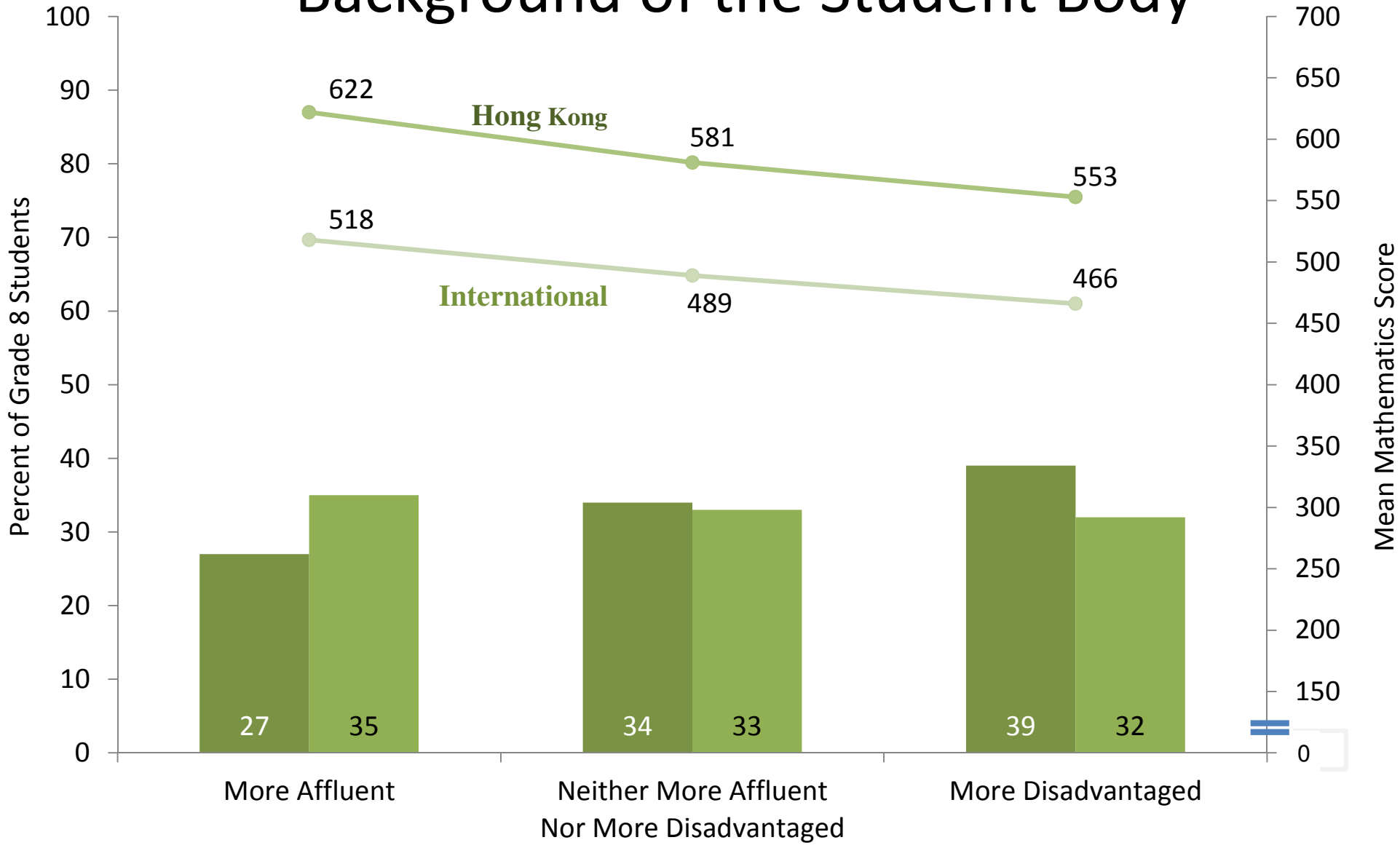
School Composition by Socioeconomic Background of the Student Body



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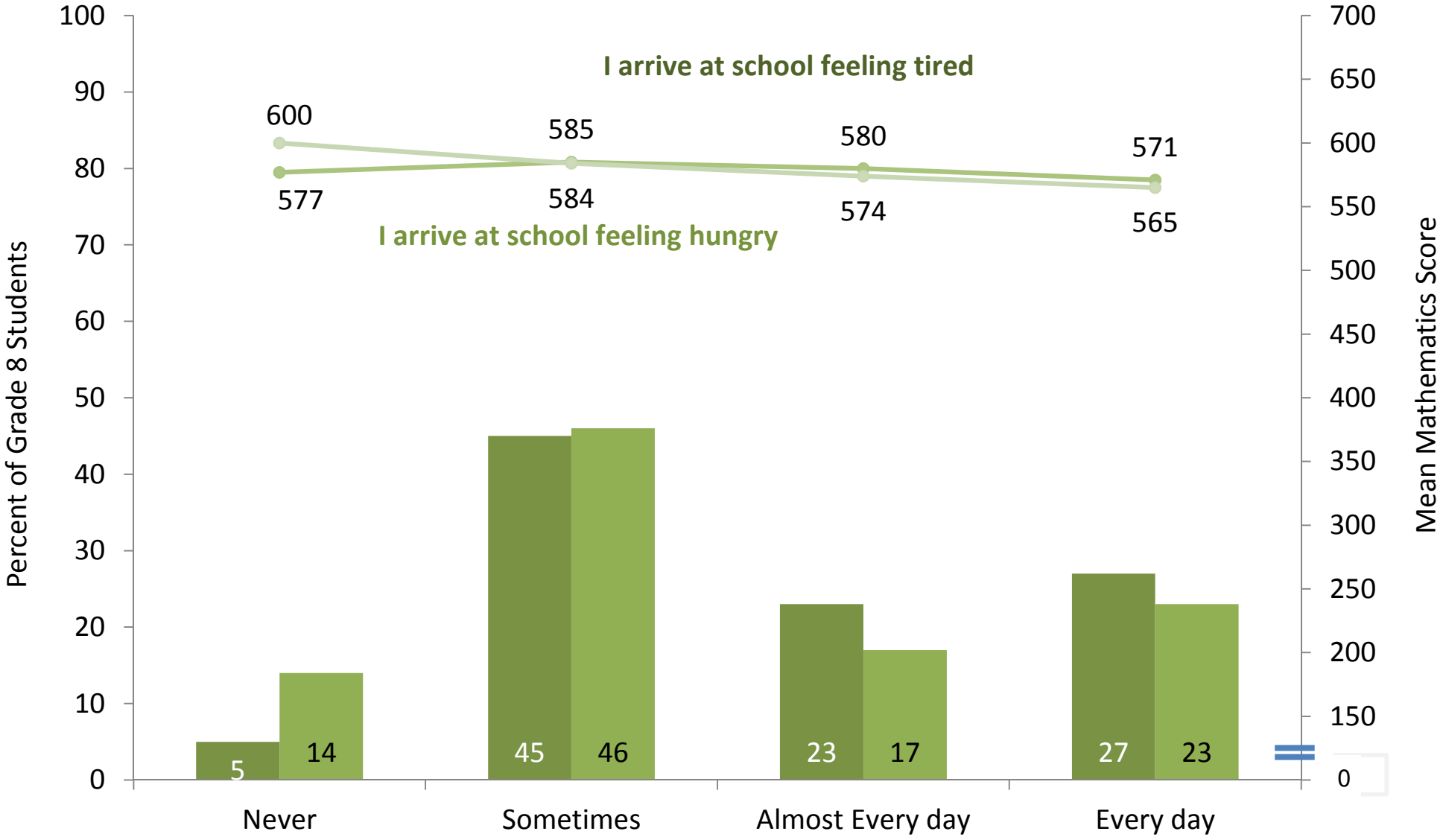
- School Composition by Socioeconomic Background of Students (Grade 8)

	More Affluent	Neither More Affluent Nor More Disadvantaged	More Disadvantaged
	%	%	%
Chinese Taipei	14	66	20
Hong Kong SAR	27	34	39
Japan	52	36	12
Korea, Rep. of	23	48	29
Singapore	43	46	10
International Average	35	33	32

School Composition by Socioeconomic Background of Students (Grade 8)

	More Affluent		Neither More Affluent Nor More Disadvantaged		More Disadvantaged	
	%	Scale Scores	%	Scale Scores	%	Scale Scores
Chinese Taipei	14	656	66	616	20	571
Hong Kong SAR	27	622	34	581	39	553
Japan	52	602	36	588	12	573
Korea, Rep. of	23	639	48	607	29	581
Singapore	43	640	46	611	10	539
International Average	35	518	33	489	32	466

HK Students Arriving at School Feeling Tired or Hungry



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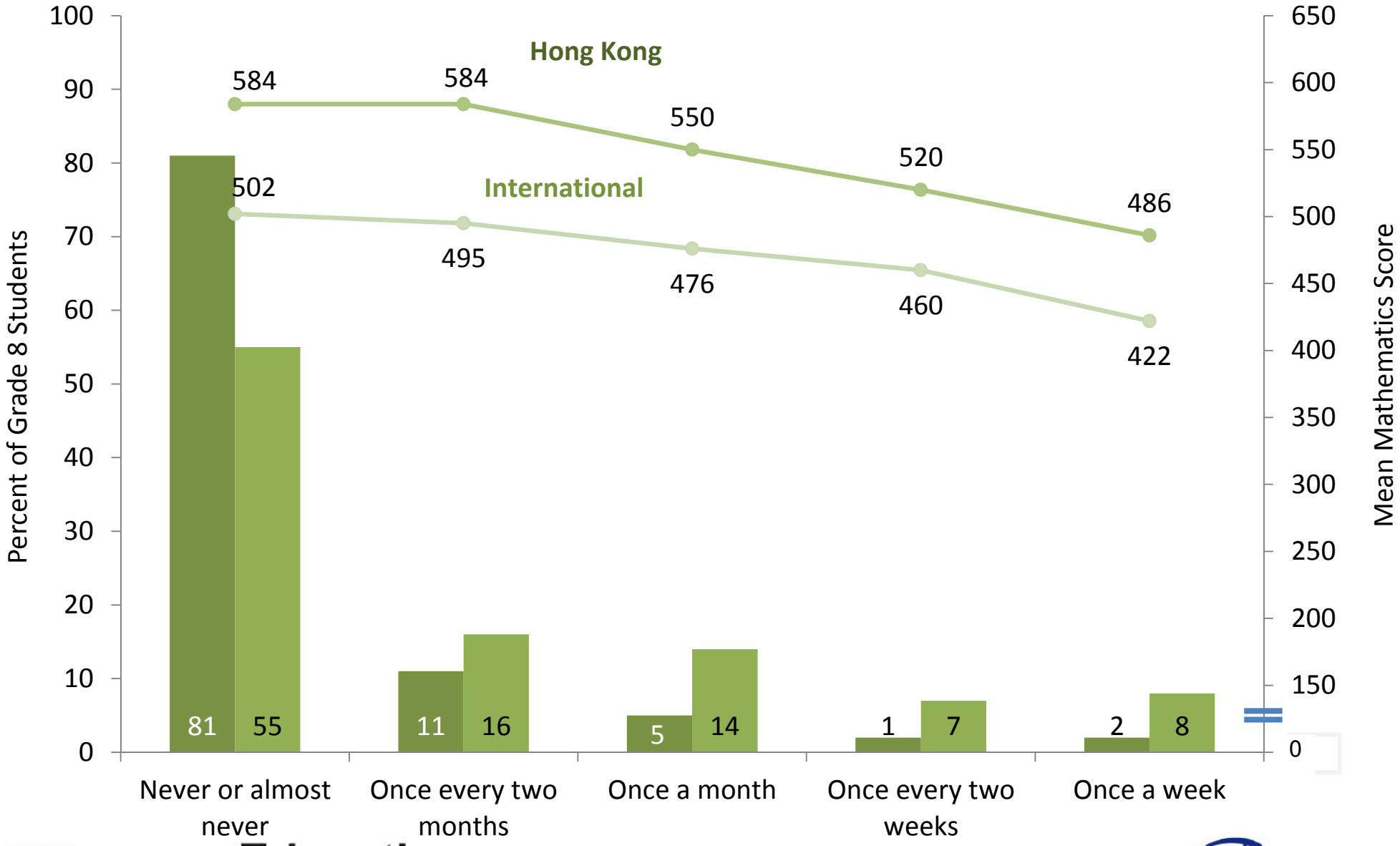
Frequency of Being Absent from School



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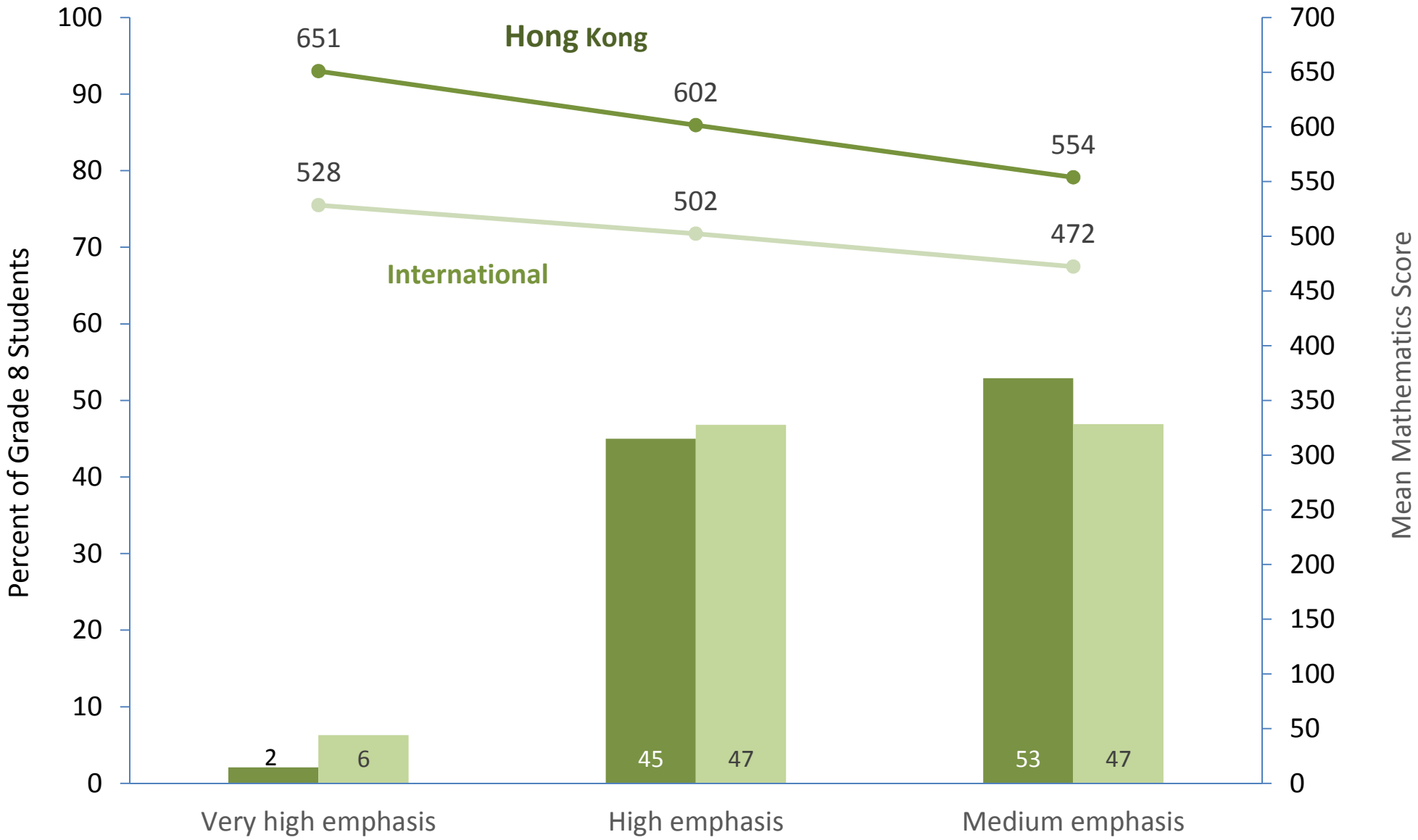
School Emphasis on Academic Success



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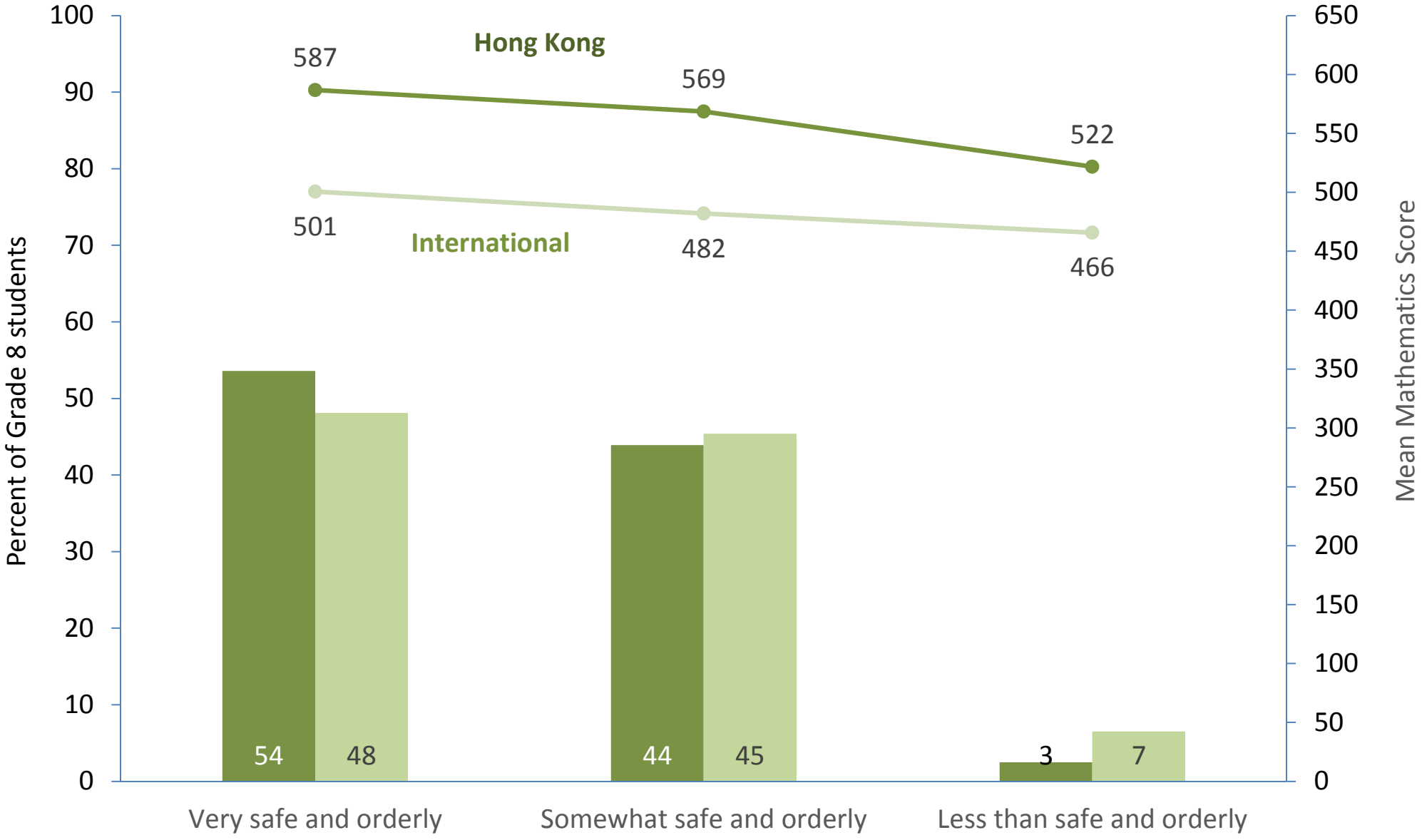
Safe and Orderly Schools



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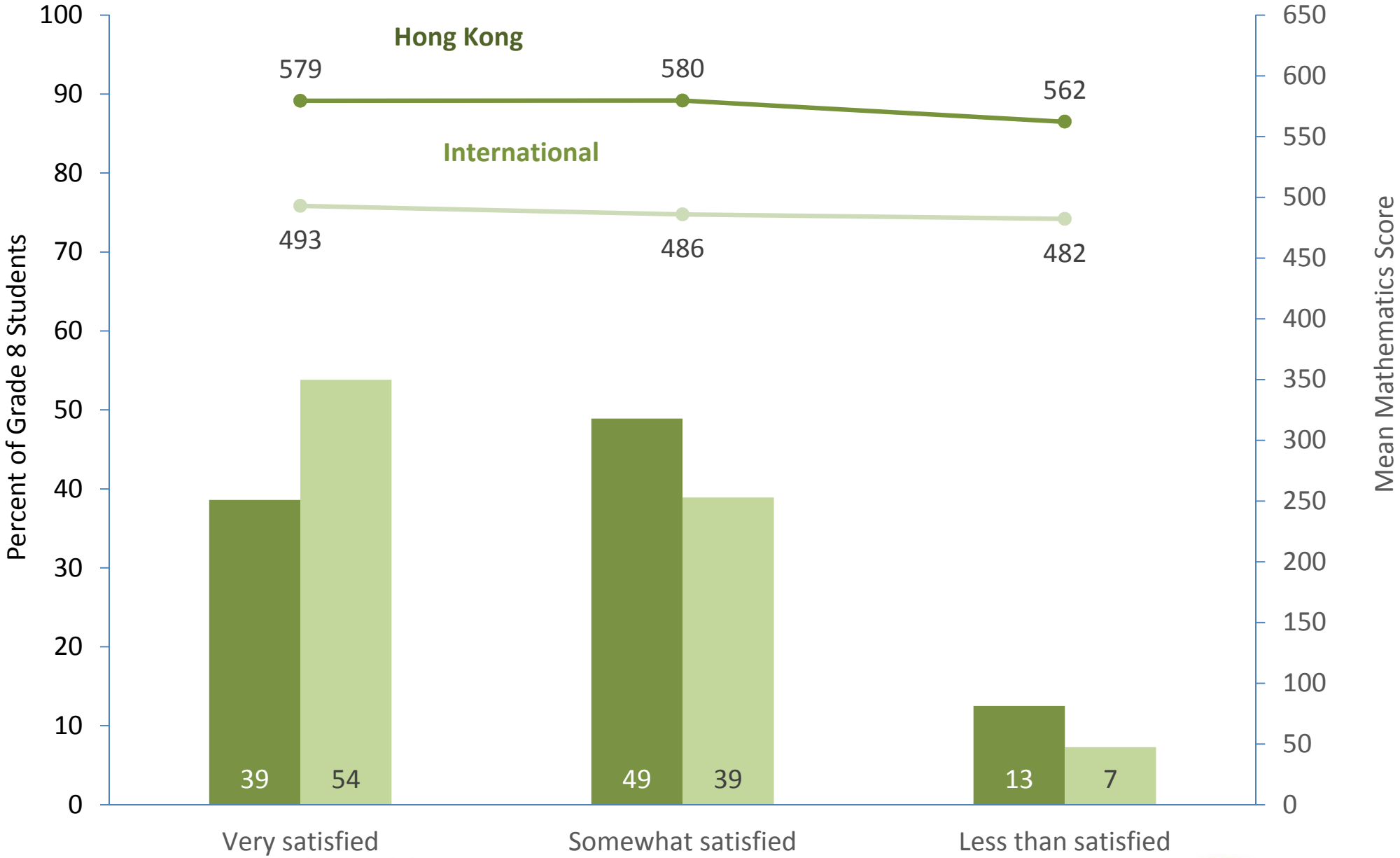
Teachers' Job Satisfaction



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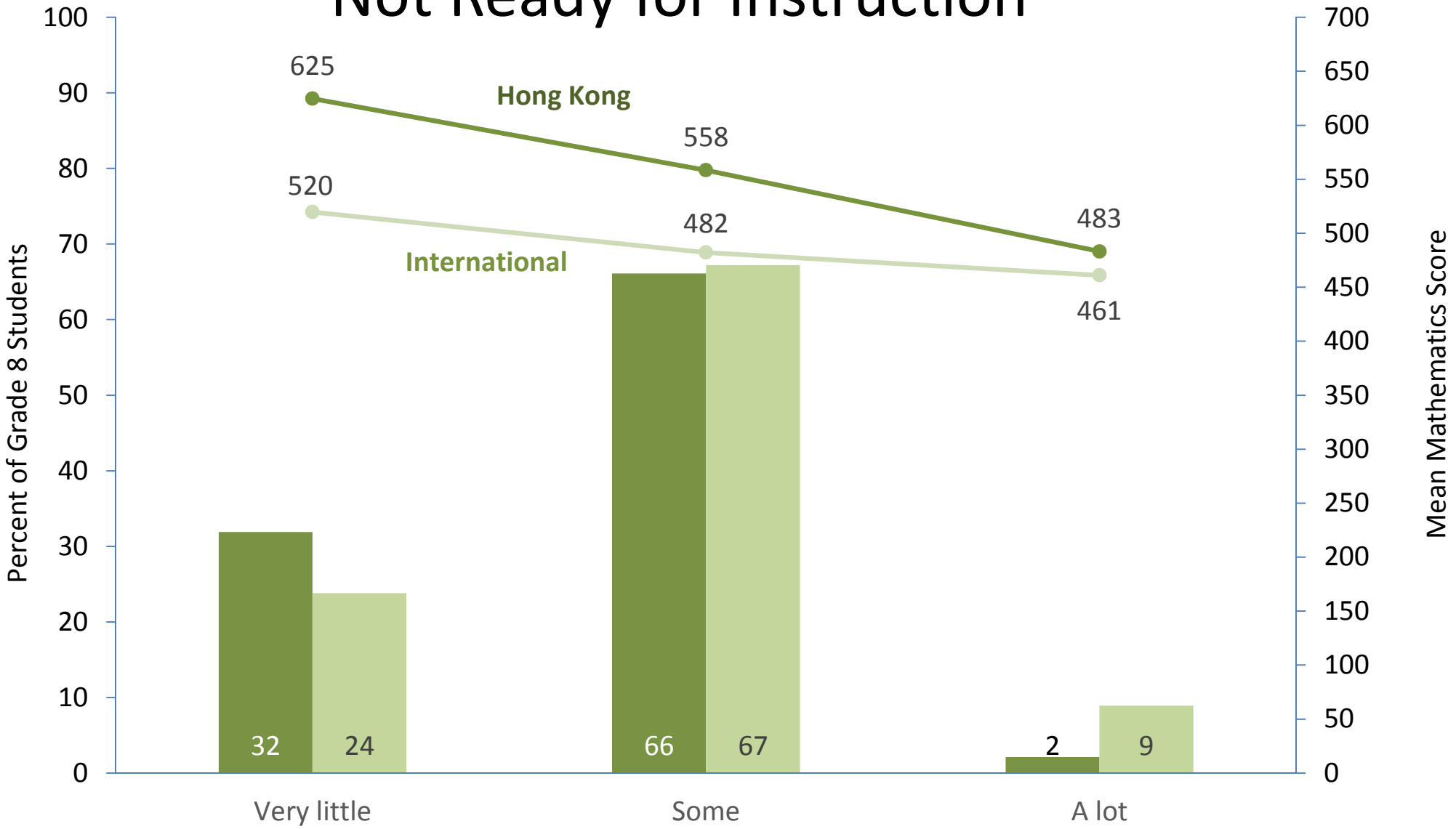
Classroom Teaching Limited by Students Not Ready for Instruction



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政策二十一

- How often do you usually assign mathematics homework to students in this class? (Grade 8)

	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	3.3	26.8	32.2	37.0
Hong Kong SAR	1.0	4.8	40.8	26.8	26.7
Japan	11.6	23.3	41.7	16.5	6.9
Korea, Rep. of	23.4	38.2	28.0	8.0	2.3
Singapore	1.2	4.2	49.0	37.0	8.6
International Average	7.7	8.0	31.1	28.6	24.6

- When you assign mathematics homework to the students in this class, about how many minutes do you usually assign? (Grade 8)

	15 minutes or less	16-30 minutes	31-60 minutes	61-90 minutes	More than 90 minutes	N/A
	%	%	%	%	%	%
Chinese Taipei	8.2	50.4	37.2	2.8	0.6	0.8
Hong Kong SAR	3.8	61.7	32.2	1.3	0.0	1.0
Japan	25.2	39.8	18.2	0.7	4.5	11.7
Korea, Rep. of	26.4	35.0	15.0	0.3	0.0	23.3
Singapore	3.6	39.5	50.7	4.9	0.0	1.2
International Average	23.5	44.0	21.4	2.7	0.7	7.7

How often do you usually assign mathematics homework to students in this class? (Grade 8)

	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	459	3.3	558	26.8	604	32.2	609	37.0	630
Hong Kong SAR	1.0	532	4.8	531	40.8	575	26.8	578	26.7	590
Japan	11.6	596	23.3	598	41.7	593	16.5	589	6.9	595
Korea, Rep. of	23.4	606	38.2	604	28.0	614	8.0	600	2.3	615
Singapore	1.2	469	4.2	598	49.0	620	37.0	620	8.6	603
International Average	7.7	461	8.0	477	31.1	485	28.6	495	24.6	495

- When you assign mathematics homework to the students in this class, about how many minutes do you usually assign? (Grade 8)

	15 minutes or less		16-30 minutes		31-60 minutes		61-90 minutes		More than 90 minutes		Not Applicable	
	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores	%	Scale Scores
Chinese Taipei	8.2	576	50.4	607	37.2	628	2.8	636	0.6	599	0.8	459
Hong Kong SAR	3.8	597	61.7	581	32.2	571	1.3	588	0.0	N/A	1.0	532
Japan	25.2	591	39.8	592	18.2	604	0.7	629	4.5	583	11.7	596
Korea, Rep. of	26.4	600	35.0	612	15.0	608	0.3	624	0.0	N/A	23.3	606
Singapore	3.6	545	39.5	599	50.7	634	4.9	651	0.0	N/A	1.2	469
International Average	23.5	476	44.0	492	21.4	499	2.7	489	0.7	467	7.7	461

5(e) Efficiency of the Education System

Home Resources for Learning

Secondary 2	Many Resources	Some Resources	Few Resources
HKSAR % (Scale Avg.)	13% (625)	74% (577)	13% (540)
Int'l % (Scale Avg.)	14% (546)	73% (488)	13% (433)

Secondary 2

Home Educational Resources for Learning Mathematics

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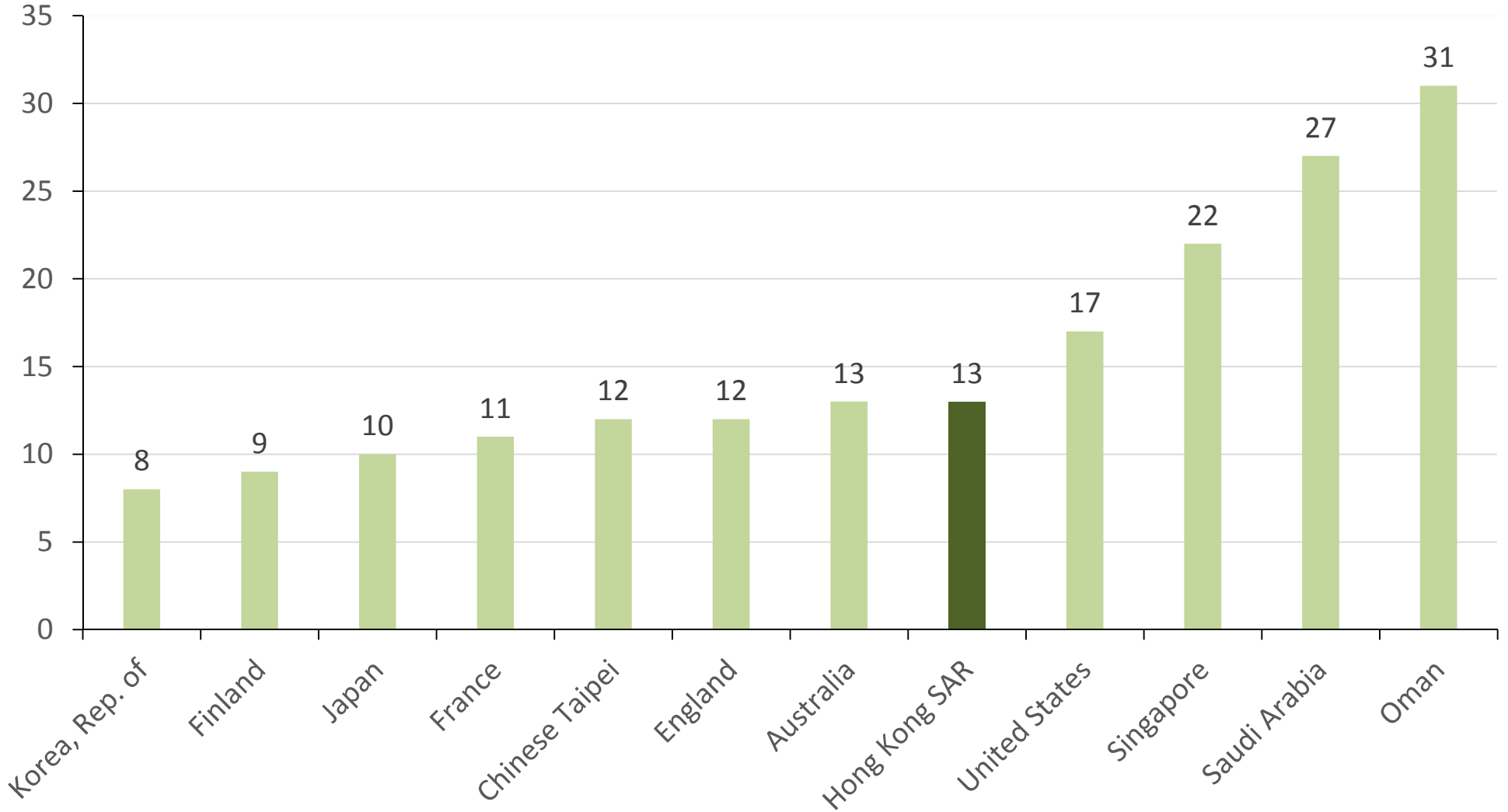
5(f) Attitudes of Students towards Mathematics and Learning

- 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 8: Students Like Learning Mathematics

(international average = 20%)



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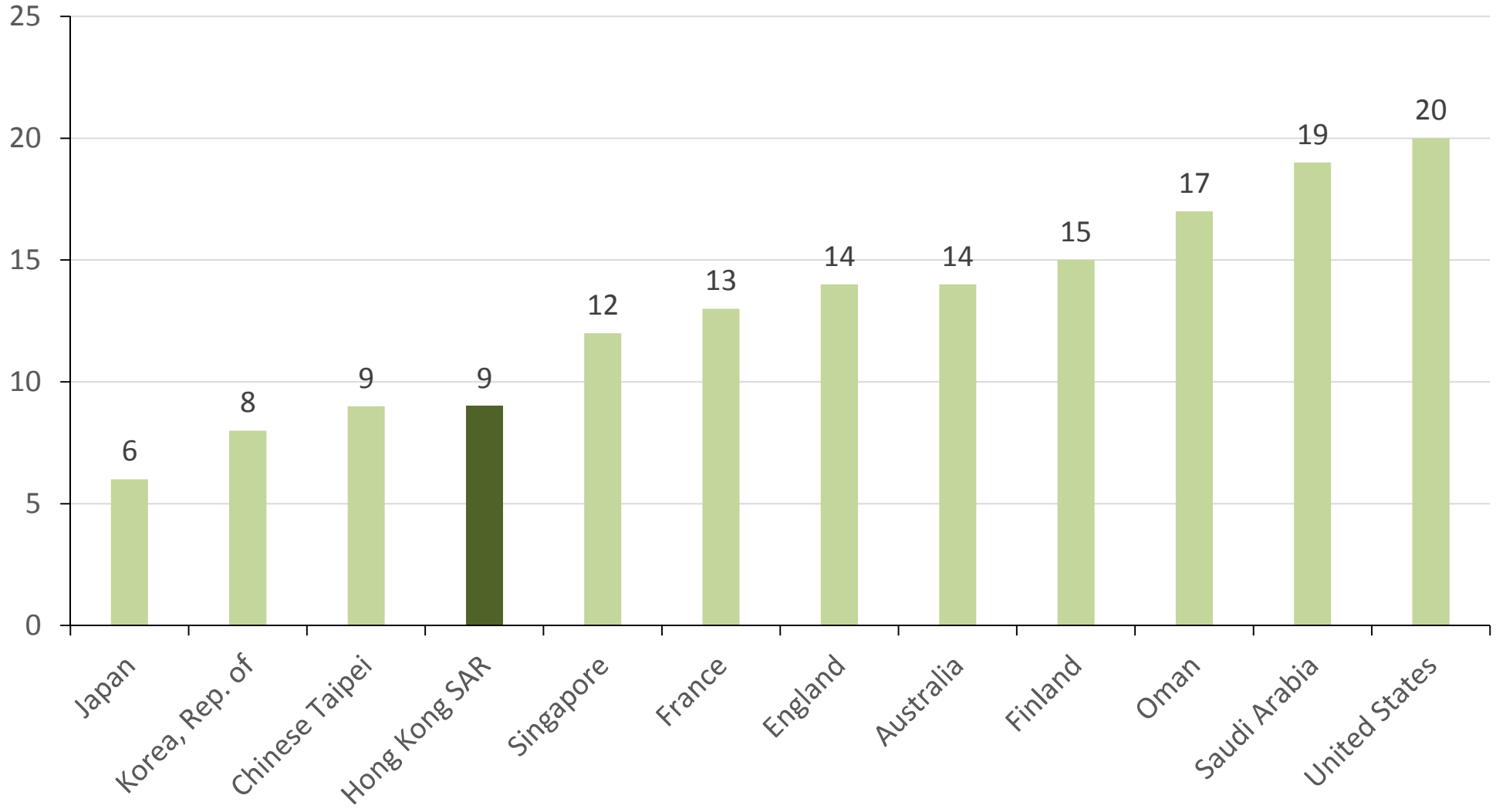
Grade 8: Students Confident in Mathematics

(international average = 15%)



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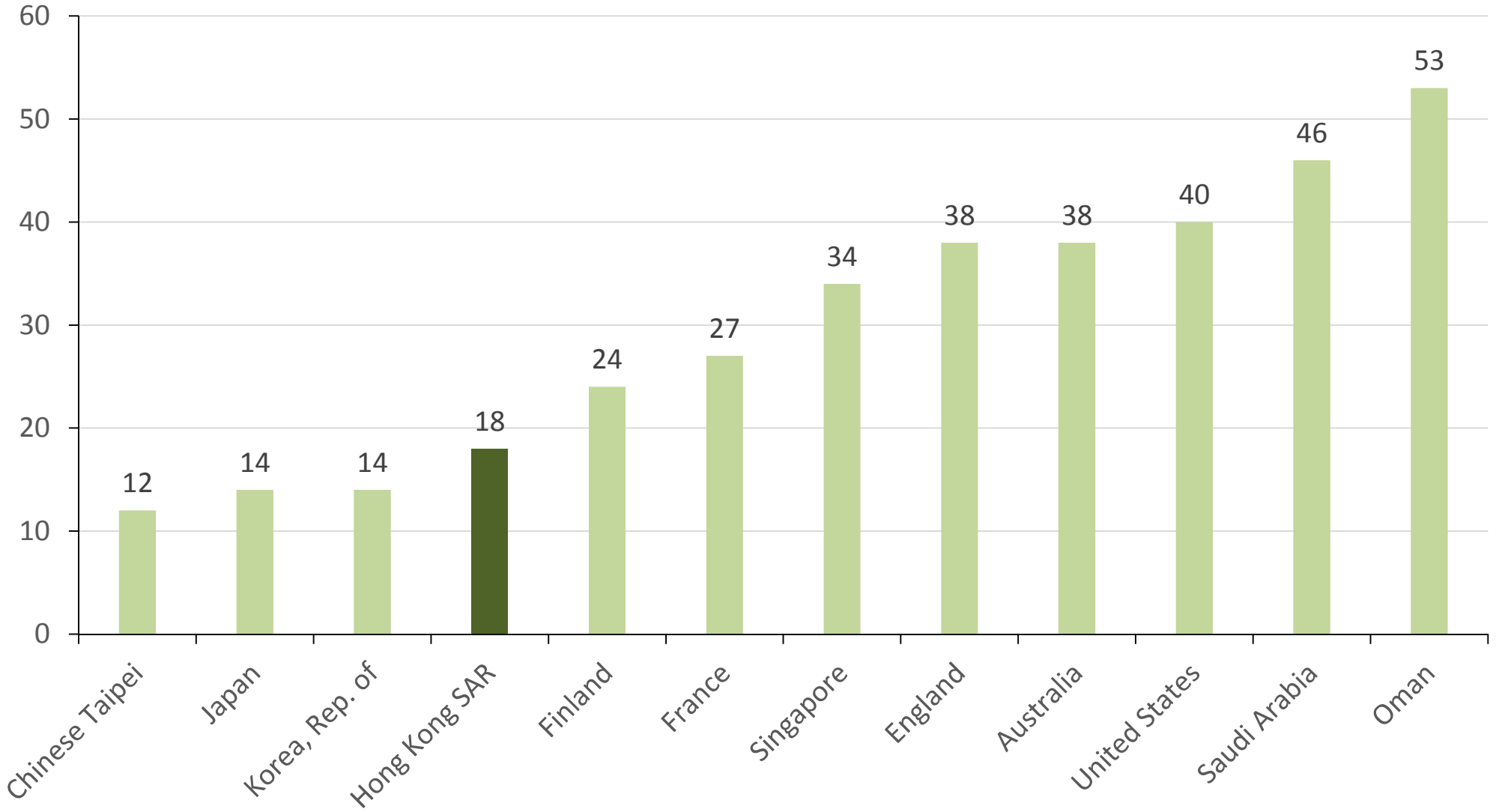
Grade 8: Students Value Mathematics

(international average = 37%)



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政策二十一

Attitudinal Results (S2 maths)

Secondary 2	Students Very Much Like Learning Mathematics	Students Somewhat Like Learning Mathematics	Students Do Not Like Learning Mathematics
HKSAR %	13%	39%	48%
International %	20%	39%	41%

Secondary 2	Students Very Confident in Mathematics	Students Somewhat Confident in Mathematics	Students Not Confident in Mathematics
HKSAR %	9%	37%	54%
International %	15%	42%	44%

Secondary 2	Students Strongly Value Mathematics	Students Somewhat Value Mathematics	Students Do Not Value Mathematics
HKSAR %	18%	54%	28%
International %	37%	47%	16%

Attitudinal Results (S2 maths)

Secondary 2	Students Very Much Like Learning Mathematics	Students Somewhat Like Learning Mathematics	Students Do Not Like Learning Mathematics
HKSAR % (Scale Avg.)	13% (622)	39% (595)	48% (554)
Int'l % (Scale Avg.)	20% (530)	39% (496)	41% (468)

Secondary 2	Students Very Confident in Mathematics	Students Somewhat Confident in Mathematics	Students Not Confident in Mathematics
HKSAR % (Scale Avg.)	9% (646)	37% (600)	54% (554)
Int'l % (Scale Avg.)	15% (562)	42% (502)	44% (456)

Secondary 2	Students Strongly Value Mathematics	Students Somewhat Value Mathematics	Students Do Not Value Mathematics
HKSAR % (Scale Avg.)	18% (605)	54% (586)	28% (547)
Int'l % (Scale Avg.)	37% (507)	47% (487)	16% (462)

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	
Egypt	42 (1.3)	437 (5.4)	41 (0.9)	396 (5.6)	17 (0.9)	405 (6.4)	11.1 (0.06)
Morocco	38 (1.1)	409 (3.0)	40 (0.7)	380 (2.9)	22 (0.9)	368 (2.7)	10.8 (0.05)
Jordan	37 (1.3)	441 (4.2)	39 (0.8)	413 (4.8)	24 (1.0)	408 (5.6)	10.8 (0.06)
South Africa (9)	36 (0.7)	403 (2.5)	44 (0.5)	382 (2.6)	19 (0.5)	385 (3.0)	10.8 (0.03)
Iran, Islamic Rep. of	34 (0.9)	478 (5.1)	39 (0.8)	438 (4.6)	27 (1.1)	418 (4.5)	10.6 (0.05)
Oman	31 (0.9)	455 (3.4)	46 (0.7)	396 (3.0)	23 (1.0)	390 (4.1)	10.6 (0.04)
Turkey	29 (1.0)	539 (5.8)	41 (0.8)	485 (4.9)	30 (1.1)	470 (4.8)	10.3 (0.05)
Lebanon	28 (1.3)	456 (3.6)	44 (1.1)	425 (3.9)	28 (1.1)	413 (3.7)	10.4 (0.06)
Saudi Arabia	27 (1.1)	413 (4.0)	36 (0.7)	391 (3.2)	37 (1.0)	386 (3.0)	10.1 (0.05)
Kazakhstan	26 (1.2)	509 (4.9)	54 (1.1)	484 (4.0)	20 (1.1)	472 (5.0)	10.6 (0.05)
United Arab Emirates	26 (0.6)	512 (3.0)	41 (0.6)	471 (2.4)	33 (0.6)	451 (1.9)	10.2 (0.03)
Georgia	25 (1.4)	493 (6.1)	43 (1.1)	461 (4.9)	32 (1.3)	438 (5.3)	10.2 (0.06)
Bahrain	24 (0.8)	510 (3.4)	36 (0.8)	483 (2.4)	40 (1.2)	462 (2.9)	9.9 (0.06)
Singapore	22 (0.7)	653 (4.0)	43 (0.7)	624 (3.9)	35 (0.8)	582 (5.0)	10.1 (0.03)
Malaysia	20 (0.8)	498 (5.2)	57 (0.8)	455 (3.3)	23 (1.0)	442 (4.2)	10.3 (0.04)
Kuwait	20 (0.9)	429 (7.0)	34 (1.0)	406 (6.3)	45 (1.3)	392 (4.4)	9.7 (0.05)
Israel	19 (1.0)	544 (6.3)	36 (1.0)	527 (5.3)	45 (1.4)	505 (4.1)	9.6 (0.06)
Cyprus	19 (0.8)	549 (3.8)	35 (0.8)	513 (2.8)	46 (1.0)	473 (2.4)	9.6 (0.04)
Portugal	19 (0.9)	548 (4.7)	34 (1.0)	508 (3.9)	48 (1.3)	477 (3.3)	9.6 (0.06)
Russian Federation	17 (0.7)	583 (6.3)	46 (0.9)	549 (4.7)	37 (1.1)	519 (5.0)	9.9 (0.04)
United States	17 (0.8)	561 (6.2)	37 (0.6)	528 (5.0)	45 (1.0)	493 (4.7)	9.6 (0.05)
Italy	16 (0.9)	537 (4.3)	34 (1.1)	513 (3.3)	49 (1.3)	474 (2.9)	9.4 (0.06)
Romania	16 (1.0)	537 (6.0)	39 (1.1)	486 (5.6)	44 (1.6)	454 (4.8)	9.7 (0.06)
Qatar	16 (0.8)	486 (5.6)	39 (1.1)	449 (5.9)	45 (1.4)	424 (3.5)	9.6 (0.06)
Ireland	14 (0.7)	567 (4.4)	35 (1.1)	537 (3.1)	50 (1.3)	504 (2.7)	9.4 (0.05)
Chile	14 (0.7)	468 (5.7)	40 (1.2)	449 (3.4)	46 (1.5)	426 (2.9)	9.6 (0.05)
New Zealand	14 (0.6)	528 (5.4)	39 (1.1)	495 (4.1)	47 (1.2)	460 (3.6)	9.5 (0.04)
Australia	13 (0.7)	576 (5.1)	37 (0.8)	536 (4.5)	50 (1.2)	489 (3.4)	9.4 (0.05)
Hong Kong SAR	13 (0.7)	622 (5.8)	39 (1.0)	595 (4.9)	48 (1.4)	554 (4.4)	9.4 (0.05)
Sweden	13 (0.7)	545 (4.7)	34 (0.9)	522 (3.4)	53 (1.2)	482 (2.5)	9.3 (0.05)
England	12 (0.8)	552 (8.5)	38 (1.1)	530 (6.6)	50 (1.2)	500 (5.0)	9.4 (0.04)
Norway (9)	12 (0.8)	558 (4.8)	34 (0.9)	524 (2.5)	54 (1.1)	479 (2.7)	9.2 (0.04)
Lithuania	12 (0.8)	563 (6.3)	43 (1.2)	531 (3.7)	44 (1.3)	500 (3.0)	9.6 (0.04)
Chinese Taipei	12 (0.6)	685 (5.2)	33 (0.7)	643 (3.0)	56 (0.9)	579 (2.7)	9.2 (0.04)
France	11 (0.7)	524 (4.8)	43 (1.2)	498 (3.1)	46 (1.3)	459 (2.5)	9.5 (0.04)
Hungary	11 (0.6)	590 (7.0)	32 (0.9)	538 (4.2)	57 (1.1)	491 (2.9)	9.2 (0.04)
Japan	10 (0.6)	658 (5.3)	34 (0.9)	618 (3.2)	56 (1.1)	569 (2.8)	9.3 (0.04)
Finland	9 (0.6)	572 (4.3)	34 (1.0)	533 (3.3)	57 (1.2)	485 (2.3)	9.1 (0.05)
Korea, Rep. of	8 (0.5)	685 (5.3)	32 (0.9)	638 (3.8)	61 (0.9)	581 (2.8)	9.0 (0.03)
International Average	20 (0.1)	530 (0.8)	39 (0.1)	496 (0.7)	41 (0.2)	468 (0.6)	

Secondary 2

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	
Israel	25 (1.1)	582 (5.4)	43 (0.9)	515 (4.4)	32 (1.2)	482 (4.1)	10.7 (0.07)
Egypt	23 (1.0)	459 (4.8)	49 (0.8)	413 (5.6)	28 (1.0)	385 (5.8)	10.8 (0.05)
Norway (9)	21 (0.8)	580 (2.9)	39 (1.1)	513 (2.8)	40 (1.0)	456 (2.7)	10.3 (0.05)
Lebanon	21 (1.0)	479 (4.2)	45 (1.1)	429 (3.0)	34 (1.3)	405 (4.0)	10.5 (0.06)
Cyprus	20 (0.7)	569 (3.1)	37 (0.9)	513 (2.8)	43 (0.9)	460 (3.0)	10.1 (0.04)
Jordan	20 (1.0)	478 (4.1)	47 (0.7)	420 (4.2)	32 (1.1)	392 (5.0)	10.6 (0.05)
United States	20 (0.8)	578 (5.0)	40 (0.7)	537 (4.5)	40 (1.0)	471 (4.2)	10.3 (0.05)
Iran, Islamic Rep. of	20 (0.7)	517 (5.9)	43 (1.0)	447 (4.6)	37 (1.0)	408 (3.8)	10.4 (0.04)
Bahrain	20 (0.7)	533 (3.6)	44 (0.8)	482 (2.5)	36 (0.9)	452 (2.8)	10.4 (0.04)
Saudi Arabia	19 (0.8)	444 (4.0)	49 (0.7)	395 (3.1)	32 (0.9)	366 (2.6)	10.5 (0.05)
United Arab Emirates	18 (0.5)	536 (2.9)	45 (0.4)	478 (2.2)	37 (0.4)	442 (2.3)	10.4 (0.02)
Italy	18 (0.7)	554 (3.9)	37 (1.0)	514 (2.9)	45 (1.2)	462 (2.9)	9.9 (0.06)
Oman	17 (0.7)	486 (4.5)	50 (0.8)	411 (3.2)	33 (0.8)	380 (2.9)	10.5 (0.04)
Hungary	16 (0.6)	609 (4.1)	39 (0.8)	530 (3.5)	45 (1.0)	471 (3.1)	10.0 (0.05)
Sweden	16 (0.8)	578 (3.1)	43 (0.9)	516 (2.8)	41 (1.1)	461 (2.9)	10.1 (0.05)
Turkey	15 (0.7)	600 (5.6)	35 (0.9)	513 (5.2)	50 (1.0)	453 (4.0)	9.8 (0.05)
Georgia	15 (0.9)	537 (6.1)	44 (1.2)	473 (4.3)	41 (1.4)	422 (4.8)	10.2 (0.06)
Ireland	15 (0.7)	584 (3.6)	44 (1.1)	533 (3.1)	41 (1.3)	495 (2.2)	10.0 (0.05)
Finland	15 (0.7)	586 (3.3)	40 (0.7)	523 (2.9)	45 (1.0)	473 (2.4)	10.0 (0.04)
Morocco	15 (0.6)	440 (3.6)	47 (0.6)	390 (2.6)	39 (0.9)	368 (2.1)	10.2 (0.04)
England	14 (0.9)	588 (6.6)	49 (1.0)	528 (5.7)	38 (1.3)	480 (5.2)	10.1 (0.05)
Australia	14 (0.6)	594 (5.1)	42 (0.8)	540 (4.3)	44 (1.0)	474 (3.3)	9.9 (0.05)
France	13 (0.7)	556 (3.8)	42 (0.9)	498 (3.0)	45 (1.1)	446 (2.4)	9.8 (0.05)
Lithuania	13 (0.7)	604 (4.1)	42 (0.9)	535 (4.1)	45 (1.2)	484 (2.9)	9.9 (0.05)
Qatar	13 (0.9)	516 (7.5)	44 (1.1)	455 (4.5)	43 (1.2)	413 (3.9)	10.0 (0.06)
Kazakhstan	13 (0.7)	539 (4.5)	54 (1.2)	494 (3.7)	34 (1.3)	459 (3.6)	10.3 (0.05)
Singapore	12 (0.5)	679 (3.5)	40 (0.8)	637 (3.6)	48 (0.9)	582 (5.0)	9.7 (0.04)
Kuwait	12 (0.6)	466 (7.6)	43 (0.8)	408 (5.5)	45 (0.9)	385 (4.5)	9.9 (0.04)
Russian Federation	12 (0.7)	609 (5.3)	44 (0.9)	563 (4.3)	45 (0.9)	508 (5.1)	9.9 (0.04)
Portugal	11 (0.7)	580 (5.6)	34 (1.1)	525 (3.3)	55 (1.2)	469 (3.4)	9.5 (0.05)
Romania	10 (0.7)	579 (5.9)	31 (1.0)	510 (5.6)	58 (1.2)	446 (4.2)	9.4 (0.05)
New Zealand	10 (0.6)	569 (4.6)	44 (0.9)	502 (3.8)	45 (0.7)	445 (3.6)	9.8 (0.04)
Chile	10 (0.6)	509 (5.1)	41 (1.1)	452 (3.2)	49 (1.3)	418 (2.9)	9.7 (0.04)
Chinese Taipei	9 (0.4)	706 (5.4)	31 (0.7)	656 (3.2)	59 (0.8)	575 (2.6)	9.2 (0.04)
Hong Kong SAR	9 (0.7)	646 (7.3)	37 (1.0)	600 (4.5)	54 (1.1)	554 (4.3)	9.4 (0.05)
Korea, Rep. of	8 (0.5)	695 (4.8)	38 (0.8)	644 (3.8)	54 (0.9)	567 (2.7)	9.5 (0.03)
South Africa (9)	7 (0.3)	468 (4.2)	40 (0.5)	396 (2.6)	53 (0.6)	376 (2.1)	9.6 (0.02)
Japan	6 (0.4)	688 (5.8)	33 (0.8)	629 (3.1)	61 (0.9)	567 (2.9)	9.1 (0.04)
Malaysia	3 (0.3)	584 (10.5)	33 (0.8)	478 (4.6)	64 (0.9)	448 (2.7)	9.2 (0.03)
International Average	**15 (0.1)**	**562 (0.8)**	**42 (0.1)**	**502 (0.6)**	**44 (0.2)**	**456 (0.6)**	

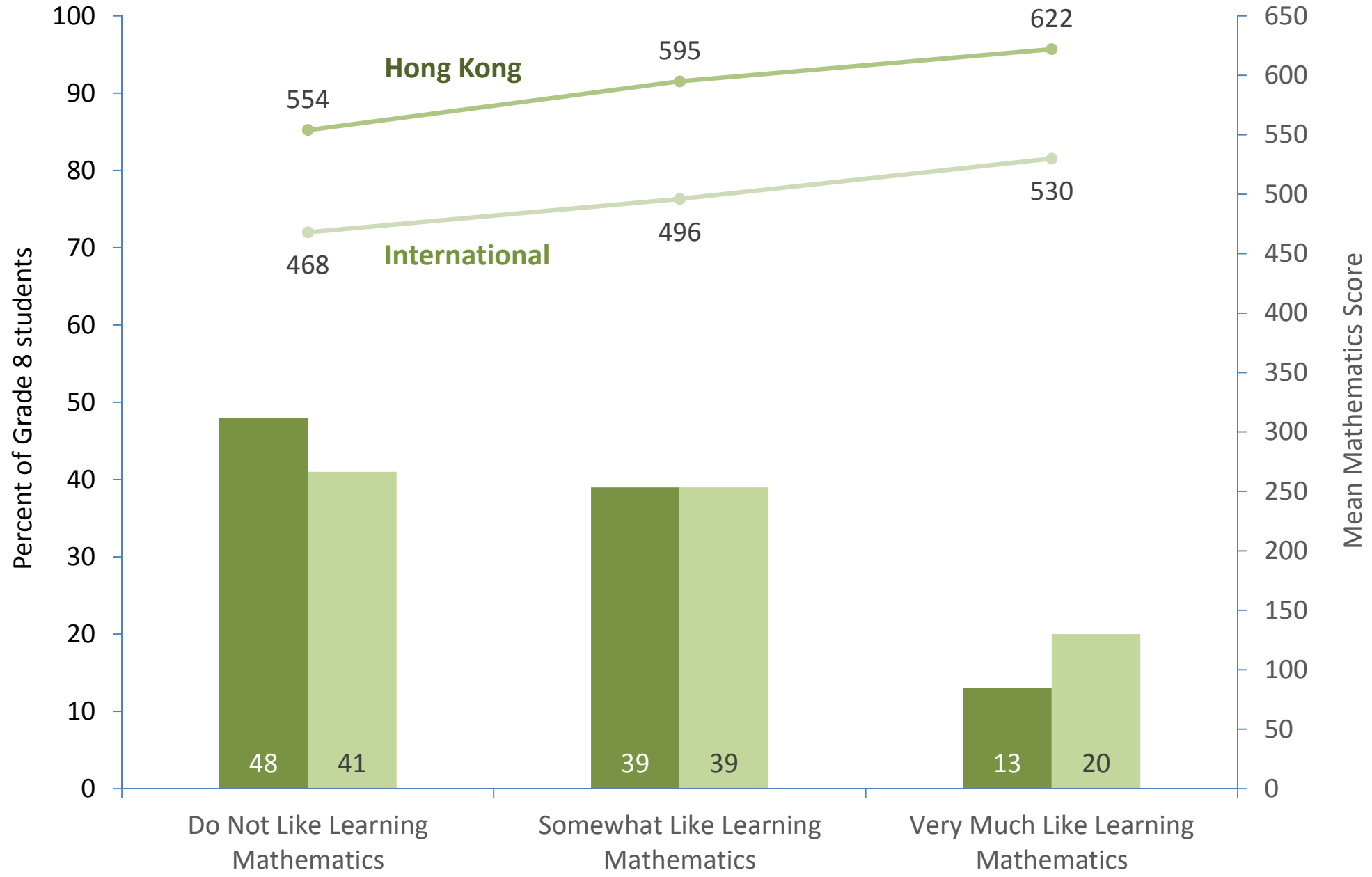
Secondary 2

Students Confident in Mathematics Scale

Country	Strongly Value Mathematics		Somewhat Value Mathematics		Do Not Value Mathematics		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
South Africa (9)	68 (0.6)	399 (2.2)	27 (0.6)	377 (2.7)	5 (0.2)	357 (4.1)	10.9 (0.03)
Egypt	63 (1.2)	425 (5.3)	31 (0.9)	403 (5.5)	6 (0.5)	381 (9.3)	10.9 (0.06)
Jordan	62 (1.2)	433 (3.6)	31 (1.0)	411 (5.4)	7 (0.5)	384 (8.8)	10.8 (0.05)
Morocco	60 (0.9)	400 (2.7)	32 (0.7)	374 (2.4)	8 (0.4)	368 (3.8)	10.7 (0.04)
Israel	54 (1.2)	529 (4.9)	37 (1.0)	514 (4.6)	9 (0.5)	501 (6.5)	10.4 (0.05)
Oman	53 (0.9)	432 (3.0)	39 (0.8)	397 (3.5)	8 (0.4)	375 (5.8)	10.3 (0.04)
Iran, Islamic Rep. of	49 (1.2)	457 (4.4)	40 (1.0)	440 (3.9)	11 (0.6)	426 (6.2)	10.2 (0.05)
Turkey	48 (1.2)	520 (4.9)	40 (0.8)	480 (4.7)	12 (0.8)	454 (6.4)	10.1 (0.06)
Georgia	47 (1.3)	474 (4.8)	43 (1.2)	455 (4.8)	10 (0.8)	436 (9.3)	10.1 (0.06)
United Arab Emirates	47 (0.6)	492 (2.7)	41 (0.6)	468 (1.8)	12 (0.3)	431 (3.4)	10.1 (0.03)
Saudi Arabia	46 (1.1)	403 (3.3)	42 (0.8)	391 (2.7)	12 (0.6)	380 (4.5)	10.1 (0.05)
Lebanon	45 (1.3)	447 (3.0)	43 (1.0)	422 (4.0)	12 (0.8)	409 (5.5)	10.0 (0.06)
Kuwait	41 (1.2)	416 (5.8)	43 (0.9)	401 (5.0)	16 (0.7)	384 (5.8)	9.7 (0.05)
Bahrain	40 (0.9)	493 (2.6)	44 (0.6)	479 (2.4)	16 (0.8)	459 (3.2)	9.7 (0.04)
United States	40 (0.8)	532 (5.0)	48 (0.7)	516 (4.7)	12 (0.5)	484 (6.1)	9.8 (0.04)
Qatar	38 (1.1)	456 (5.7)	44 (1.1)	449 (4.5)	18 (1.1)	409 (4.8)	9.6 (0.06)
Australia	38 (0.9)	539 (4.5)	48 (0.8)	514 (3.8)	14 (0.6)	479 (4.8)	9.7 (0.04)
England	38 (1.2)	528 (6.1)	51 (0.9)	515 (5.6)	10 (0.7)	500 (7.3)	9.8 (0.05)
New Zealand	37 (1.0)	494 (4.2)	50 (0.9)	481 (3.6)	14 (0.7)	461 (5.1)	9.6 (0.05)
Cyprus	37 (1.0)	523 (2.8)	46 (0.9)	499 (2.2)	17 (0.7)	467 (3.9)	9.6 (0.04)
Ireland	35 (1.0)	538 (3.5)	49 (0.9)	525 (2.6)	16 (0.7)	496 (4.3)	9.5 (0.04)
Chile	35 (1.0)	446 (3.5)	53 (1.0)	442 (3.1)	12 (0.6)	425 (5.2)	9.7 (0.04)
Romania	35 (1.3)	502 (5.6)	43 (1.0)	472 (4.8)	22 (1.3)	461 (4.9)	9.4 (0.07)
Norway (9)	35 (1.0)	524 (3.4)	51 (0.9)	503 (2.4)	15 (0.7)	467 (4.4)	9.6 (0.05)
Malaysia	34 (1.0)	486 (3.3)	56 (0.9)	453 (3.7)	10 (0.8)	421 (5.6)	9.6 (0.04)
Portugal	34 (1.1)	525 (4.8)	48 (1.3)	493 (3.1)	17 (1.0)	473 (4.0)	9.5 (0.05)
Singapore	34 (0.8)	628 (4.8)	56 (0.8)	614 (4.1)	10 (0.4)	584 (6.3)	9.6 (0.03)
Kazakhstan	31 (1.0)	493 (4.6)	53 (0.9)	487 (3.6)	15 (0.8)	482 (5.1)	9.5 (0.05)
France	27 (0.9)	493 (3.8)	57 (1.0)	485 (2.7)	16 (0.7)	458 (3.8)	9.3 (0.04)
Russian Federation	26 (1.0)	560 (6.1)	53 (0.9)	543 (4.5)	21 (1.0)	526 (5.0)	9.2 (0.05)
Lithuania	26 (1.2)	533 (4.7)	56 (1.1)	520 (3.2)	19 (0.9)	508 (4.3)	9.2 (0.04)
Hungary	25 (0.9)	543 (5.5)	53 (0.9)	516 (3.4)	22 (0.8)	489 (3.8)	9.1 (0.04)
Italy	25 (0.8)	511 (4.0)	54 (0.9)	498 (2.9)	21 (0.8)	482 (3.6)	9.1 (0.04)
Finland	24 (0.9)	535 (3.3)	54 (0.8)	513 (2.5)	22 (0.9)	473 (3.7)	9.0 (0.04)
Sweden	24 (0.9)	515 (4.1)	58 (0.8)	505 (2.7)	18 (0.7)	487 (3.5)	9.2 (0.04)
Hong Kong SAR	18 (1.0)	605 (6.3)	54 (1.0)	586 (4.3)	28 (0.9)	547 (5.2)	8.7 (0.05)
Korea, Rep. of	14 (0.6)	668 (5.0)	56 (0.9)	620 (2.9)	30 (1.1)	554 (3.1)	8.5 (0.04)
Japan	14 (0.7)	629 (5.7)	59 (0.8)	598 (2.7)	27 (0.8)	568 (3.7)	8.6 (0.03)
Chinese Taipei	12 (0.5)	659 (5.8)	48 (0.8)	634 (3.1)	40 (1.0)	573 (3.0)	8.2 (0.04)
International Average	**37 (0.2)**	**507 (0.7)**	**47 (0.1)**	**487 (0.6)**	**16 (0.1)**	**462 (0.8)**	

Secondary 2

Students Value Mathematics Scale



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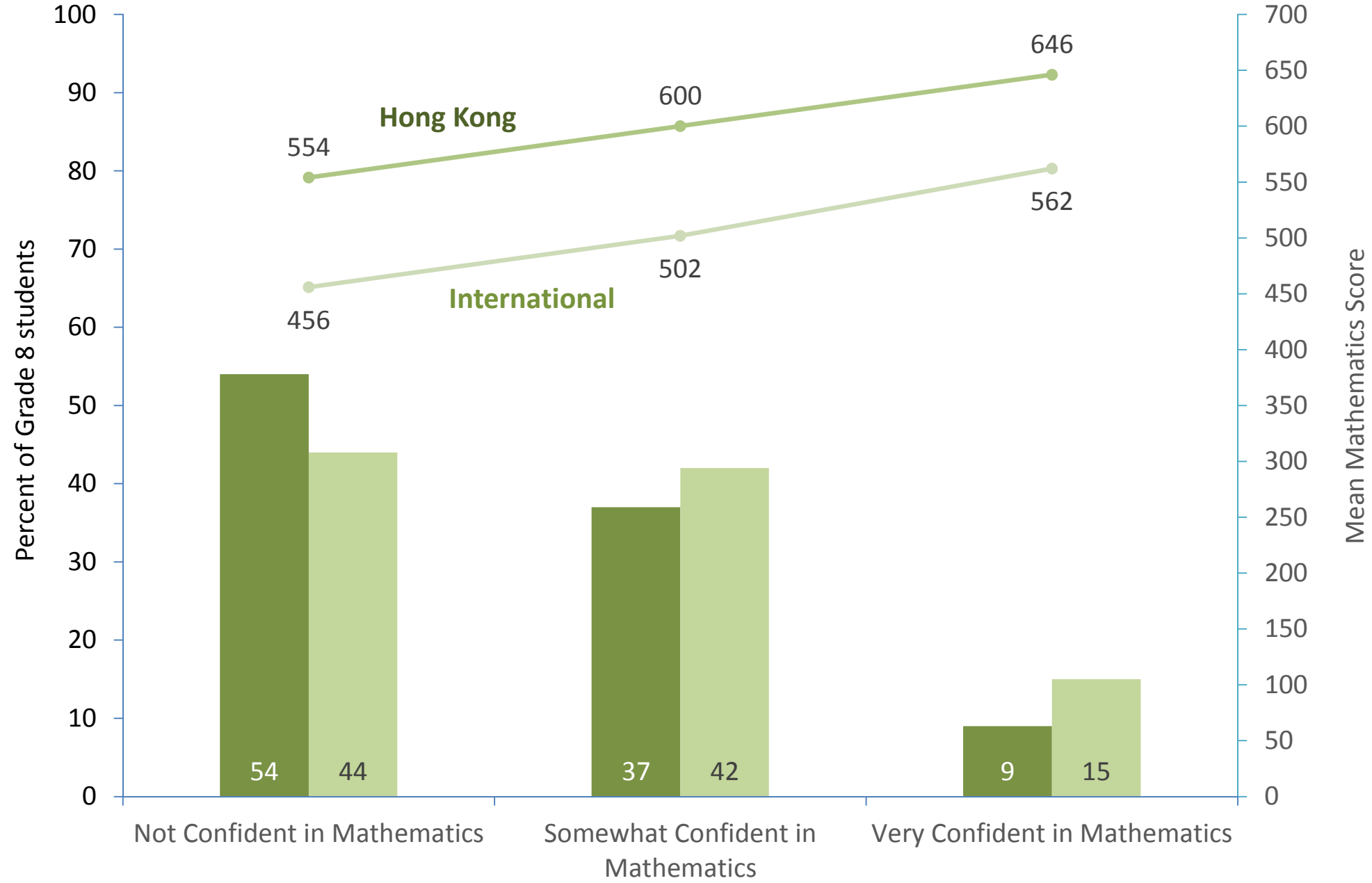
Policy 21
政策二十一



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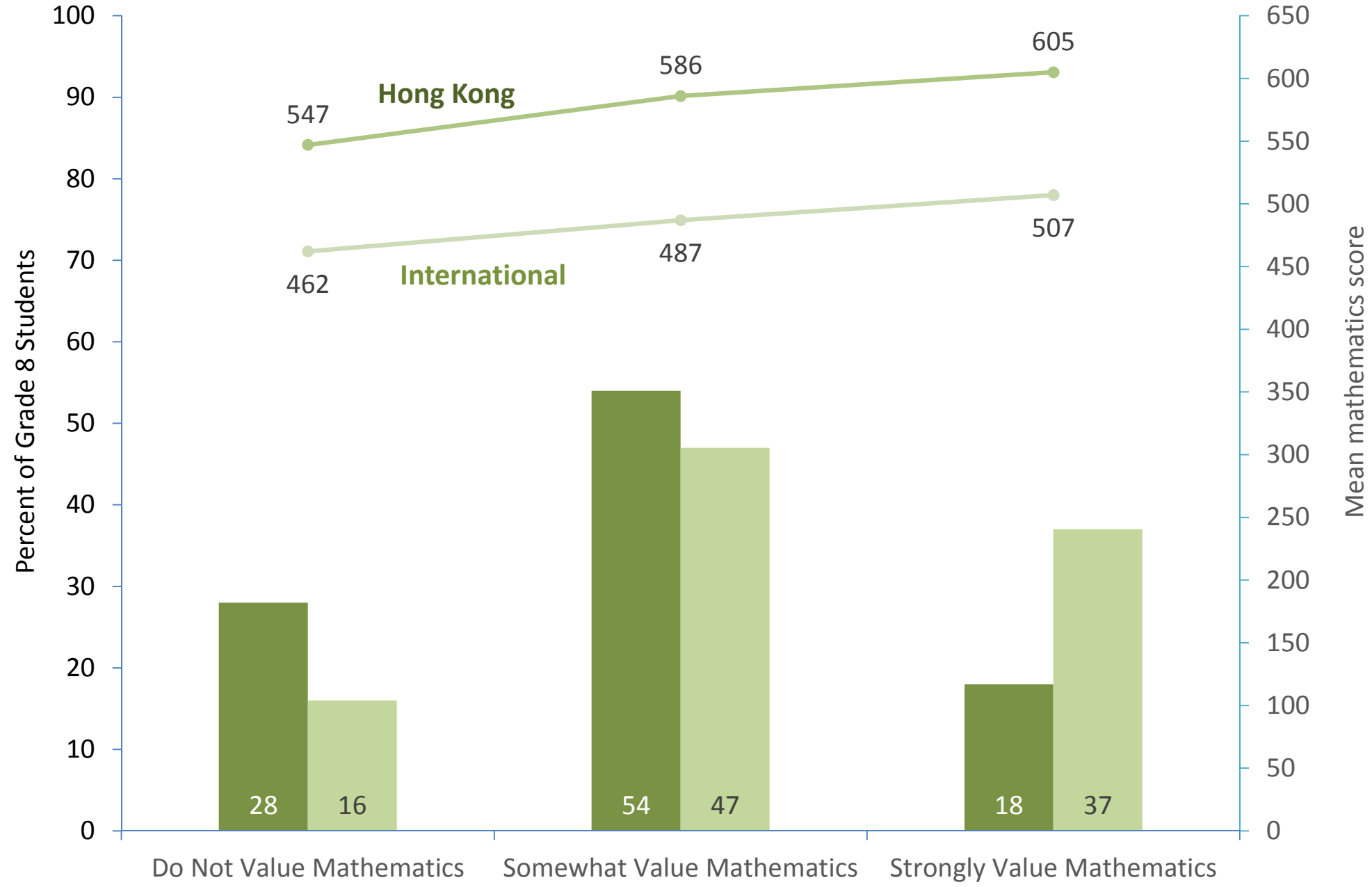
IEA

Policy 21
政策二十一



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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 學年中二年級 2C 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	代數	幾何	數據與概率	知識	應用	推理
TIMSS 2019 香港參與學校的平均水平	578	570	584	596	563	580	575	582
貴校參與班別的平均表現	**599**	**587**	**596**	**620**	**611**	**602**	**602**	**600**

*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)
- 代數 (Algebra)
- 幾何 (Geometry)
- 數據與概率 (Data and Probability)

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。

學校名稱：[redacted]　　（學校編號：[redacted]）

班別： 2018-19 學年中二年級 2C 班　　（班級編號：[redacted]）

聯絡老師：[redacted]

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	13	622	39	595	48	554
貴校參與班別的平均表現	**4**	**570**	**26**	**623**	**70**	**592**

	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	9	646	37	600	54	554
貴校參與班別的平均表現	**N/A**	**N/A**	**41**	**631**	**59**	**578**

	對數學的重視					
	很重視		重視		不重視	
	%	表現	%	表現	%	表現
TIMSS 2019 香港參與學校的平均水平	18	605	54	586	28	547
貴校參與班別的平均表現	**7**	**577**	**56**	**598**	**37**	**605**

School report

Trends in International Mathematics and Science Study (TIMSS) 2019
School Report: Overall Mathematics and Science Performance

Mathematics

School: [redacted] **(School ID:** [redacted]**)**
Class: 2A to 2E Overall (2018-19 School Year) **(Class ID: Overall)**
School Coordinator: [redacted]

Part I: Overall Performance of the Students in the Sampled Class

	Overall Mathematics Performance	Content Domains*				Cognitive Domains*		
		Number	Algebra	Geometry	Data and Probability	Knowing	Applying	Reasoning
Performance of all the participating schools in Hong Kong	578	570	584	596	563	580	575	582
Performance of the sampled students in your school	**552**	**546**	**563**	**573**	**507**	**555**	**545**	**557**

*TIMSS assessment is organized around two dimensions, a content dimension and a cognitive dimension. The content dimension specifies the subject matter or content domains to be assessed in mathematics. The cognitive dimension specifies the thinking processes that students are likely to use as they engage with the content. Each item is associated with one content domain and one cognitive domain.

Content Domains of Mathematics:

- Number
- Algebra
- Geometry
- Data and Probability

Cognitive Domains of Mathematics:

- Knowing – refers to student's knowledge base of mathematics facts, concepts, tools, and procedures
- Applying – focuses on the student's ability to apply knowledge and conceptual understanding in a problem situation
- Reasoning – goes beyond the solution of routine problems to encompass unfamiliar situations, complex contexts, and multi-steps problems

* "Trends in International Mathematics and Science (TIMSS) 2019" has a scale average of 500 and a standard deviation of 100.

School: [redacted] **(School ID:** [redacted]**)**

Class: 2A to 2E Overall (2018-19 School Year) **(Class ID: Overall)**

School Coordinator: [redacted]

Part II: Attitudinal Results of the Students in the Sampled Class and their Performance

	Students Like Learning Mathematics Scale					
	Very Much Like Learning Mathematics		Somewhat Like Learning Mathematics		Do Not Like Learning Mathematics	
	%	Performance	%	Performance	%	Performance
Performance of all the participating schools in Hong Kong	13	622	39	595	48	554
Performance of the sampled students in your school	**15**	**605**	**39**	**558**	**46**	**529**

	Students Confident in Mathematics Scale					
	Very Confident in Mathematics		Somewhat Confident in Mathematics		Not Confident in Mathematics	
	%	Performance	%	Performance	%	Performance
Performance of all the participating schools in Hong Kong	9	646	37	600	54	554
Performance of the sampled students in your school	**10**	**618**	**45**	**575**	**45**	**522**

	Students Value Mathematics Scale					
	Strongly Value Mathematics		Somewhat Value Mathematics		Do Not Value Mathematics	
	%	Performance	%	Performance	%	Performance
Performance of all the participating schools in Hong Kong	18	605	54	586	28	547
Performance of the sampled students in your school	**22**	**567**	**51**	**557**	**26**	**529**

School: [redacted] **(School ID:** [redacted]**)**

Class: 2A (2018-19 School Year) **(Class ID:** [redacted]**)**

School Coordinator: [redacted]

Part I: Overall Performance of the Students in the Sampled Class

	Overall Mathematics Performance	Content Domains*				Cognitive Domains*		
		Number	Algebra	Geometry	Data and Probability	Knowing	Applying	Reasoning
Performance of all the participating schools in Hong Kong	578	570	584	596	563	580	575	582
Performance of the sampled students in your school	**484**	**480**	**503**	**513**	**415**	**491**	**472**	**483**

*TIMSS assessment is organized around two dimensions, a content dimension and a cognitive dimension. The content dimension specifies the subject matter or content domains to be assessed in mathematics. The cognitive dimension specifies the thinking processes that students are likely to use as they engage with the content. Each item is associated with one content domain and one cognitive domain.

School: [redacted] **(School ID:** [redacted]**)**

Class: 2A (2018-19 School Year) **(Class ID:** [redacted]**)**

School Coordinator: [redacted]

Part II: Attitudinal Results of the Students in the Sampled Class and their Performance

	Students Like Learning Mathematics Scale					
	Very Much Like Learning Mathematics		Somewhat Like Learning Mathematics		Do Not Like Learning Mathematics	
	%	Performance	%	Performance	%	Performance
Performance of all the participating schools in Hong Kong	13	622	39	595	48	554
Performance of the sampled students in your school	**N/A**	**N/A**	**53**	**502**	**47**	**464**

	Students Confident in Mathematics Scale					
	Very Confident in Mathematics		Somewhat Confident in Mathematics		Not Confident in Mathematics	
	%	Performance	%	Performance	%	Performance
Performance of all the participating schools in Hong Kong	9	646	37	600	54	554
Performance of the sampled students in your school	**N/A**	**N/A**	**29**	**489**	**71**	**487**

	Students Value Mathematics Scale					
	Strongly Value Mathematics		Somewhat Value Mathematics		Do Not Value Mathematics	
	%	Performance	%	Performance	%	Performance
Performance of all the participating schools in Hong Kong	18	605	54	586	28	547
Performance of the sampled students in your school	**13**	**465**	**53**	**483**	**33**	**494**

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

Grade 8 Example:

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

M02_06

Janet described the graph of a function:

- The graph is a straight line.
- The graph intercepts the y-axis at 3.

Which could be the function of Janet's graph?

(A) $y = x^2 + 3$

(B) $y = 3x + 1$

(C) $y = 3x^2 - 1$

(D) $y = x + 3$

Algebra/Applying (M02_06)

	A	B	C	D	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	11.1	25.8	25.0	33.6	4.2	0.3	30.5	36.4
CHINESE TAIPEI	10.4	21.6	10.2	**55.8**	2.0	0.0	61.6	50.3
JAPAN	3.7	20.1	7.2	**66.3**	1.9	0.8	66.0	66.5
KOREA	4.7	19.1	11.4	**63.0**	1.3	0.6	63.8	62.4
SINGAPORE	11.4	18.1	9.6	**58.5**	1.6	0.7	64.2	53.4
INT'L AVG	10.2	23.6	15.1	**42.2**	7.3	1.6	44.4	40.0

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

Discussion on Item M02_06

- 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?

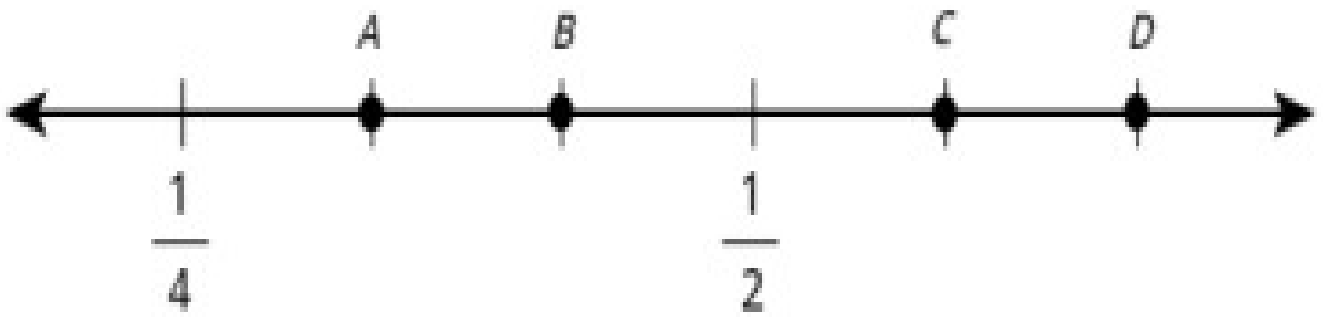
IEA eTIMSS 2019

TIME LEFT 0

1

1

Which point shows $\frac{5}{12}$ on the number line?



A A

B B

C C

D D

ME02_02 (ME72025): Number / Applying Type: MC Key: B
Label: Arrow to show 5/12 on number line

		DIFF	A	B	C	D	OMITTED	NOT REACHED		
COUNTRY	N	%	%	%	%	%	%	%	1.GIRL % RIGHT	2.BOY % RIGHT
Chile	582	22.1	11.5	22.1	23.4	39.6	3.1	0.3	21.7	22.4
Chinese Taipei	694	70.4	10.0	70.4	10.0	9.4	0.2	0.0	72.0	68.8
England	473	51.5	9.8	51.5	18.7	18.4	1.6	0.0	47.4	56.1
Finland	690	52.0	10.8	52.0	17.5	17.6	1.9	0.1	50.3	53.7
France	549	38.6	13.5	38.6	24.7	21.3	2.0	0.0	35.3	41.6
Georgia	486	30.8	19.4	30.8	13.2	31.0	5.3	0.4	27.2	34.0
Hong Kong SAR	454	68.3	8.4	68.3	12.8	9.6	0.7	0.3	68.0	68.6
Hungary	653	49.7	9.7	49.7	18.1	21.3	1.1	0.0	45.4	54.6
Israel	532	60.0	11.0	60.0	13.2	15.0	0.7	0.1	57.8	62.6
Italy	510	34.8	11.1	34.8	21.8	28.8	2.9	0.6	36.0	33.4
Korea, Rep. of	545	69.8	7.6	69.8	13.1	8.6	0.6	0.2	66.5	73.0
Lithuania	546	38.7	7.4	38.7	16.8	34.6	2.4	0.0	35.1	41.6
Malaysia	997	36.1	7.4	36.1	20.5	34.8	1.3	0.0	34.6	37.6
Norway (9)	644	57.4	8.3	57.4	15.9	13.3	3.5	1.6	55.0	60.4
Portugal	478	40.6	5.8	40.6	25.9	25.5	2.1	0.0	38.8	42.8
Qatar	553	29.2	17.1	29.2	21.2	30.3	1.8	0.5	26.9	31.4
Russian Federation	555	52.9	10.2	52.9	15.1	19.5	2.2	0.0	46.0	59.0
Singapore	701	82.2	4.9	82.2	5.2	6.7	1.0	0.0	84.7	79.5
Sweden	565	61.6	10.8	61.6	14.1	11.6	1.9	0.0	58.5	64.4
Turkey	576	45.5	12.8	45.5	17.8	19.6	4.2	0.0	43.3	48.1
United Arab Emirates	3208	40.1	13.8	40.1	16.6	27.9	1.6	0.0	36.4	43.5
United States	1243	58.2	9.1	58.2	14.5	17.5	0.7	0.0	53.9	61.6
International Avg (n=22)	16234	49.6	10.5	49.6	16.8	21.0	1.9	0.2	47.3	51.8
Ontario, Canada	533	64.2	6.5	64.2	14.0	12.7	2.4	0.1	60.5	68.3
Quebec, Canada	448	64.3	9.4	64.3	14.3	8.9	3.1	0.1	61.3	67.4
Moscow City, Russian Fed.	544	66.1	6.6	66.1	12.1	11.9	3.3	0.0	60.5	71.3
Abu Dhabi, UAE	1187	35.1	16.2	35.1	16.9	30.9	0.9	0.0	30.1	39.6
Dubai, UAE	822	53.6	11.4	53.6	14.8	19.3	0.8	0.0	49.6	58.0

DIFF = Percent correct; V1 = Percent scoring 1 pt or better; V2 = Percent scoring 2 pts
Percent right for boys and girls corresponds to percent obtaining full credit.
Because of missing gender information, some totals may appear inconsistent.

6(d) How TIMSS Informs Teaching and Learning

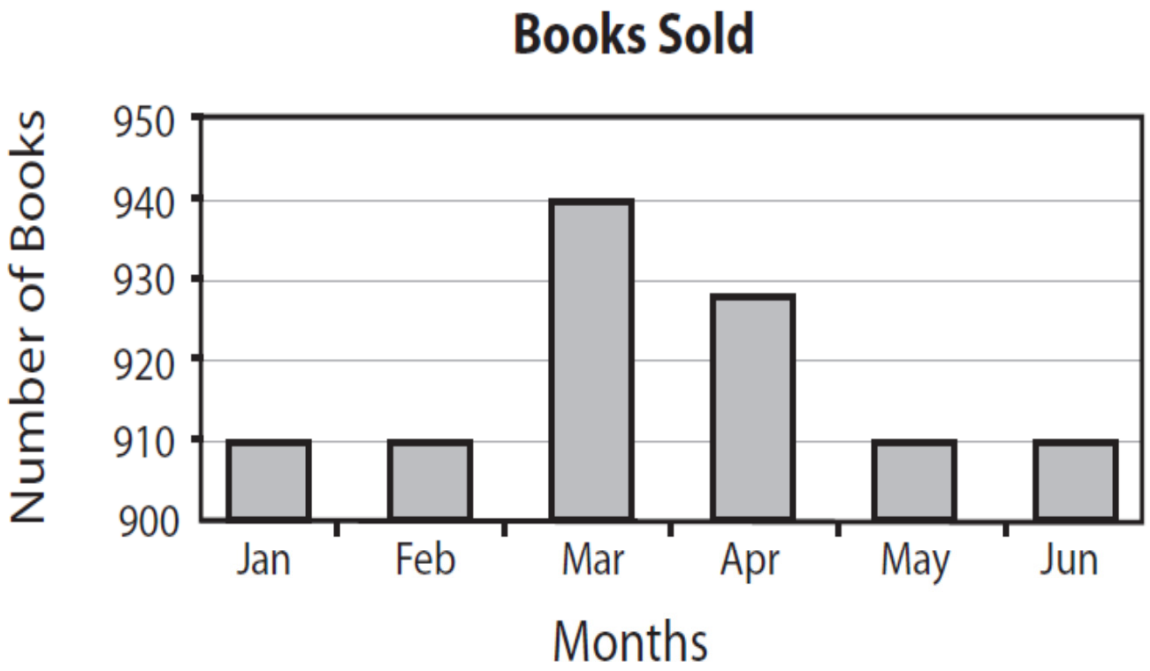
Two-digit Diagnostic Codes

- 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: M01_14 (Data and Chance / Reasoning)

M01_14



A salesman looked at the graph showing his sales of books for the first 6 months of 2004, and said, "In March, I sold four times as many books as I sold in February."

Explain whether you agree or disagree with the salesman, and give a reason.

Note: Code 10 takes precedence over other correct explanation (code 11 and code 12). Code 11 takes precedence over code 12.

Code	Response	Item: M042164
	Correct Response	
10	Disagree, with reference to false origin or scale not starting from zero *Examples:* *I disagree because the graph section of the number of books does not start at zero.* *I disagree with the salesman. He should look at the graph carefully. The graph is plotted using 900 as the base and not 0.*	
11	Disagree with explanation based on multiplication or division *Examples:* *I disagree because I do not think that 940 is 4 times as many. I think if it is 4 times as many it would be 3640.* *Disagree. As the graph shows that he sold 910 books in February and 940 books in March. 940 is not 4 times of 910.* *I disagree because if you divide March's total by 4 (940Z ÷ 4), you get 235, which is not February's total. February's total was 910*	
12	Disagree, with explanation that the increase cannot be 4 times as many books. *Example:* *I disagree because he only sold 30 more books in March. From 910 books he went to 940.*	
	Incorrect Response	
70	Agree or disagree, with explanation based on only relative heights of the bars shown *Examples:* *I agree because the graph shows that in March the bar went up four times.* *I disagree as if you look at the bar you will see between February and March there are only three bars, so he would have to say, "In March I sold three times as many books as I did in February."*	
79	Other incorrect (including crossed out, erased, stray marks, illegible, or off task) *Examples:* *I agree because in February he sold 30 less book then March.* *I disagree with the salesman because in February he sold 910 books. That would mean he would have sold 1820 books but he only sold 940 books in March.*	
	Nonresponse	
99	Blank	

Two-digit Diagnostic Codes

- Example: M01_14 (Data and Chance / Reasoning)

	10	11	12	70	79	V1	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	8.8	53.4	11.2	1.2	20.6	73.5	3.7	1.0	71.9	74.9
CHINESE TAIPEI	2.4	53.8	7.5	2.2	29.0	63.6	4.2	1.0	66.4	60.9
JAPAN	6.1	37.1	14.7	10.1	22.3	57.8	8.4	1.4	59.4	56.2
KOREA	2.2	52.9	15.8	7.0	17.5	71.0	3.7	0.8	72.0	70.1
SINGAPORE	8.3	58.5	7.2	5.6	16.4	74.0	2.3	1.7	78.4	69.9
INT'L AVG	3.1	23.8	8.2	7.3	40.1	35.1	12.5	5.0	35.4	34.8

Two-digit Diagnostic Codes

- Example: M01_02 (Number / Knowing)

M01_02

Write this as a decimal number.

$$8 + 50 + \frac{3}{100} + \frac{1}{10}$$

Answer: _____

Two-digit Diagnostic Codes

- Example: M01_02 (Number / Knowing)

ID: **M042081**	Mathematics Grade 8	Block_Seq: M01_02

Code	Response	Item: M042081
	Correct Response	
10	58.13	
	Incorrect Response	
70	$58\frac{13}{100}$	
71	58.31	
72	85.31	
79	Other incorrect (including crossed out, erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

Two-digit Diagnostic Codes

- Example: M01_02 (Number / Knowing)

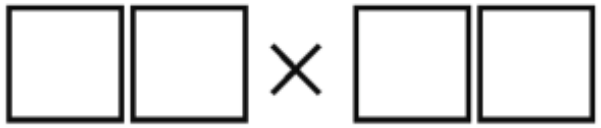
	10	70	71	72	79	V1	OMITTED	NOT REACHED	GIRLS	BOYS
HONG KONG	**68.9**	8.4	0.0	0.0	19.6	68.9	3.1	0.0	70.0	67.9
CHINESE TAIPEI	**54.0**	2.0	0.5	0.0	37.9	54.0	5.6	0.0	52.2	55.8
JAPAN	**48.4**	0.9	0.0	0.0	40.8	48.4	9.8	0.1	49.2	47.5
KOREA	**61.3**	0.7	0.0	0.1	34.1	61.3	3.6	0.2	60.2	62.3
SINGAPORE	**85.7**	2.6	0.0	0.0	10.5	85.7	1.1	0.1	87.6	84.0
INT'L AVG	**35.4**	2.2	0.5	0.2	48.6	35.4	13.0	0.2	36.8	34.0

Secondary 2 - MP06_04

ID: **MP62002** Mathematics Grade 8

Content Domain	Topic Area
Number	Integers

Write each of the digits 1, 2, 3, and 4 in a box below to make the **smallest** product. Each digit may only be used once.



M062002

Secondary 2 - MP06_04

Block_Seq: MP06_04

Topic	Cognitive Domain	Cognitive Area	Key	Max Pts
2	Reasoning	Evaluate	X	1

Code	Response	Item: M062002
	Correct Response	
10	13×24 OR 24×13	
	Incorrect Response	
70	14×23 OR 23×14	
71	32×41 OR 41×32 OR 31×42 OR 42×31 (trying "as large as possible")	
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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Faculty of Education
The University of Hong Kong
香 港 大 學 教 育 學 院

IEA

Policy 21
政策二十一

Thank you very much for your attention!

My e-mail address:

frederickleung@hku.hk

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

IEA

Policy 21
政策二十一