

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

**Development Webinar  
Event AC (Secondary Science)**

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牛年

科學

疫苗

# Smallpox

- a deadly disease throughout history

天花

- ❑ Deadly airborne viral infection
- ❑ During 19<sup>th</sup> century, the death toll was estimated to be 300-500 million
  - 3-5 million per year!!

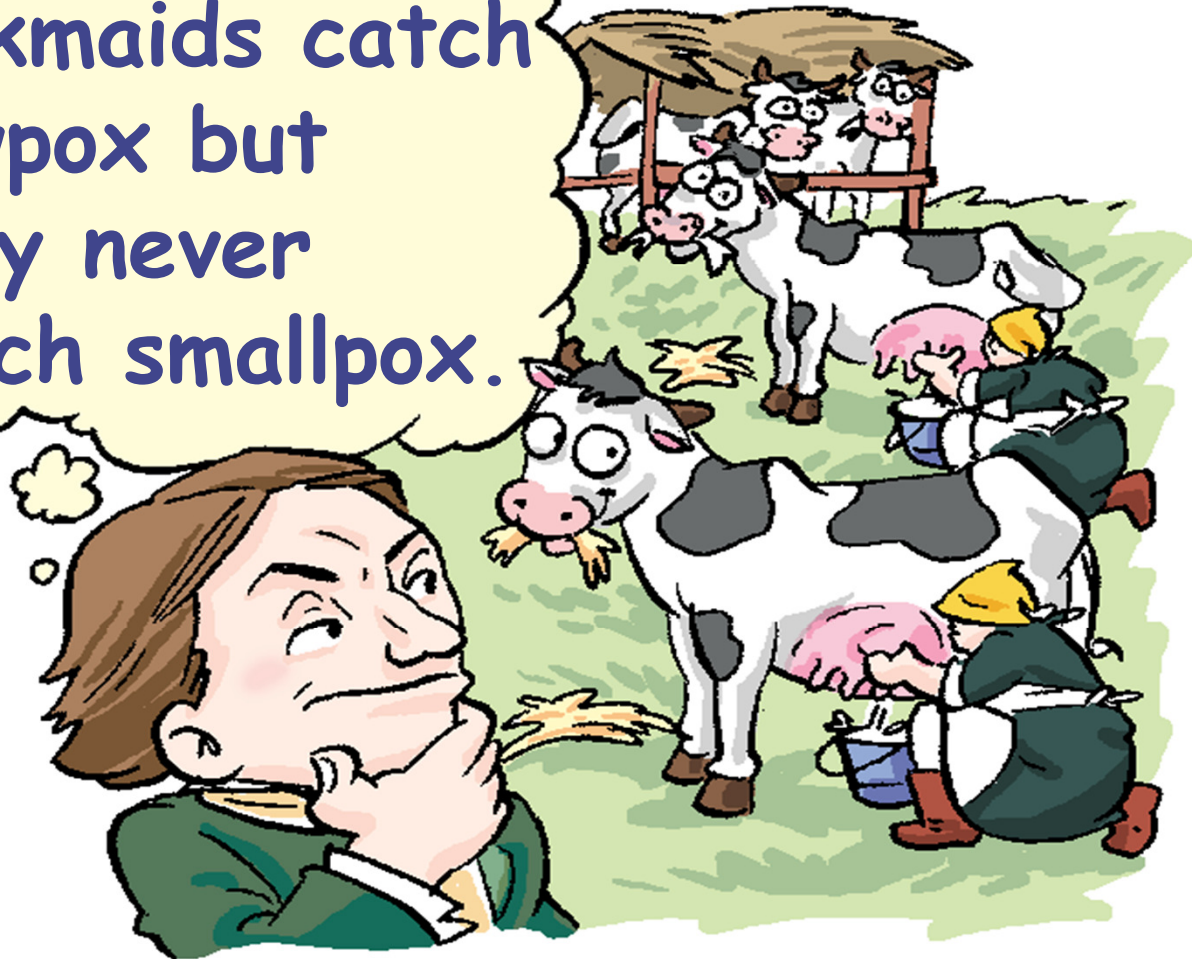


Pimples on the face to the whole body  
(Source: wikipedia)

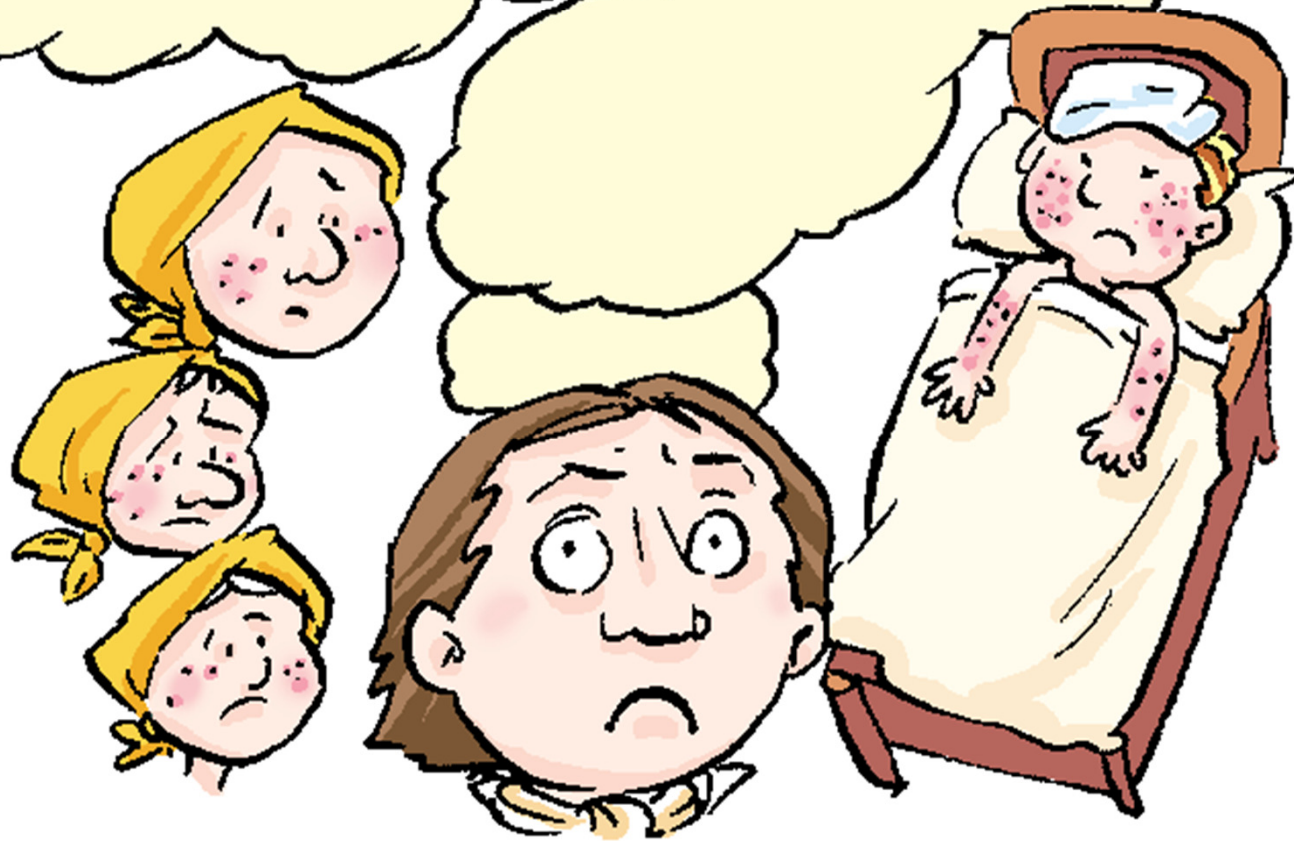
In the 18th century,  
**smallpox** was a serious disease.

Milkmaids catch  
cowpox but  
they never  
catch smallpox.

Dr. Jenner  
(1749-1823)



Why do milkmaids catch  
cowpox but not smallpox ?



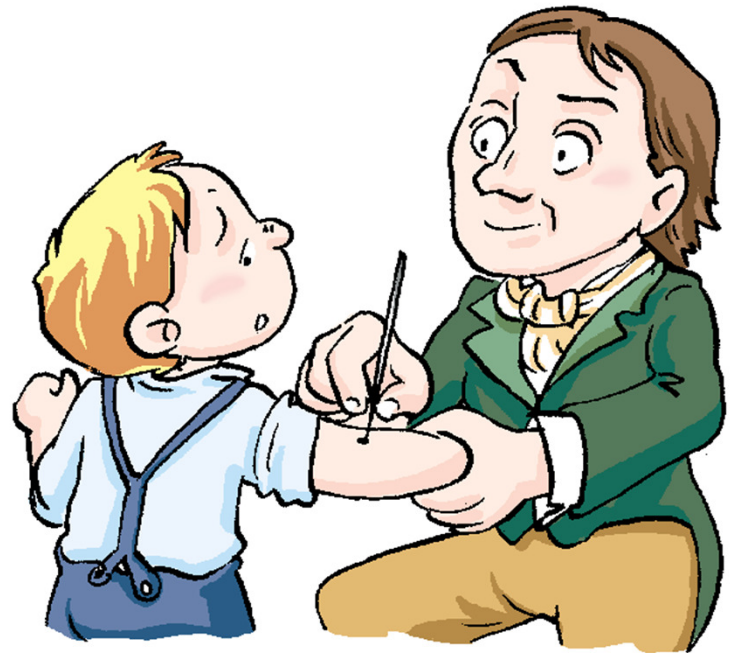
Perhaps milkmaids do not catch smallpox because they have caught cowpox before.



Dr. Jenner first put cowpox pus  
onto a boy's arm.

After a few days, he put smallpox  
pus onto the boy's arm.

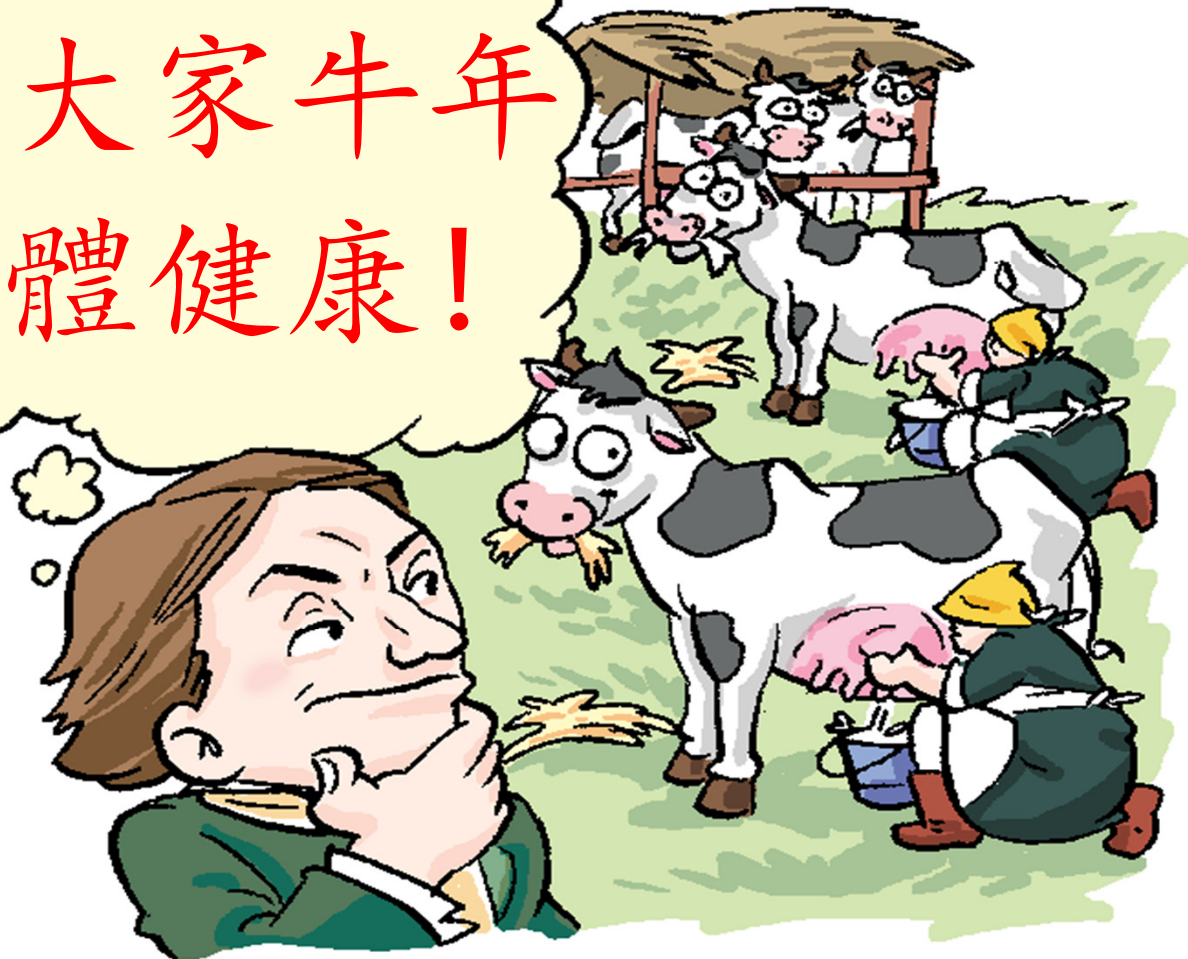
The boy did  
not fall ill !



I'm right! If we have  
caught cowpox before,  
we won't catch  
smallpox !



祝大家牛年  
身體健康！



YouTube: Edward Jenner story

# Idea of Evidence

**Evidence** consists of observation or data scientists collect. It is important for scientists to support their ideas.

In the story above, what was the **evidence** that Jenner used to support his idea? (tick the right box)

- ☐ Milkmaids who had caught cowpox before seldom catch smallpox.
- ☐ The boy who had recovered from cowpox did not catch smallpox after he received smallpox pus.

# Outline

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- What is TIMSS?
- What does it test? And what does it measure?
- Findings in TIMSS 2019 HK study
  - ▣ I'd compare them with the results of previous rounds
- HK students performance in selected items
  - ▣ Pedagogies.

# Background of TIMSS 2019

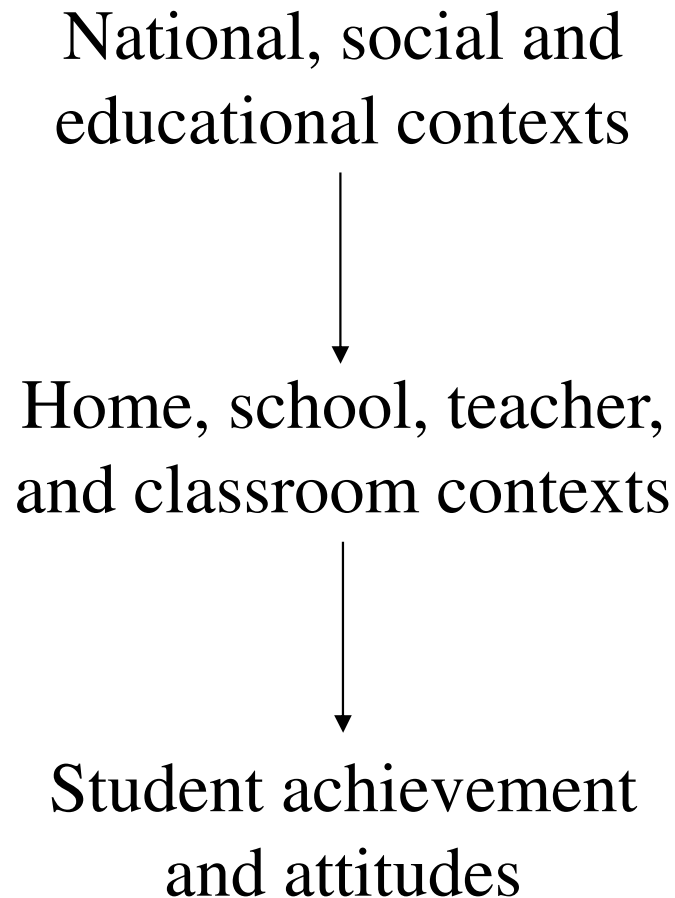
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- Trends in International Mathematics and Science Study
- TIMSS is conducted under the auspices of the International Association for the Evaluation of Educational Assessment (IEA)
- Its dates back to 1964
- Among others, it measures student achievement in mathematics and science at Grade 4 (Yr 5) and Grade 8 (Yr 9)



# Background of TIMSS 2019

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# Participating Countries/Regions

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- ~70 countries/regions participated in TIMSS 2019
- ~60 countries/regions participated in the 4<sup>th</sup> grade (Year 5) assessment
- ~45 countries/regions participated in the 8<sup>th</sup> grade (Year 9) assessment
- More than 580,000 students were tested worldwide

# From paperTIMSS to eTIMSS

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- TIMSS 2019 is transitioning from paper-and-pencil test (paperTIMSS) to computer-based assessment (eTIMSS)
- Transitioning to eTIMSS is to:
  - ▣ reflect the growing use of digital devices in school and everyday life
  - ▣ keep pace with an increasing worldwide reliance on digital communication and assessment
  - ▣ enable participating countries to capitalize on the benefits of technology to ask students to solve mathematics problems and conduct science investigations in interactive situations

TIMSS 2015  
paper

70% correct

TIMSS 2019  
electronic

50% correct

Comparable?

# Bridge Study in TIMSS 2019

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**2019**

Same set of items

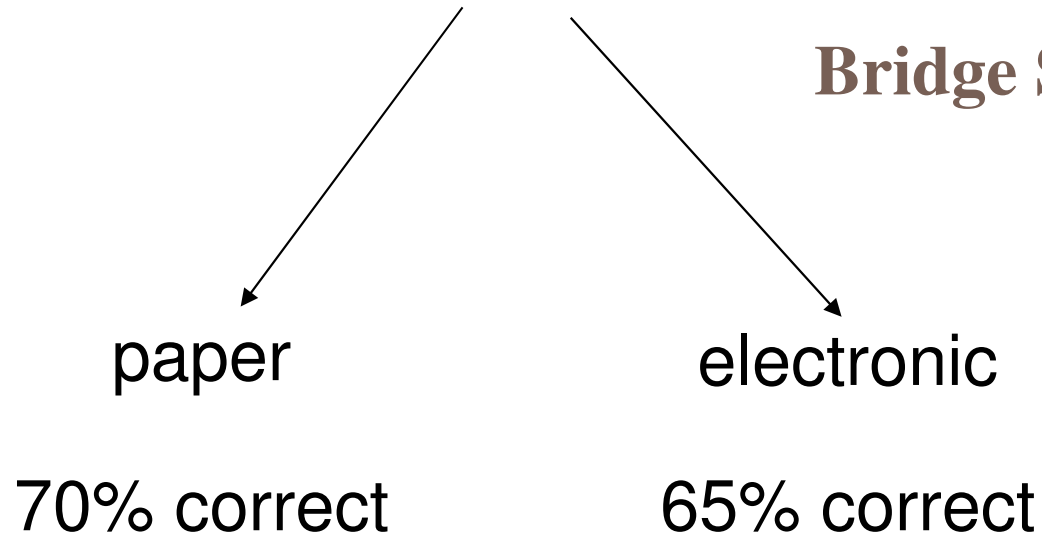
**Bridge Study**

paper

electronic

70% correct

65% correct



# TIMSS 2019 in Hong Kong

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- The Hong Kong samples included students from local and non-local schools
- 139 primary schools and 136 secondary schools
- 2968 Primary 4 students and 3265 Secondary 2 students were tested in eTIMSS
- 1329 Primary 4 students and 1423 Secondary 2 students were tested in the Bridge study

# Bridge and eTIMSS

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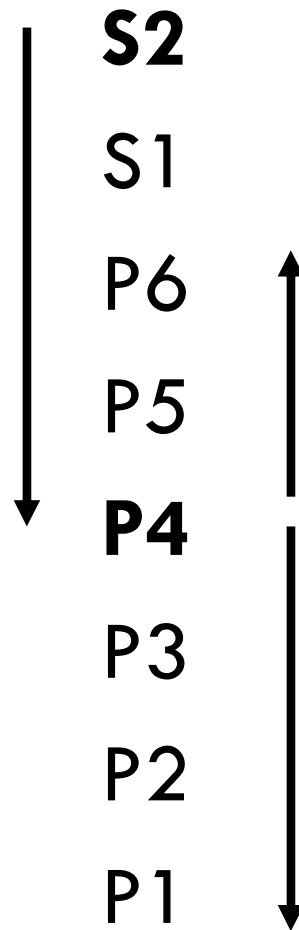
**Exhibit 6: eTIMSS 2019 International Average Percent Correct on Paper Bridge and eTIMSS Invariant Items**

| 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) |

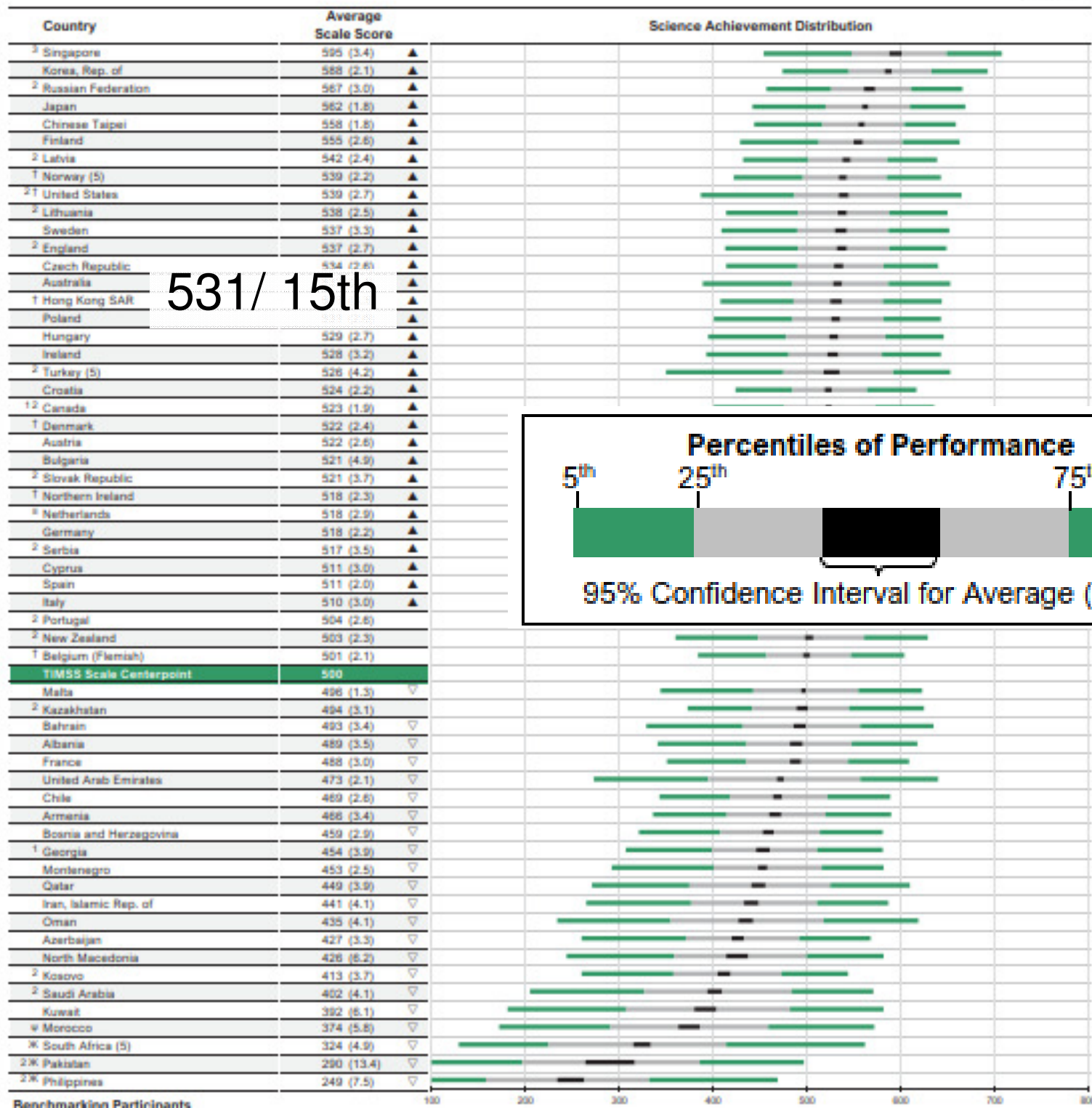
B>E indicates the bridge students performed significantly higher than the eTIMSS students ( $\alpha = 0.05$ ).

# Why do I cover Grade 4 and Grade 8 results?

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## Primary 4



# Primary 4 Science

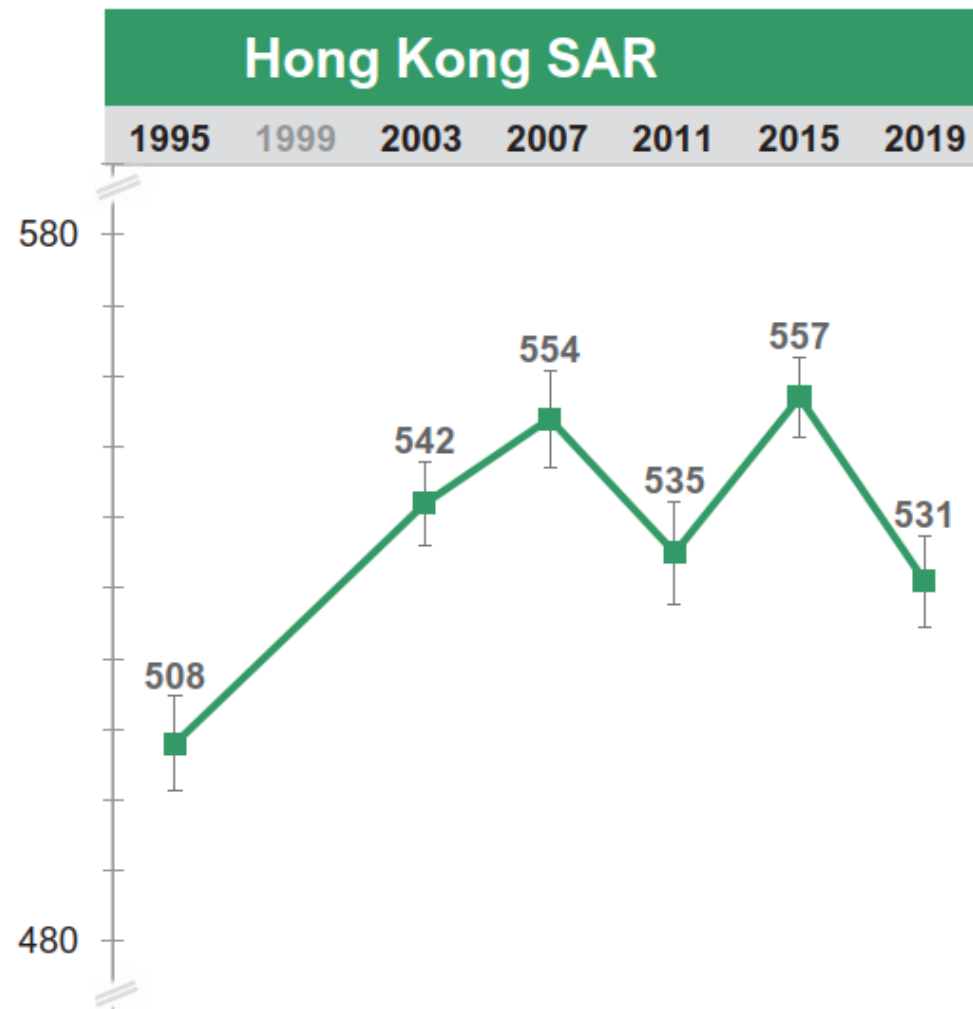
Science • Grade 4

Exhibit 2.1: Average Science Achievement and Scale Score Distributions

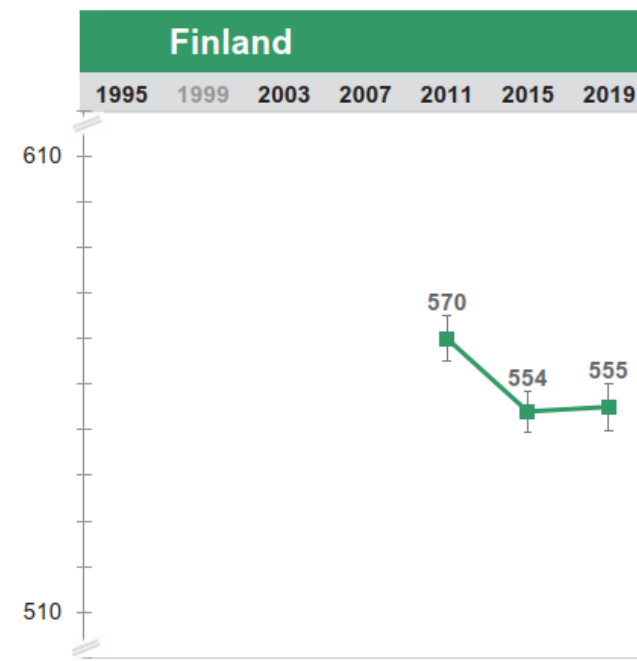
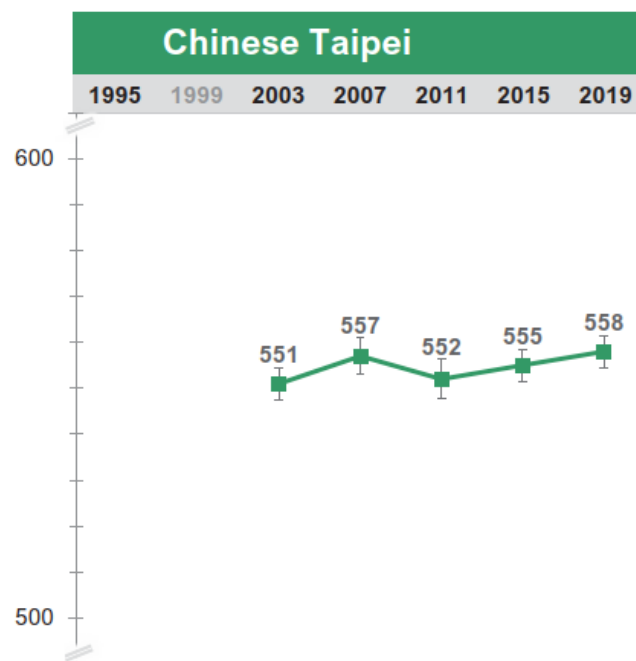
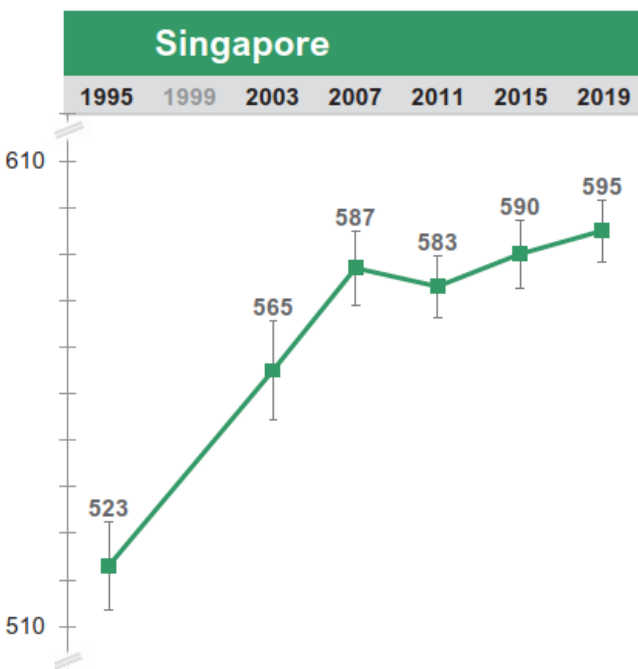
| Country                         | Average Scale Score | Science Achievement Distribution |
|---------------------------------|---------------------|----------------------------------|
| <sup>3</sup> Singapore          | 595 (3.4) ▲         |                                  |
| Korea, Rep. of                  | 588 (2.1) ▲         |                                  |
| <sup>2</sup> Russian Federation | 567 (3.0) ▲         |                                  |
| Japan                           | 562 (1.8) ▲         |                                  |
| Chinese Taipei                  | 558 (1.8) ▲         |                                  |
| Finland                         | 555 (2.6) ▲         |                                  |
| <sup>2</sup> Latvia             | 542 (2.4) ▲         |                                  |
| † Norway (5)                    | 539 (2.2) ▲         |                                  |
| <sup>2</sup> † United States    | 539 (2.7) ▲         |                                  |
| <sup>2</sup> Lithuania          | 538 (2.5) ▲         |                                  |
| Sweden                          | 537 (3.3) ▲         |                                  |
| <sup>2</sup> England            | 537 (2.7) ▲         |                                  |
| Czech Republic                  | 534 (2.6) ▲         |                                  |
| Australia                       | 533 (2.4) ▲         |                                  |
| † Hong Kong SAR                 | 531 (3.3) ▲         |                                  |

9<sup>th</sup>-20<sup>th</sup>: no stat. sign. diff.

# Trends in Primary 4 Science



| Country       | Average Scale Score | Differences Between Years |      |       |       |      | Science Achievement Distribution |  |  |  |  |
|---------------|---------------------|---------------------------|------|-------|-------|------|----------------------------------|--|--|--|--|
|               |                     | 2015                      | 2011 | 2007  | 2003  | 1995 |                                  |  |  |  |  |
| Hong Kong SAR |                     |                           |      |       |       |      |                                  |  |  |  |  |
| † 2019        | 531 (3.3)           | -25 ▽                     | -4   | -23 ▽ | -11 ▽ | 23 ▲ |                                  |  |  |  |  |
| † 2015        | 557 (2.9)           |                           | 22 ▲ | 2     | 14 ▲  | 49 ▲ |                                  |  |  |  |  |
| ² 2011        | 535 (3.7)           |                           |      | -19 ▽ | -8    | 27 ▲ |                                  |  |  |  |  |
| 2007          | 554 (3.5)           |                           |      |       | 12 ▲  | 46 ▲ |                                  |  |  |  |  |
| † 2003        | 542 (3.0)           |                           |      |       |       | 35 ▲ |                                  |  |  |  |  |
| 1995          | 508 (3.4)           |                           |      |       |       |      |                                  |  |  |  |  |



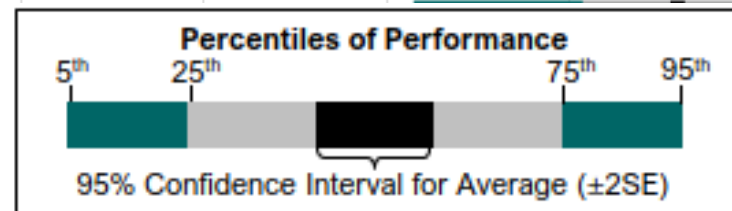
## Secondary 2

# Secondary 2 Science

Science • Grade 8

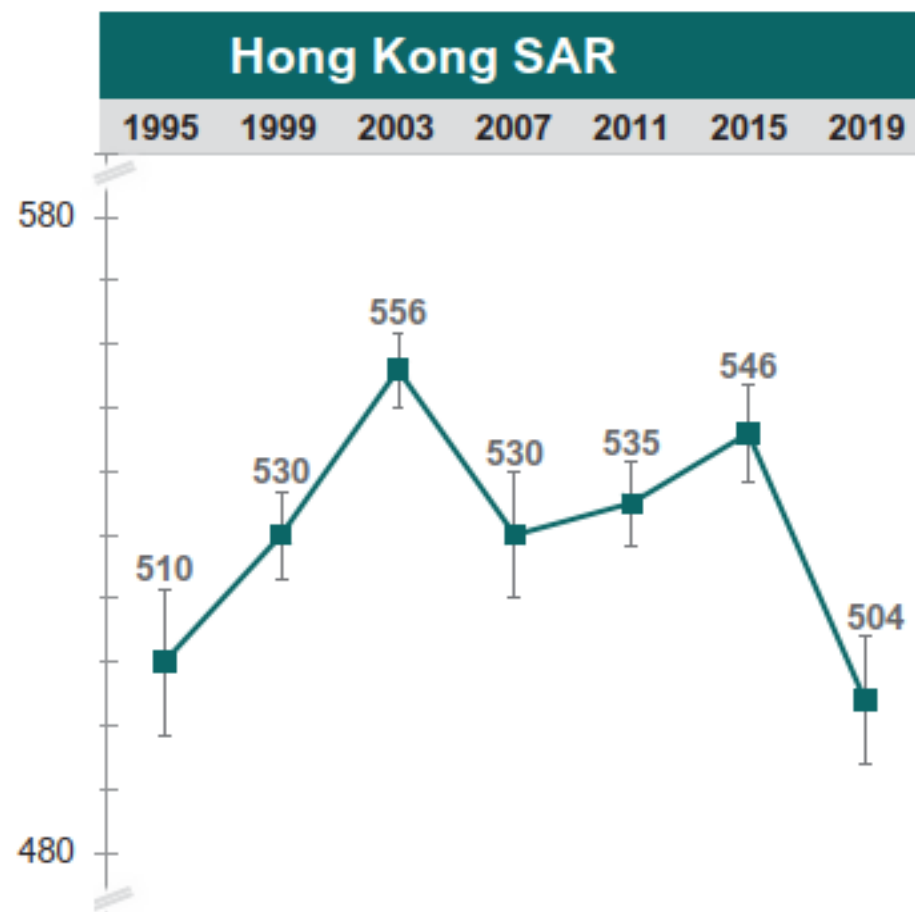
Exhibit 4.1: Average Science Achievement and Scale Score Distributions

| Country                         | Average Scale Score | Science Achievement Distribution |
|---------------------------------|---------------------|----------------------------------|
| <sup>2</sup> Singapore          | 608 (3.9) ▲         |                                  |
| Chinese Taipei                  | 574 (1.9) ▲         |                                  |
| Japan                           | 570 (2.1) ▲         |                                  |
| Korea, Rep. of                  | 561 (2.1) ▲         |                                  |
| <sup>2</sup> Russian Federation | 543 (4.2) ▲         |                                  |
| Finland                         | 543 (3.1) ▲         |                                  |
| Lithuania                       | 534 (3.0) ▲         |                                  |
| Hungary                         | 530 (2.6) ▲         |                                  |
| Australia                       | 528 (3.2) ▲         |                                  |
| Ireland                         | 523 (2.9) ▲         |                                  |
| † United States                 | 522 (4.7) ▲         |                                  |
| <sup>2</sup> Sweden             | 521 (3.2) ▲         |                                  |
| Portugal                        | 519 (2.9) ▲         |                                  |
| England                         | 517 (4.8) ▲         |                                  |
| Turkey                          | 515 (3.7) ▲         |                                  |
| <sup>3</sup> Israel             | 513 (4.2) ▲         |                                  |
| † Hong Kong SAR                 | 504 (5.2)           |                                  |
| Italy                           | 500 (2.6)           |                                  |
| TIMSS Scale Centerpoint         | 500                 |                                  |



14<sup>th</sup>-20<sup>th</sup>: no stat. sign. diff.

# Trends in Secondary 2 Science



| Country       | Average Scale Score | Differences Between Years |       |       |       |       |      | Science Achievement Distribution |
|---------------|---------------------|---------------------------|-------|-------|-------|-------|------|----------------------------------|
|               |                     | 2015                      | 2011  | 2007  | 2003  | 1999  | 1995 |                                  |
| Hong Kong SAR |                     |                           |       |       |       |       |      |                                  |
| † 2019        | 504 (5.2)           | -42 ▽                     | -32 ▽ | -27 ▽ | -53 ▽ | -26 ▽ | -6   |                                  |
| 2015          | 546 (3.9)           |                           | 11 ▲  | 16 ▲  | -10 ▽ | 16 ▲  | 36 ▲ |                                  |
| 2011          | 535 (3.4)           |                           |       | 5     | -21 ▽ | 6     | 25 ▲ |                                  |
| † 2007        | 530 (5.0)           |                           |       |       | -26 ▽ | 1     | 20 ▲ |                                  |
| † 2003        | 556 (3.0)           |                           |       |       |       | 27 ▲  | 46 ▲ |                                  |
| † 1999        | 530 (3.5)           |                           |       |       |       |       | 20 ▲ |                                  |
| 1995          | 510 (5.9)           |                           |       |       |       |       |      |                                  |

# Trend: Bridge & Previous Cycles (S2)

| Bridge 2019 vs. Previous TIMSS Cycles (Secondary 2) |                        |            |
|-----------------------------------------------------|------------------------|------------|
|                                                     | Science                |            |
|                                                     | Scale scores           | s.e.       |
| <b>2019 eTIMSS</b>                                  | <b>504</b>             | <b>5.2</b> |
| <b>2019 Bridge Study</b>                            | <b>531</b>             | <b>5.3</b> |
| <b>2015</b>                                         | <b>546<sup>#</sup></b> | <b>3.9</b> |
| <b>2011</b>                                         | <b>535</b>             | <b>3.4</b> |
| <b>2007</b>                                         | <b>530</b>             | <b>5.0</b> |
| <b>2003</b>                                         | <b>556<sup>#</sup></b> | <b>3.0</b> |
| <b>1999</b>                                         | <b>530</b>             | <b>3.5</b> |
| <b>1995</b>                                         | <b>510<sup>^</sup></b> | <b>5.9</b> |

<sup>^</sup> TIMSS 2019 Bridge result significantly higher

<sup>#</sup> TIMSS 2019 Bridge result significantly lower

## **Secondary 2: Gender**

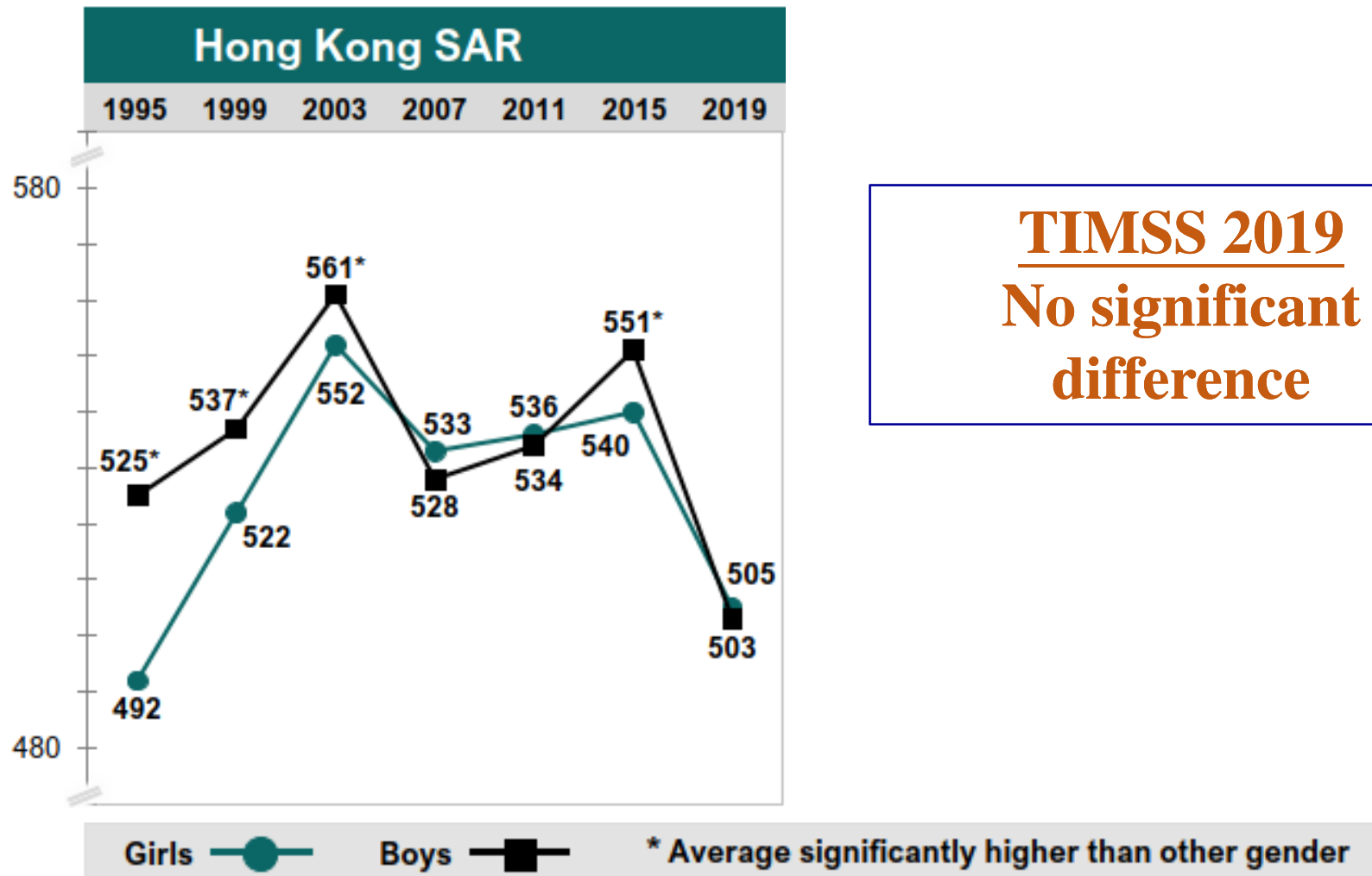
# TIMSS 2019

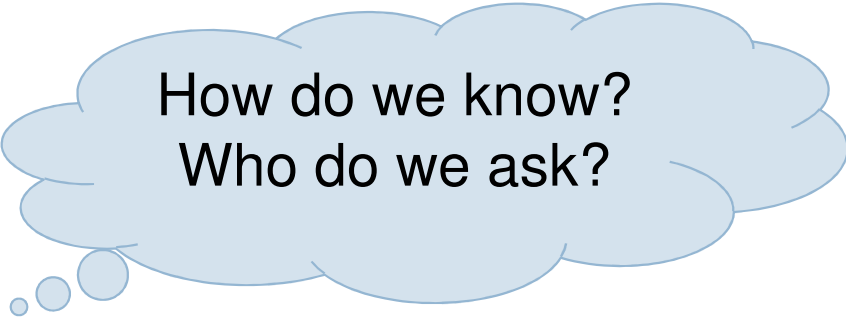
## Gender & Science Achievement (Secondary 2)

■ Difference statistically significant  
■ Difference not statistically significant

| Country                         | Girls               |                     | Boys                |                     | Difference (Absolute Value) | Gender Difference   |                    |
|---------------------------------|---------------------|---------------------|---------------------|---------------------|-----------------------------|---------------------|--------------------|
|                                 | Percent of Students | Average Scale Score | Percent of Students | Average Scale Score |                             | Girls Scored Higher | Boys Scored Higher |
| Oman                            | 48 (1.1)            | 485 (3.1)           | 52 (1.1)            | 431 (4.5)           | 54 (5.1)                    |                     |                    |
| Jordan                          | 48 (3.4)            | 480 (4.0)           | 52 (3.4)            | 427 (6.6)           | 53 (7.6)                    |                     |                    |
| Bahrain                         | 49 (0.9)            | 512 (2.6)           | 51 (0.9)            | 461 (2.8)           | 51 (3.7)                    |                     |                    |
| <sup>2</sup> Saudi Arabia       | 49 (0.9)            | 455 (3.3)           | 51 (0.9)            | 408 (3.9)           | 47 (5.0)                    |                     |                    |
| Kuwait                          | 53 (2.2)            | 461 (5.7)           | 47 (2.2)            | 426 (9.4)           | 35 (10.3)                   |                     |                    |
| Qatar                           | 50 (2.4)            | 488 (5.2)           | 50 (2.4)            | 461 (6.0)           | 28 (7.4)                    |                     |                    |
| <sup>2</sup> Egypt              | 55 (2.0)            | 402 (6.1)           | 45 (2.0)            | 374 (8.2)           | 27 (9.2)                    |                     |                    |
| United Arab Emirates            | 48 (1.8)            | 486 (3.9)           | 52 (1.8)            | 461 (4.0)           | 25 (6.5)                    |                     |                    |
| Finland                         | 48 (0.8)            | 552 (3.1)           | 52 (0.8)            | 533 (3.9)           | 19 (3.5)                    |                     |                    |
| Iran, Islamic Rep. of           | 47 (1.3)            | 459 (4.6)           | 53 (1.3)            | 441 (5.4)           | 17 (7.2)                    |                     |                    |
| Cyprus                          | 49 (0.6)            | 491 (2.4)           | 51 (0.6)            | 476 (2.5)           | 15 (3.1)                    |                     |                    |
| <sup>ψ</sup> South Africa (9)   | 52 (0.6)            | 376 (3.2)           | 48 (0.6)            | 364 (3.6)           | 12 (2.8)                    |                     |                    |
| <sup>2</sup> Sweden             | 49 (0.9)            | 527 (3.7)           | 51 (0.9)            | 516 (3.8)           | 11 (4.0)                    |                     |                    |
| Romania                         | 51 (0.9)            | 475 (4.3)           | 49 (0.9)            | 465 (4.9)           | 10 (3.9)                    |                     |                    |
| Turkey                          | 50 (1.3)            | 520 (3.8)           | 50 (1.3)            | 510 (5.1)           | 10 (5.1)                    |                     |                    |
| <sup>2</sup> Kazakhstan         | 49 (1.1)            | 483 (3.4)           | 51 (1.1)            | 474 (3.6)           | 9 (3.4)                     |                     |                    |
| Malaysia                        | 51 (1.1)            | 463 (3.5)           | 49 (1.1)            | 458 (4.3)           | 5 (3.7)                     |                     |                    |
| Ireland                         | 49 (1.1)            | 526 (3.0)           | 51 (1.1)            | 521 (3.9)           | 5 (3.8)                     |                     |                    |
| Lebanon                         | 49 (1.4)            | 379 (5.3)           | 51 (1.4)            | 374 (5.2)           | 5 (5.0)                     |                     |                    |
| <sup>†</sup> United States      | 49 (0.9)            | 525 (3.9)           | 51 (0.9)            | 520 (6.1)           | 5 (4.3)                     |                     |                    |
| England                         | 53 (1.9)            | 518 (5.5)           | 47 (1.9)            | 515 (6.6)           | 3 (7.2)                     |                     |                    |
| Lithuania                       | 50 (1.0)            | 535 (3.0)           | 50 (1.0)            | 533 (3.6)           | 2 (2.9)                     |                     |                    |
| <sup>†</sup> Hong Kong SAR      | 46 (2.1)            | 505 (5.9)           | 54 (2.1)            | 503 (6.3)           | 2 (6.5)                     |                     |                    |
| Morocco                         | 50 (0.7)            | 395 (2.9)           | 50 (0.7)            | 393 (2.9)           | 2 (2.4)                     |                     |                    |
| <sup>1</sup> Georgia            | 48 (1.2)            | 447 (4.4)           | 52 (1.2)            | 446 (4.5)           | 1 (4.3)                     |                     |                    |
| Australia                       | 49 (1.5)            | 529 (3.1)           | 51 (1.5)            | 528 (4.6)           | 0 (4.7)                     |                     |                    |
| <sup>†</sup> Norway (9)         | 49 (0.7)            | 495 (3.5)           | 51 (0.7)            | 496 (3.8)           | 1 (3.9)                     |                     |                    |
| <sup>†</sup> New Zealand        | 48 (2.1)            | 497 (3.6)           | 52 (2.1)            | 500 (4.9)           | 3 (5.0)                     |                     |                    |
| <sup>3</sup> Israel             | 52 (1.7)            | 512 (4.5)           | 48 (1.7)            | 515 (5.0)           | 3 (4.6)                     |                     |                    |
| France                          | 49 (0.8)            | 487 (2.6)           | 51 (0.8)            | 490 (3.6)           | 4 (3.4)                     |                     |                    |
| Chinese Taipei                  | 50 (0.9)            | 572 (2.4)           | 50 (0.9)            | 576 (2.5)           | 4 (2.9)                     |                     |                    |
| Portugal                        | 50 (1.1)            | 516 (3.2)           | 50 (1.1)            | 522 (3.4)           | 6 (3.1)                     |                     |                    |
| <sup>2</sup> Singapore          | 49 (0.7)            | 604 (4.5)           | 51 (0.7)            | 611 (4.5)           | 7 (4.4)                     |                     |                    |
| <sup>2</sup> Russian Federation | 48 (1.0)            | 539 (4.5)           | 52 (1.0)            | 546 (4.6)           | 7 (3.5)                     |                     |                    |
| Italy                           | 50 (1.0)            | 497 (2.8)           | 50 (1.0)            | 504 (3.0)           | 7 (2.7)                     |                     |                    |
| Japan                           | 52 (1.0)            | 565 (2.4)           | 48 (1.0)            | 575 (2.5)           | 10 (2.5)                    |                     |                    |
| Korea, Rep. of                  | 48 (1.4)            | 555 (2.9)           | 52 (1.4)            | 566 (2.6)           | 10 (3.5)                    |                     |                    |
| Chile                           | 49 (1.6)            | 457 (3.6)           | 51 (1.6)            | 468 (3.9)           | 11 (4.7)                    |                     |                    |
| Hungary                         | 50 (0.9)            | 520 (2.9)           | 50 (0.9)            | 540 (3.2)           | 20 (3.1)                    |                     |                    |
| International Average           | 50 (0.2)            | 495 (0.6)           | 50 (0.2)            | 485 (0.8)           |                             |                     |                    |

# Gender and Achievement (S2)





How do we know?  
Who do we ask?

## **Primary 4: Socioeconomic status; resources**

# Primary 4

## Number of books in the home (students):

- 1) 0-10
- 2) 11-25
- 3) 26-100
- 4) 101-200
- 5) More than 200

## Number of home study supports (students):

- 1) None
- 2) Internet connection or own room
- 3) Both internet connection and own room

## Highest level of occupation of either parent (parents):

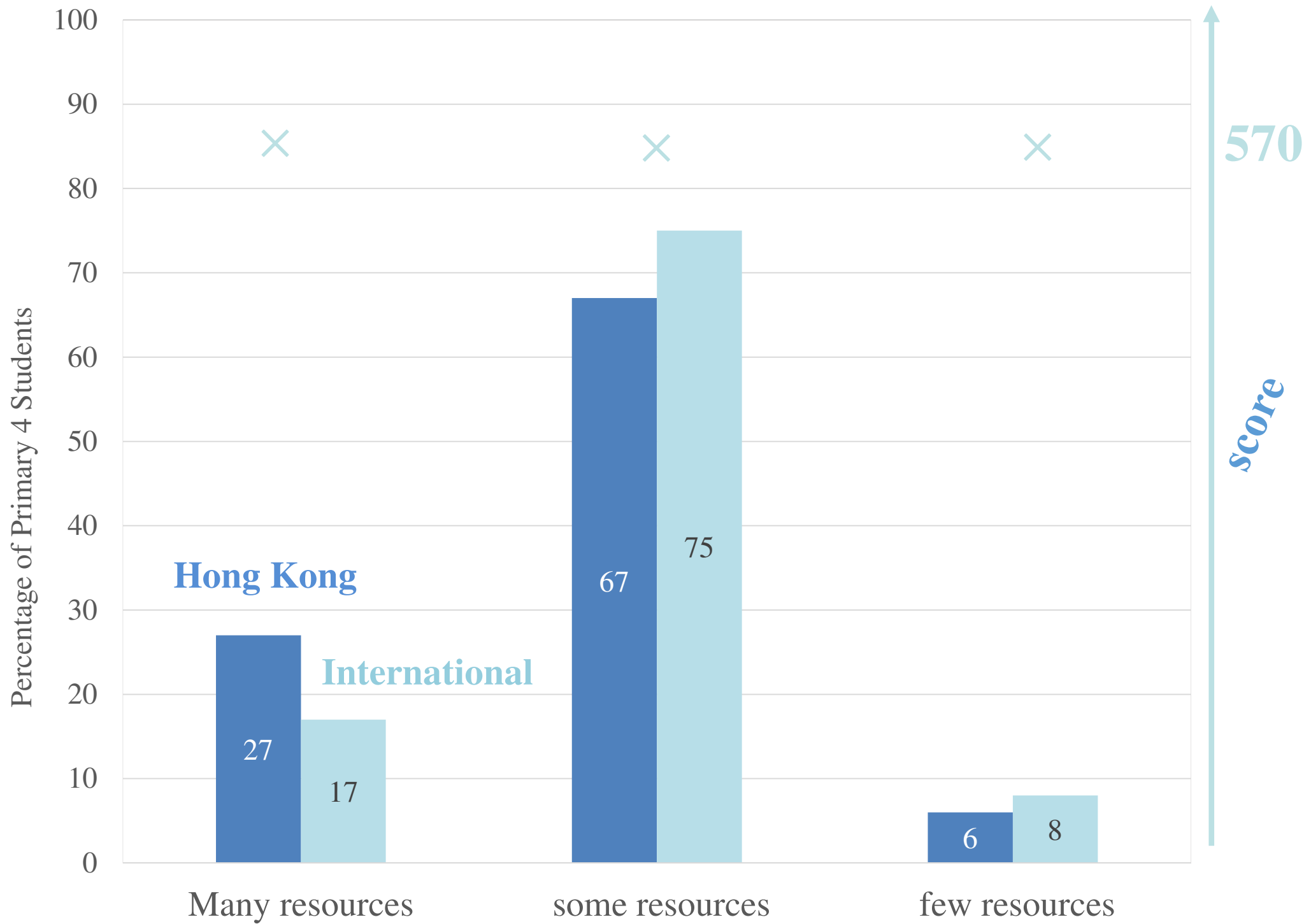
- 1) Has never worked outside home for pay, general laborer, or semi-professional (skilled agricultural or fishery worker, craft or trade worker, plant or machine operator)
- 2) Clerical (clerk or service or sales worker)
- 3) Small business owner
- 4) Professional (corporate manager or senior official, professional, or technician or associate professional)

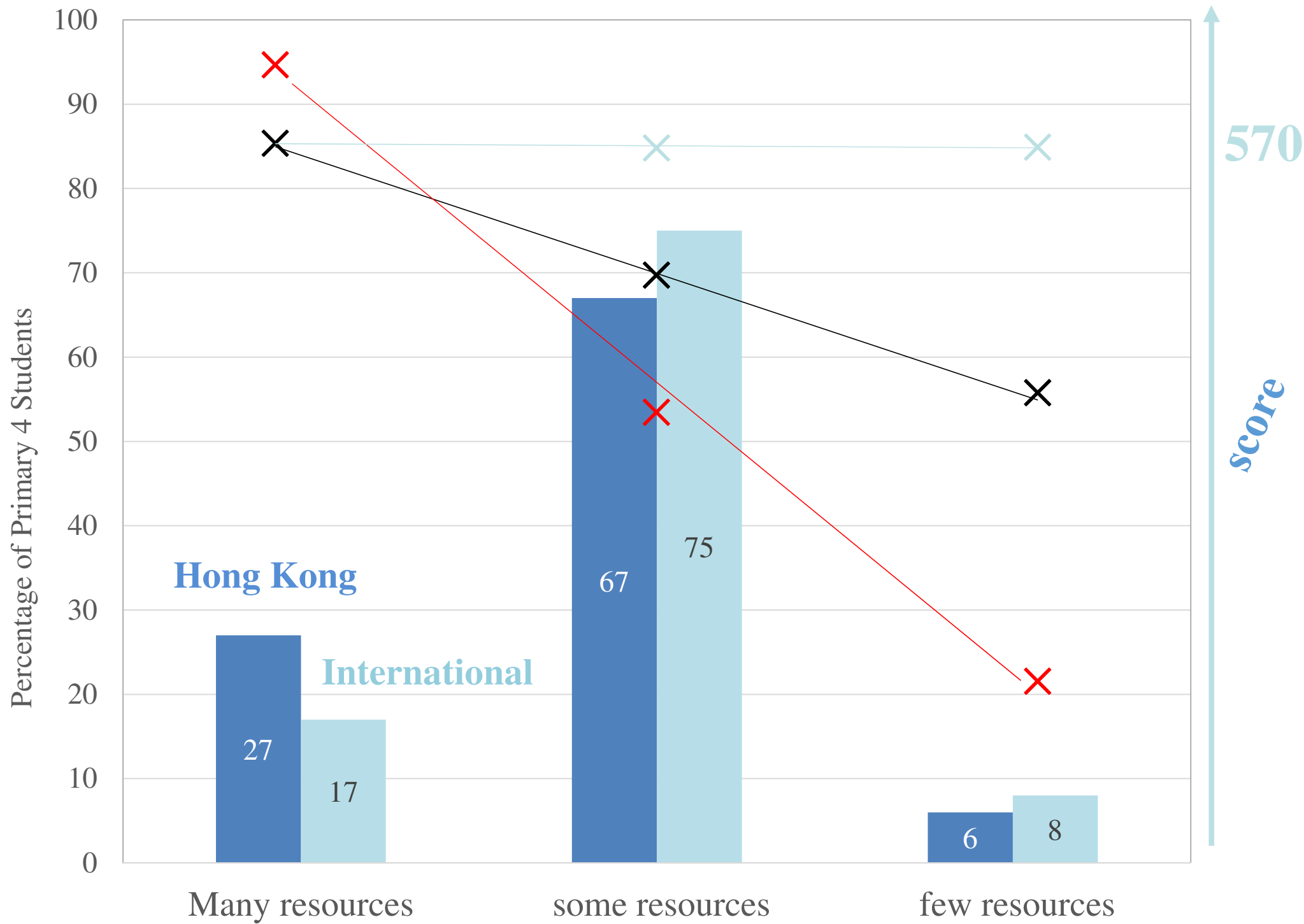
## Number of children's books in the home (parents):

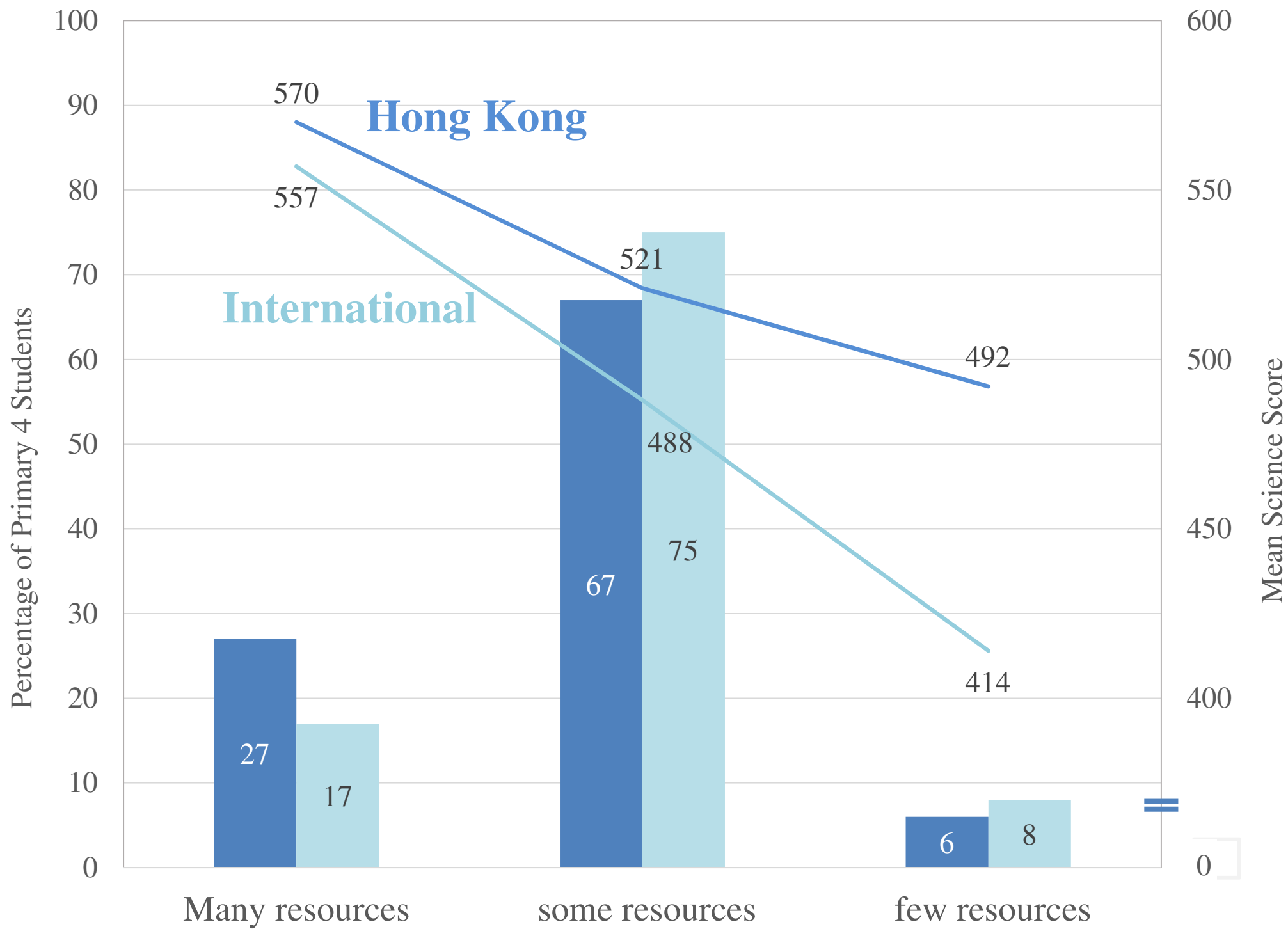
- 1) 0-10
- 2) 11-25
- 3) 26-50
- 4) 51-100
- 5) More than 100

## Highest level of education of either parent (parents):

- 1) Finished some primary or lower secondary or did not go to school
- 2) Finished lower secondary
- 3) Finished upper secondary
- 4) Finished post-secondary education
- 5) Finished university or higher







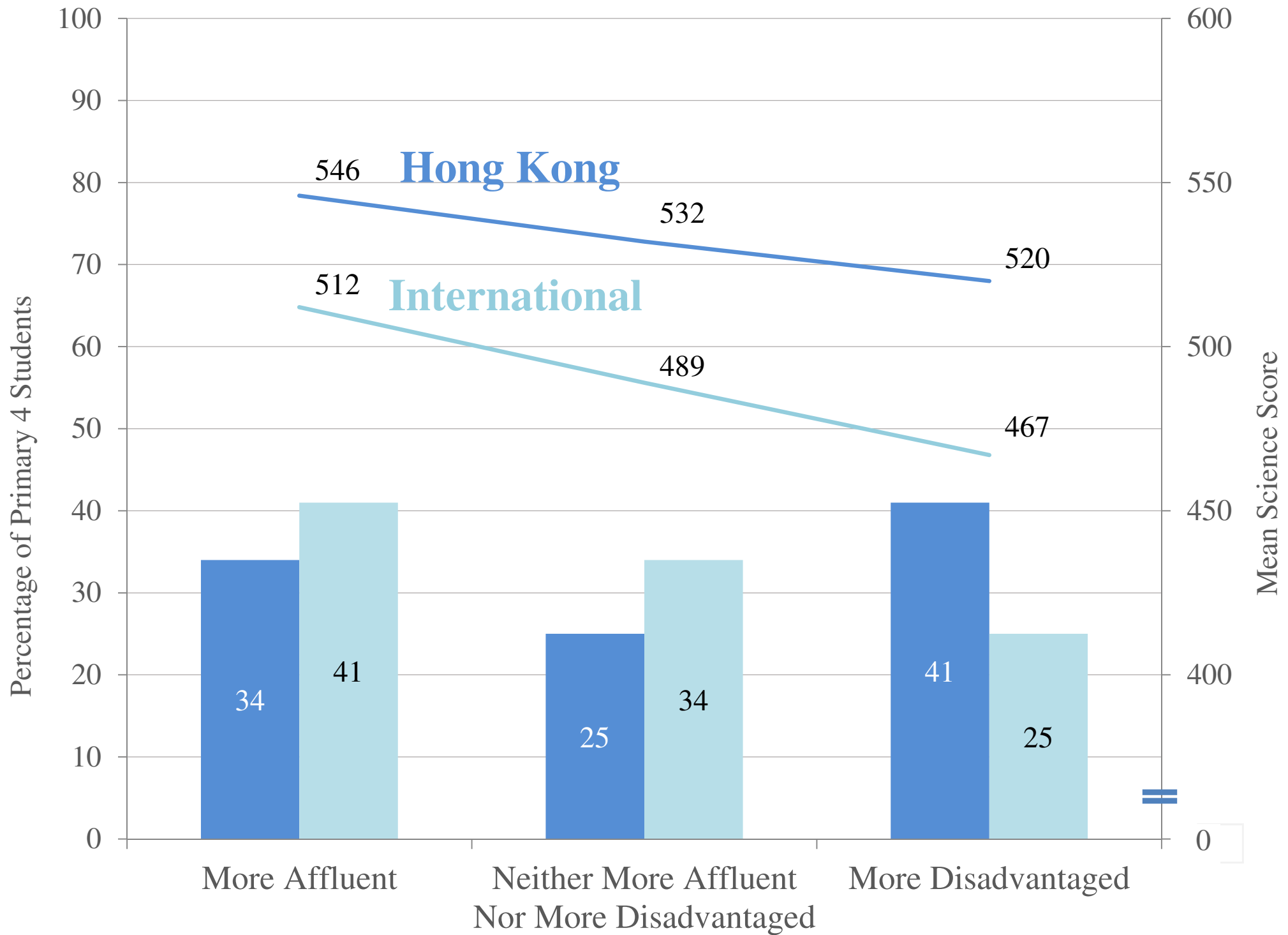
Approximately what percentage of students in your school have the following backgrounds?

|                                                         | 0 to 10%              | 11 to 25%             | 26 to 50%             | More than 50%         |
|---------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1) Come from economically disadvantaged homes - - - - - | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2) Come from economically affluent homes - - - - -      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**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



## **Secondary 2: Socioeconomic status; resources**

# Secondary 2

## Number of books in the home:

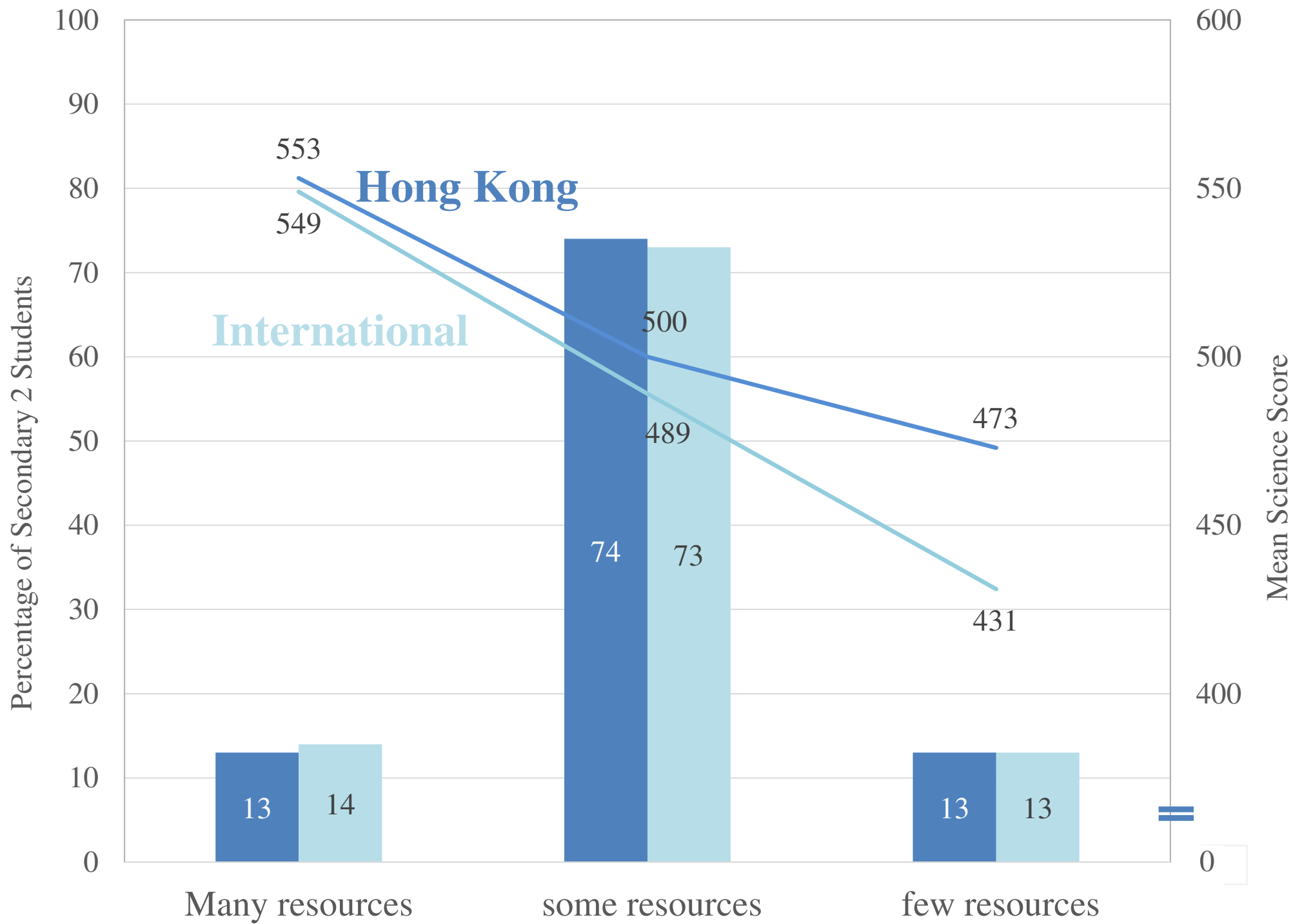
- 1) 0-10
- 2) 11-25
- 3) 26-100
- 4) 101-200
- 5) More than 200

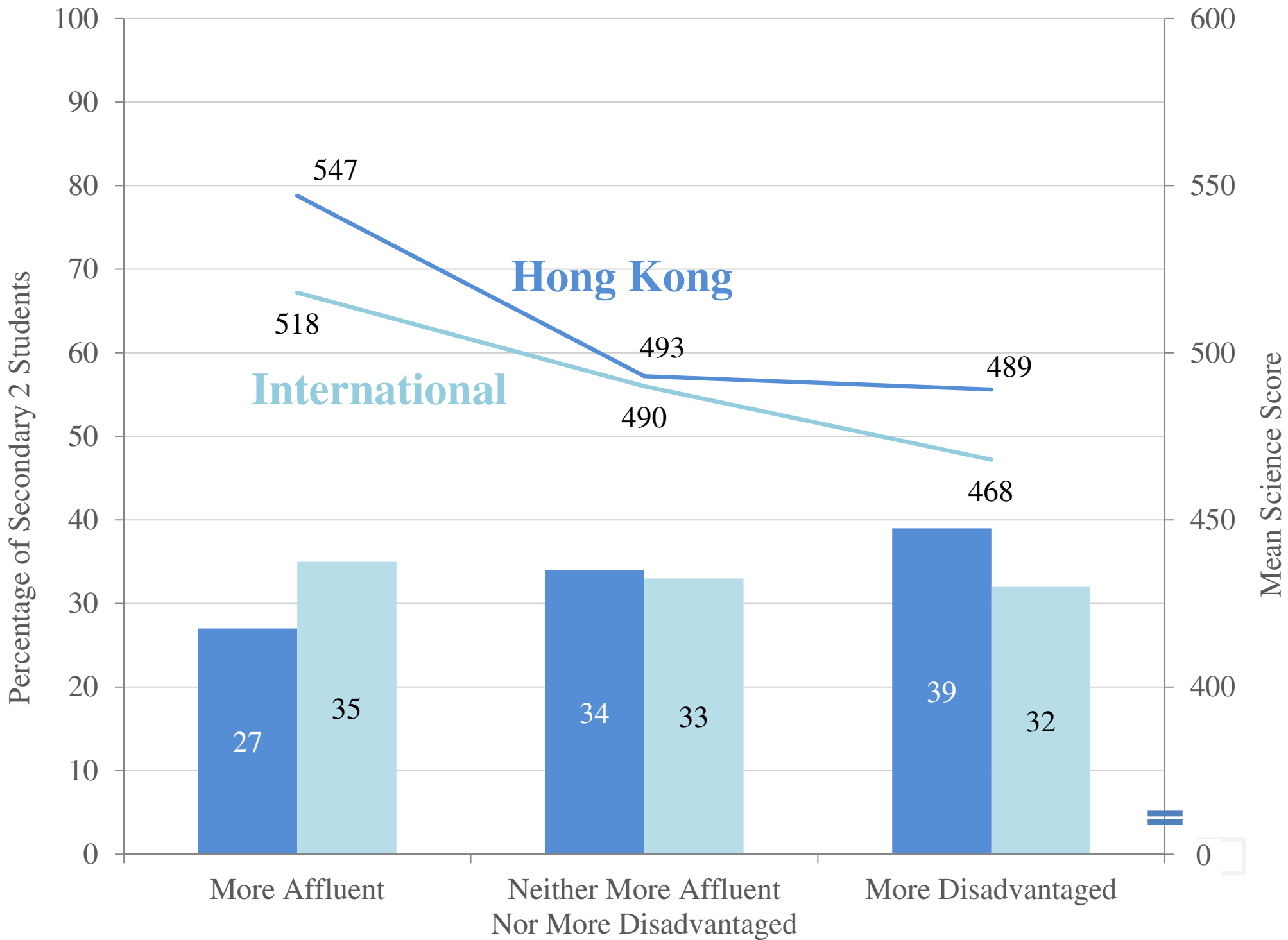
## Number of home study supports:

- 1) None
- 2) Internet connection or own room
- 3) Both internet connection and own room

## Highest level of education of either parent:

- 1) Finished some primary or lower secondary or did not go to school
- 2) Finished lower secondary
- 3) Finished upper secondary
- 4) Finished post-secondary education
- 5) Finished university or higher

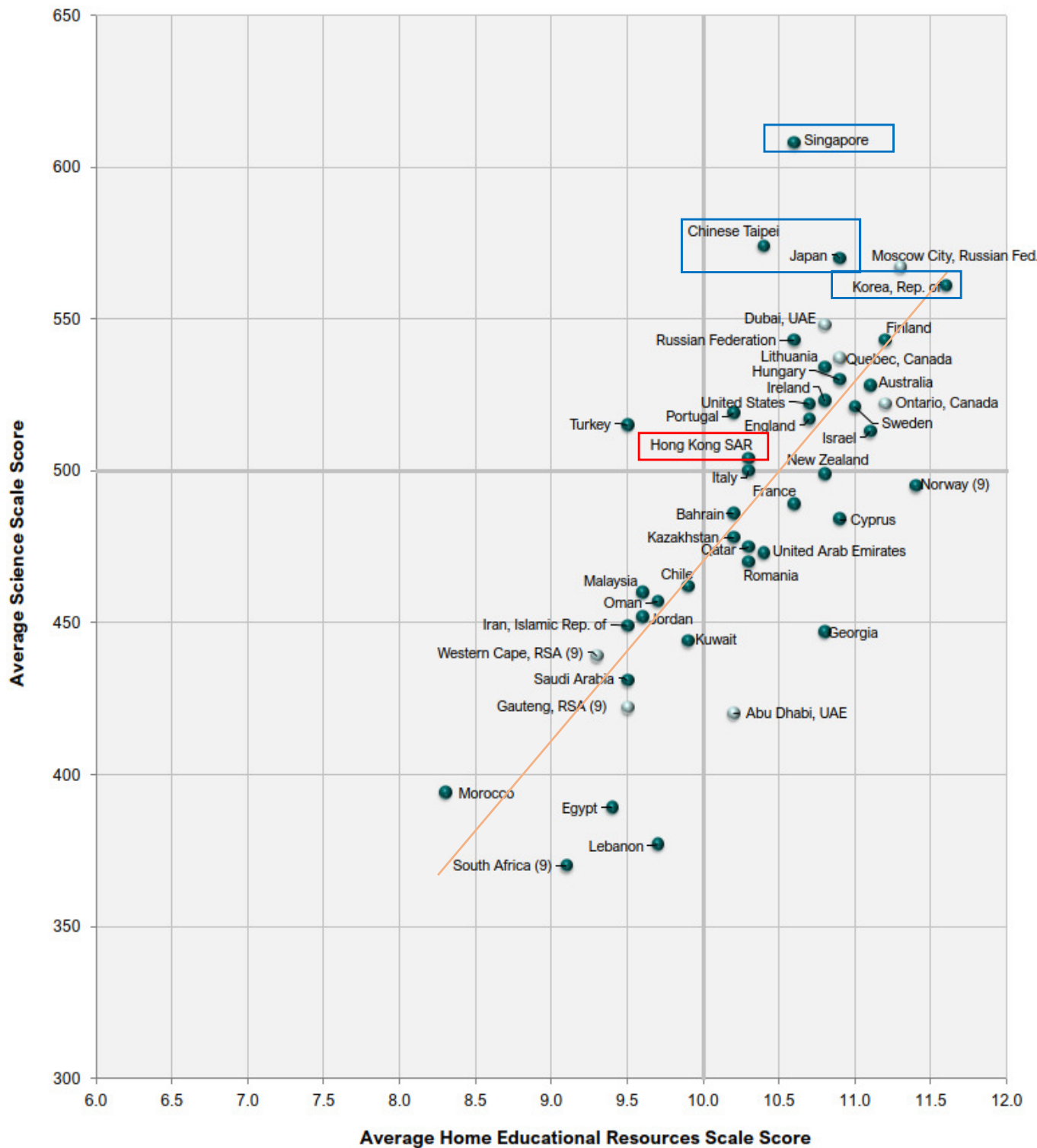




## Secondary 2

# Home Educational Resources

Average Science Achievement by Home Educational Resources



# A Short Summary

46

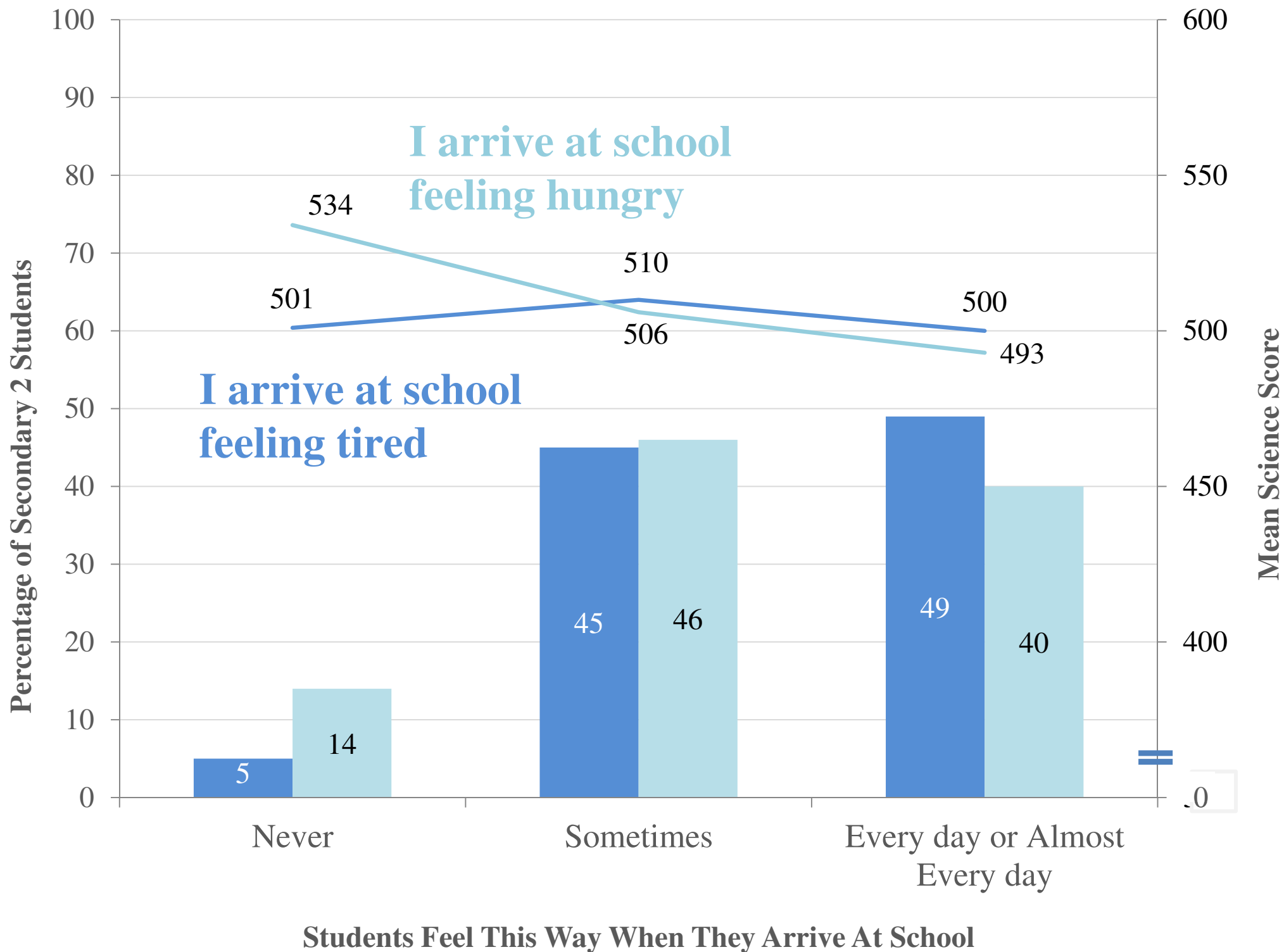
- P4: There have been ups and downs over the past 25 years.
  - ▣ No evidence that ‘we have been getting worse’.
  - ▣ Nor evidence that ‘we have been getting better’.
- S2: We are at the 20 years low
- Switching to e-test negatively impacted on students’ achievement.

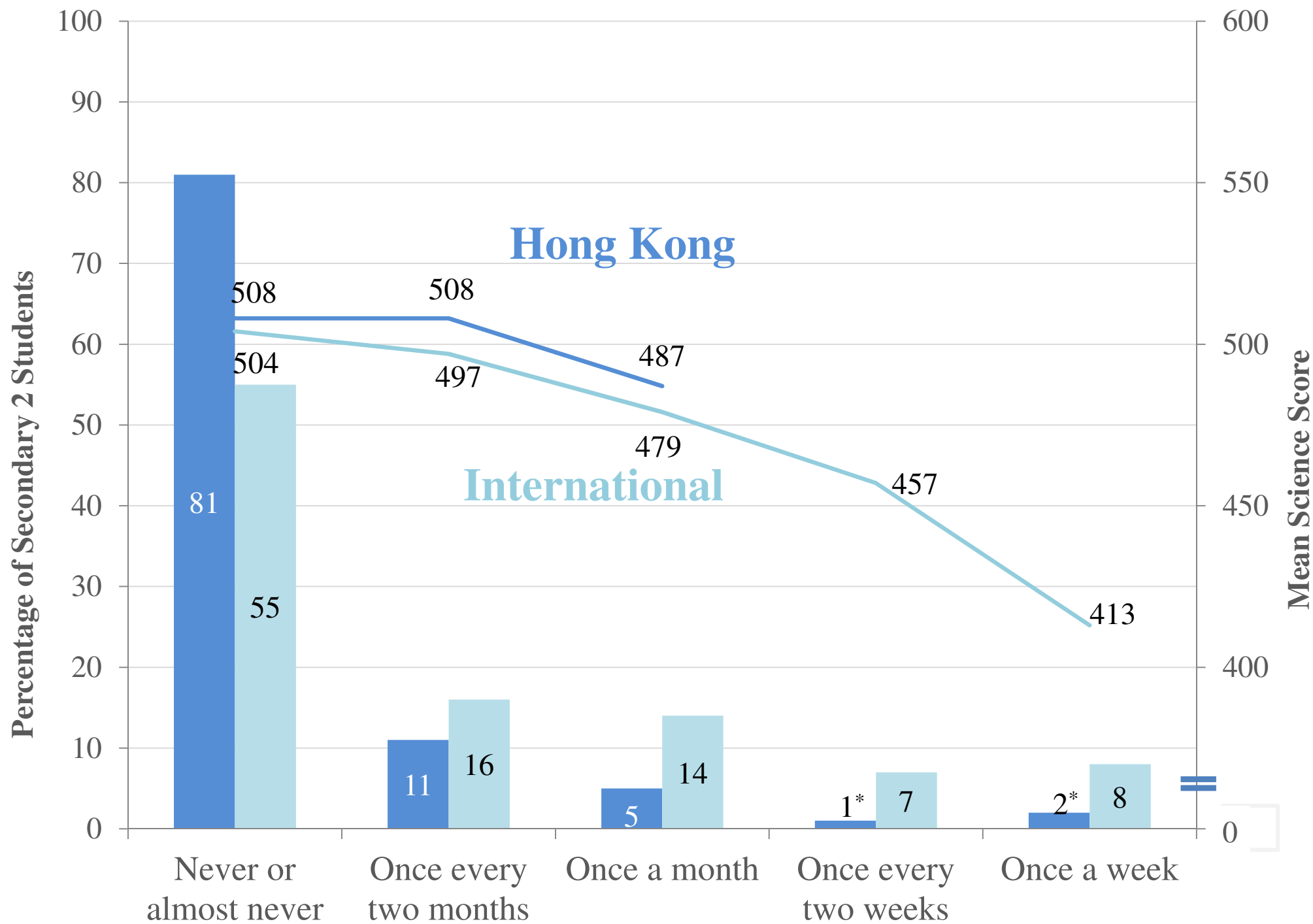
# A Short Summary



- There's no gender differences overall
- In primary school, the association between Socioeconomic status and achievement in HK is weaker than the international association.
  - ▣ In S2, it still applies for students of middle to low SES
  - ▣ High SES are privileged.

## **Secondary 2: Students' well-being and absence**





\* % too low for score estimation

# A short summary – S2

51

- The attendance of HK students was remarkable as compared with the world
- The data prompts us to support those who arrive at school feeling hungry and/or tired.
- These all may relate to SES – but we need to further investigate.

**What do the scores  
mean? (Secondary 2)**

# Four Levels of International Benchmarks

53



## **Low** International Benchmark

*Students show limited understanding of scientific principles and concepts and limited knowledge of science facts.*

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

# Four Levels of International Benchmarks

54



## Intermediate International Benchmark

*Students show and apply some knowledge of biology and the physical sciences.*

- Students demonstrate limited knowledge of **characteristics of animals and of animals' adaptations to their environment**. They can apply knowledge of ecosystems and the interaction of living things with their environment.
- Students show some knowledge of the structure and properties of matter and chemical changes.
- Students can separate conductors from insulators based on differences in electric current, recognize energy change in an everyday object moving downhill, and recognize that the gravity on Earth is different than on another planet.
- Students can interpret information from graphs and pictorial diagrams.

Dixon read a fact sheet about crocodiles.

### **Crocodile Facts**

1. Crocodiles have a lifespan of up to 75 years.
2. Crocodiles today look like ancient crocodiles found in fossils.
3. Crocodiles have an angle of vision of  $290^\circ$  as shown in the diagram.



How can a crocodile's angle of vision help it to survive in its environment?

Give one reason.

The crocodile can see predators and prey almost all of the way around body without moving its head.

Dixon read a fact sheet about crocodiles.

Crocodile Facts

- 1. Crocodiles have a lifespan of up to 75 years
- 2. Crocodiles today look like ancient crocodiles
- 3. Crocodiles have an angle of vision of 290 degrees



How can a crocodile's angle of vision help it to survive in its environment?

Give one reason.

|                                 |          |   |
|---------------------------------|----------|---|
| Japan                           | 85 (1.6) | ▲ |
| <sup>2</sup> Singapore          | 84 (1.5) | ▲ |
| Portugal                        | 79 (1.9) | ▲ |
| Ireland                         | 76 (2.2) | ▲ |
| Korea, Rep. of                  | 75 (2.1) | ▲ |
| Turkey                          | 75 (2.0) | ▲ |
| <sup>3</sup> Israel             | 72 (1.9) | ▲ |
| Finland                         | 72 (1.8) | ▲ |
| France                          | 69 (2.2) | ▲ |
| Australia                       | 68 (1.9) | ▲ |
| Lithuania                       | 68 (2.4) | ▲ |
| <sup>2</sup> Sweden             | 68 (2.2) | ▲ |
| England                         | 67 (2.7) | ▲ |
| † United States                 | 66 (1.5) | ▲ |
| <sup>2</sup> Russian Federation | 65 (2.3) | ▲ |
| Hungary                         | 63 (2.4) | ▲ |
| Chinese Taipei                  | 63 (1.8) | ▲ |
| † New Zealand                   | 62 (2.5) | ▲ |
| Italy                           | 62 (2.1) | ▲ |
| † Norway (9)                    | 62 (2.7) | ▲ |
| Cyprus                          | 56 (2.3) |   |
| International Average           | 55 (0.3) |   |
| <sup>2</sup> Kazakhstan         | 54 (2.9) |   |
| Bahrain                         | 54 (1.6) |   |
| Romania                         | 49 (2.8) | ▼ |
| Chile                           | 48 (2.5) | ▼ |
| Qatar                           | 44 (1.8) | ▼ |
| Jordan                          | 44 (2.3) | ▼ |
| United Arab Emirates            | 44 (1.0) | ▼ |
| Iran, Islamic Rep. of           | 44 (2.1) | ▼ |
| † Hong Kong SAR                 | 40 (2.7) | ▼ |

# Four Levels of International Benchmarks

57

## High International Benchmark

*Students apply understanding of concepts from biology, chemistry, physics, and Earth science.*

In some large cities, owners of large buildings and houses have installed gardens on the roofs. Having more gardens helps reduce the amount of carbon dioxide in the air.

How does increasing the number of gardens help reduce the amount of carbon dioxide in the air?

The trees and plants in the gardens take carbon dioxide out of the air during photosynthesis and give off oxygen.

|                              |                 |   |
|------------------------------|-----------------|---|
| 2 Singapore                  | 85 (1.5)        | ▲ |
| Chinese Taipei               | 69 (2.0)        | ▲ |
| 2 Kazakhstan                 | 68 (2.3)        | ▲ |
| Turkey                       | 67 (2.4)        | ▲ |
| 2 Russian Federation         | 65 (2.5)        | ▲ |
| 2 Sweden                     | 63 (2.6)        | ▲ |
| † Hong Kong SAR              | 60 (2.9)        | ▲ |
| Korea, Rep. of               | 58 (2.5)        | ▲ |
| Australia                    | 57 (2.0)        | ▲ |
| Qatar                        | 57 (2.0)        | ▲ |
| 3 Israel                     | 57 (2.2)        | ▲ |
| Ireland                      | 56 (2.3)        | ▲ |
|                              | 53 (2.7)        |   |
|                              | 52 (2.3)        |   |
| United States                | 51 (2.5)        |   |
| Bahrain                      | 50 (2.1)        |   |
| Romania                      | 49 (2.5)        |   |
| United Arab Emirates         | 49 (1.2)        |   |
| Finland                      | 49 (1.8)        |   |
| Kuwait                       | 49 (2.8)        |   |
| <b>International Average</b> | <b>48 (0.4)</b> |   |
| Jordan                       | 48 (2.6)        |   |
| Portugal                     | 47 (3.0)        |   |

So this is not true HK students are always poor at writing.

# Four Levels of International Benchmarks

59



## High International Benchmark

*Students apply understanding of concepts from biology, chemistry, physics, and Earth science.*

- Students apply knowledge of the characteristics of groups of animals and life processes in humans.
- They apply knowledge of cells and their functions, recognizing, for example, what happens to an animal's cells as it grows, and distinguishing between plant and animal cells.
- They can communicate understanding of ecosystems and the interaction of organisms with their environment. Students can apply some knowledge of human health related to nutrition.
- ...

# Four Levels of International Benchmarks

60



## **Advanced** International Benchmark

*Students communicate understanding of concepts related to biology, chemistry, physics, and Earth science in a variety of contexts.*

# Four Levels of International Benchmarks

61



## Advanced International Benchmark

Here is a list of animals.

ant

cat

dolphin

earthworm

fish

frog

jellyfish

Classify the animals into two groups based on whether or not the animal is a mammal. List the animals in each group in the table.

| Mammal         | Not a mammal                                  |
|----------------|-----------------------------------------------|
| cat<br>dolphin | ant<br>earthworm<br>fish<br>frog<br>jellyfish |

|                                 |                 |   |
|---------------------------------|-----------------|---|
| Japan                           | 75 (1.9)        | ▲ |
| Chinese Taipei                  | 63 (1.9)        | ▲ |
| <sup>2</sup> Singapore          | 62 (2.0)        | ▲ |
| Hungary                         | 53 (2.8)        | ▲ |
| † Hong Kong SAR                 | 46 (2.6)        | ▲ |
| <sup>2</sup> Russian Federation | 44 (2.5)        | ▲ |
| <sup>1</sup> Georgia            | 42 (3.2)        | ▲ |
| Italy                           | 41 (2.6)        | ▲ |
| Romania                         | 40 (2.4)        | ▲ |
| Finland                         | 37 (1.7)        | ▲ |
| Lithuania                       | 37 (2.7)        | ▲ |
| <sup>2</sup> Kazakhstan         | 35 (2.6)        | ▲ |
| Australia                       | 35 (1.6)        | ▲ |
| Portugal                        | 35 (2.6)        | ▲ |
| <sup>3</sup> Israel             | 33 (2.5)        |   |
| Korea, Rep. of                  | 31 (2.1)        |   |
| † New Zealand                   | 30 (2.0)        |   |
| † United States                 | 30 (1.9)        |   |
| <b>International Average</b>    | <b>30 (0.3)</b> |   |
| England                         | 27 (2.5)        |   |
| Cyprus                          | 27 (2.0)        |   |
| United Arab Emirates            | 27 (1.2)        | ▼ |
| Ukraine                         | 26 (2.2)        |   |

# Four Levels of International Benchmarks

63



## **Advanced** International Benchmark

*Students communicate understanding of concepts related to biology, chemistry, physics, and Earth science in a variety of contexts.*

- Students can classify animals into taxonomic groups and apply the knowledge of cell structures and their functions.
- They show some understanding of diversity, adaptation and natural selection among organisms, and recognize the interdependence of populations of organisms in an ecosystem.
- They demonstrate knowledge of the composition of matter and use physical properties of matter to sort, classify and compare substances and materials. They also recognize evidence that a chemical reaction has occurred.
- ...

# • Example of an Intermediate Benchmark Item – Secondary 2

| Country                         | Percent Correct |   |
|---------------------------------|-----------------|---|
| <sup>2</sup> Singapore          | 90 (1.2)        | ▲ |
| Korea, Rep. of                  | 86 (1.5)        | ▲ |
| Hungary                         | 84 (1.4)        | ▲ |
| Ireland                         | 84 (1.7)        | ▲ |
| <sup>2</sup> Russian Federation | 81 (2.1)        | ▲ |
| Australia                       | 80 (1.6)        | ▲ |
| Italy                           | 80 (2.0)        | ▲ |
| England                         | 80 (2.0)        | ▲ |
| † Norway (9)                    | 79 (1.9)        | ▲ |
| Cyprus                          | 77 (1.9)        | ▲ |
| Lithuania                       | 77 (2.1)        | ▲ |
| † New Zealand                   | 76 (1.8)        | ▲ |
| † United States                 | 74 (2.4)        | ▲ |
| Chinese Taipei                  | 74 (1.7)        | ▲ |
| Finland                         | 73 (1.8)        | ▲ |
| Portugal                        | 73 (2.6)        |   |
| <sup>2</sup> Sweden             | 72 (2.1)        |   |
| Malaysia                        | 72 (1.9)        |   |
| <sup>3</sup> Israel             | 71 (2.1)        |   |
| Oman                            | 71 (1.9)        |   |
| Bahrain                         | 70 (1.9)        |   |
| Romania                         | 69 (2.2)        |   |
| <b>International Average</b>    | <b>69 (0.3)</b> |   |
| Japan                           | 68 (1.7)        |   |
| Iran, Islamic Rep. of           | 67 (1.9)        |   |
| Chile                           | 67 (2.6)        |   |
| France                          | 67 (2.3)        |   |
| Turkey                          | 67 (2.1)        |   |
| Qatar                           | 66 (2.2)        |   |
| Jordan                          | 65 (2.1)        |   |
| Kuwait                          | 65 (2.5)        |   |
| United Arab Emirates            | 65 (1.1)        | ▼ |
| † Hong Kong SAR                 | 61 (2.7)        | ▼ |

**Content Domain:** Physics

**Cognitive Domain:** Knowing

**Description:** Recognizes why a vehicle has a different weight on Mars than it does on Earth

Scientists sent a special vehicle to Mars to make a map of the surface of the planet. A diagram of the vehicle is shown.



The vehicle has a different weight on Mars than it has on the Earth.

Why does the vehicle have different weights on the two planets?

- A** The vehicle lost mass when it was transported from Earth to Mars.
- B** The vehicle gained mass when it began moving on Mars.
- C** The magnetic attraction on Earth is different from Mars.
- D** The gravitational attraction on Earth is different from Mars.

## • Example of a High Benchmark Item – Secondary 2

| Country                         | Percent Full Credit |
|---------------------------------|---------------------|
| Chinese Taipei                  | 78 (1.8) ▲          |
| Turkey                          | 61 (2.1) ▲          |
| <sup>2</sup> Singapore          | 59 (2.5) ▲          |
| Japan                           | 56 (2.2) ▲          |
| Lithuania                       | 56 (2.8) ▲          |
| Korea, Rep. of                  | 53 (2.6) ▲          |
| Malaysia                        | 52 (2.0) ▲          |
| † Hong Kong SAR                 | 51 (3.3) ▲          |
| Qatar                           | 50 (2.8) ▲          |
| Jordan                          | 46 (2.3) ▲          |
| <sup>2</sup> Sweden             | 46 (2.3) ▲          |
| France                          | 44 (2.5) ▲          |
| Finland                         | 44 (2.1) ▲          |
| Hungary                         | 43 (2.2) ▲          |
| <sup>2</sup> Russian Federation | 42 (2.8)            |
| <sup>2</sup> Kazakhstan         | 42 (2.0)            |
| <sup>2</sup> Saudi Arabia       | 41 (2.2)            |
| <sup>1</sup> Georgia            | 40 (2.8)            |
| United Arab Emirates            | 39 (1.1)            |
| <b>International Average</b>    | <b>38 (0.4)</b>     |
| Portugal                        | 38 (2.7)            |
| † United States                 | 37 (2.3)            |
| Cyprus                          | 36 (2.4)            |
| England                         | 35 (2.8)            |
| Oman                            | 33 (1.9) ▼          |
| Australia                       | 33 (2.1) ▼          |
| Kuwait                          | 33 (2.8) ▼          |
| Ireland                         | 33 (2.3) ▼          |
| <sup>2</sup> Egypt              | 32 (2.0) ▼          |
| † New Zealand                   | 31 (2.1) ▼          |

**Content Domain:** Physics

**Cognitive Domain:** Applying

**Description:** Applies knowledge of sound transmission to explain whether a ringing cell phone in a vacuum can be heard outside the vacuum chamber

Nada hangs her cell phone under a glass bowl as shown. The ringer on the phone is turned on. She removes the air from under the bowl so that her phone is in a vacuum.



Nada asks her friend to call her phone. Will they hear it ring?

(Click one box.)

☐

Yes

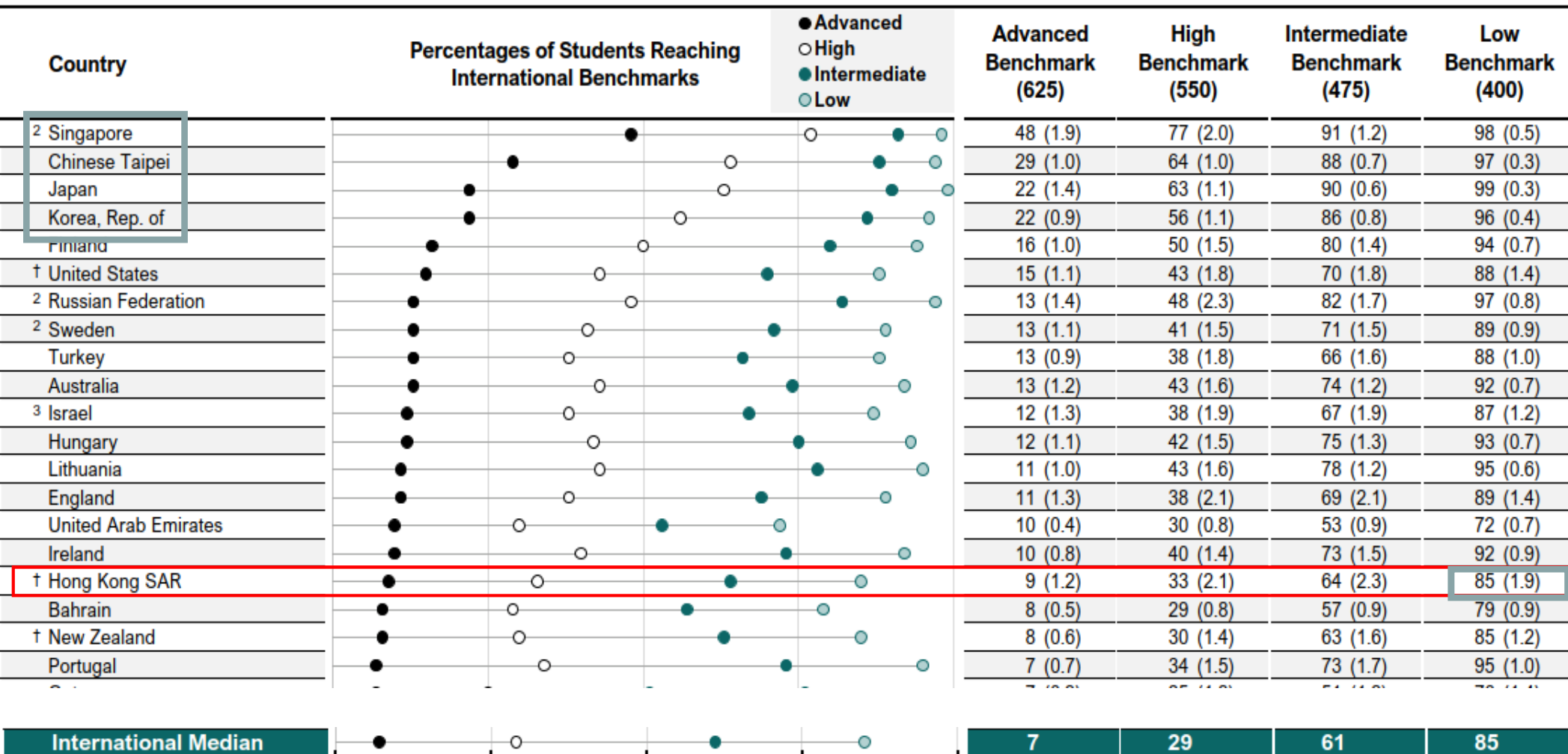
☒

No

Explain your answer.

There is no air under the bowl for the sound waves to travel through.

# International Benchmarks (S2)



# International Benchmarks: Trend

|                    | Advanced               |  | High                   |  | Intermediate           |  | Low                    |
|--------------------|------------------------|--|------------------------|--|------------------------|--|------------------------|
| <b>Secondary 2</b> |                        |  |                        |  |                        |  |                        |
| 2019               | <b>9%</b>              |  | <b>33%</b>             |  | <b>64%</b>             |  | <b>85%</b>             |
| 2015               | <b>12%</b>             |  | <b>51%<sup>#</sup></b> |  | <b>85%<sup>#</sup></b> |  | <b>96%<sup>#</sup></b> |
| 2011               | <b>9%</b>              |  | <b>47%<sup>#</sup></b> |  | <b>80%<sup>#</sup></b> |  | <b>95%<sup>#</sup></b> |
| 2007               | <b>10%</b>             |  | <b>45%<sup>#</sup></b> |  | <b>77%<sup>#</sup></b> |  | <b>92%<sup>#</sup></b> |
| 2003               | <b>13%<sup>*</sup></b> |  | <b>58%<sup>#</sup></b> |  | <b>89%<sup>#</sup></b> |  | <b>98%<sup>#</sup></b> |
| 1999               | <b>7%</b>              |  | <b>40%<sup>#</sup></b> |  | <b>80%<sup>#</sup></b> |  | <b>96%<sup>#</sup></b> |
| 1995               | <b>7%</b>              |  | <b>33%</b>             |  | <b>70%</b>             |  | <b>90%</b>             |

# A Short Summary – S2

68

- There are four levels of benchmarks in TIMSS
  - ▣ They can be great reference for your curriculum planning
- Students who achieved advanced level remained steady
- The percentages of students who achieved intermediate and high benchmark were lower than the previous rounds (2015, 2007, 2011, 2003)
- The percentages of students who achieved low benchmark were lower than the previous rounds (2015, 2007, 2011, 2003)

**What do the scores  
mean? (Primary 4)**

# Four Levels of International Benchmarks

70



## Low International Benchmark

*Students show limited understanding of scientific concepts and limited knowledge of foundational science facts.*

Which animal has a backbone?

**A**



octopus

**B**



spider

**C**



butterfly

**D**



frog

Which animal has a backbone?

**A**



octopus

**B**



spider

**C**



butterfly

**D**



frog

|                                 |                 |   |
|---------------------------------|-----------------|---|
| Hungary                         | 89 (1.6)        | ▲ |
| <sup>2</sup> Latvia             | 88 (1.6)        | ▲ |
| Croatia                         | 87 (1.6)        | ▲ |
| Korea, Rep. of                  | 87 (1.6)        | ▲ |
| Albania                         | 86 (2.5)        | ▲ |
| Armenia                         | 85 (1.7)        | ▲ |
| Chinese Taipei                  | 85 (1.4)        | ▲ |
| <sup>2</sup> Slovak Republic    | 84 (1.7)        | ▲ |
| † Norway (5)                    | 83 (2.0)        | ▲ |
| <sup>1</sup> Georgia            | 83 (1.8)        | ▲ |
| Bulgaria                        | 83 (2.1)        | ▲ |
| <sup>2†</sup> United States     | 82 (1.2)        | ▲ |
| <sup>2</sup> Serbia             | 82 (1.9)        | ▲ |
| Poland                          | 81 (1.6)        | ▲ |
| Bosnia and Herzegovina          | 81 (1.7)        | ▲ |
| <sup>2</sup> Turkey (5)         | 81 (1.8)        | ▲ |
| Czech Republic                  | 81 (1.9)        | ▲ |
| North Macedonia                 | 81 (2.1)        | ▲ |
| <sup>2</sup> Russian Federation | 80 (1.9)        | ▲ |
| Japan                           | 80 (1.5)        | ▲ |
| † Denmark                       | 79 (2.0)        | ▲ |
| Malta                           | 79 (1.7)        | ▲ |
| Finland                         | 79 (1.7)        | ▲ |
| Sweden                          | 79 (1.9)        | ▲ |
| Australia                       | 78 (1.7)        | ▲ |
| <sup>2</sup> New Zealand        | 78 (1.8)        | ▲ |
| <sup>1 2</sup> Canada           | 78 (1.5)        | ▲ |
| <sup>2</sup> Kazakhstan         | 77 (1.8)        |   |
| <sup>2</sup> England            | 77 (2.4)        |   |
| France                          | 76 (2.0)        |   |
| Azerbaijan                      | 76 (2.0)        |   |
| † Northern Ireland              | 76 (2.0)        |   |
| Ireland                         | 76 (2.1)        |   |
| Montenegro                      | 75 (1.7)        |   |
| Cyprus                          | 75 (1.8)        |   |
| <sup>2</sup> Lithuania          | 74 (2.0)        |   |
| <b>International Average</b>    | <b>74 (0.3)</b> |   |
| Morocco                         | 74 (1.7)        |   |
| <sup>2</sup> Kosovo             | 74 (1.8)        |   |
| † Hong Kong SAR                 | 74 (2.3)        |   |

# Four Levels of International Benchmarks

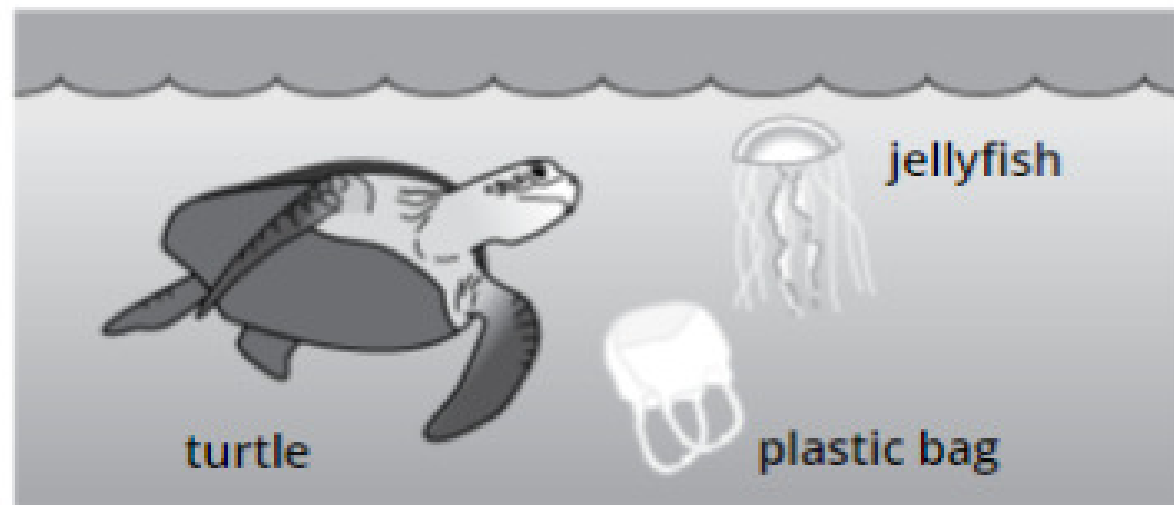
72



## **Intermediate** International Benchmark

*Students show knowledge and understanding of some aspects of science.*

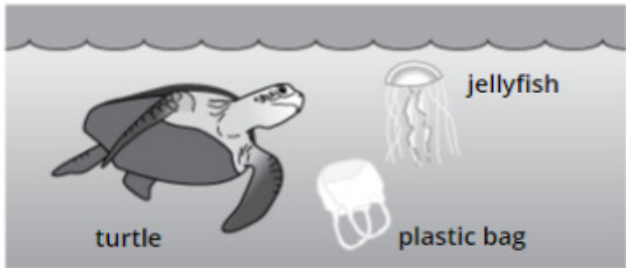
The picture shows a turtle and jellyfish swimming in the ocean. A plastic bag is floating nearby.



Write down one reason why plastic objects in the ocean are dangerous for animals such as turtles.

The turtle's flippers could get tangled up in the bag and make it hard for it to swim.

The picture shows a turtle and jellyfish swimming in the ocean. A plastic bag is floating nearby.



Write down one reason why plastic objects in the ocean are dangerous for animals such as turtles.

The turtle's flippers could get tangled up in the bag and make it hard for it to swim.

|                                 |          |   |
|---------------------------------|----------|---|
| Sweden                          | 86 (1.8) | ▲ |
| Finland                         | 85 (1.4) | ▲ |
| † Norway (5)                    | 85 (1.9) | ▲ |
| Australia                       | 84 (1.6) | ▲ |
| Japan                           | 83 (1.6) | ▲ |
| ≡ Netherlands                   | 83 (1.8) | ▲ |
| <sup>3</sup> Singapore          | 83 (1.2) | ▲ |
| Cyprus                          | 83 (1.7) | ▲ |
| <sup>2</sup> England            | 81 (2.1) | ▲ |
| Ireland                         | 81 (1.9) | ▲ |
| <sup>2†</sup> United States     | 79 (1.2) | ▲ |
| † Denmark                       | 78 (2.2) | ▲ |
| † Belgium (Flemish)             | 78 (2.1) | ▲ |
| † Northern Ireland              | 76 (2.5) | ▲ |
| Malta                           | 76 (1.8) | ▲ |
| Chinese Taipei                  | 75 (2.2) | ▲ |
| <sup>1 2</sup> Canada           | 75 (1.6) | ▲ |
| <sup>2</sup> Russian Federation | 74 (2.3) | ▲ |
| Czech Republic                  | 73 (1.9) | ▲ |
| Germany                         | 73 (2.1) | ▲ |
| Korea, Rep. of                  | 73 (2.1) | ▲ |
| <sup>2</sup> Lithuania          | 71 (1.9) | ▲ |
| Spain                           | 70 (2.0) | ▲ |
| <sup>2</sup> New Zealand        | 70 (1.7) | ▲ |
| <sup>2</sup> Portugal           | 70 (2.2) | ▲ |
| Austria                         | 70 (2.2) | ▲ |
| Hungary                         | 68 (2.0) | ▲ |
| Poland                          | 67 (1.9) | ▲ |
| Italy                           | 65 (2.1) | ▲ |
| <sup>2</sup> Slovak Republic    | 63 (2.4) | ▲ |
| France                          | 62 (2.6) | ▲ |
| † Hong Kong SAR                 | 62 (3.0) |   |
| Chile                           | 61 (2.1) |   |
| <sup>2</sup> Latvia             | 60 (2.2) |   |
| <sup>2</sup> Turkey (5)         | 58 (2.4) |   |
| International Average           | 57 (0.3) |   |
| <sup>2</sup> Serbia             | 54 (2.7) |   |

# Four Levels of International Benchmarks

75



**High** International Benchmark

*Students communicate and apply knowledge of life, physical, and Earth sciences.*

The picture below shows a desert.



What are two **living things** shown in the picture?

1. Camel

2. Cactus

What are two **non-living things** shown in the picture?

1. Rock

2. Sand

The picture below shows a desert.



What are two **living things** shown in the picture?

1.
2.

What are two **non-living things** shown in the picture?

1.
2.

|                              |                 |   |
|------------------------------|-----------------|---|
| KUWAIT                       | 40 (2.3)        |   |
| <b>International Average</b> | <b>45 (0.3)</b> |   |
| Albania                      | 39 (2.8)        | ▽ |
| <sup>2</sup> England         | 38 (2.6)        | ▽ |
| North Macedonia              | 38 (3.3)        | ▽ |
| Bosnia and Herzegovina       | 38 (2.4)        | ▽ |
| France                       | 37 (2.2)        | ▽ |
| Japan                        | 37 (2.3)        | ▽ |
| Korea, Rep. of               | 37 (2.4)        | ▽ |
| Iran, Islamic Rep. of        | 35 (2.5)        | ▽ |
| Ireland                      | 34 (2.1)        | ▽ |
| † Denmark                    | 34 (2.4)        | ▽ |
| <sup>2</sup> Pakistan        | 34 (3.6)        | ▽ |
| Azerbaijan                   | 33 (2.0)        | ▽ |
| <sup>2</sup> New Zealand     | 32 (2.0)        | ▽ |
| Spain                        | 32 (2.2)        | ▽ |
| <sup>1</sup> Georgia         | 31 (2.7)        | ▽ |
| ≡ Netherlands                | 30 (2.3)        | ▽ |
| † Northern Ireland           | 29 (2.4)        | ▽ |
| Austria                      | 27 (2.4)        | ▽ |
| South Africa (5)             | 27 (1.6)        | ▽ |
| Morocco                      | 27 (2.0)        | ▽ |
| Germany                      | 23 (1.9)        | ▽ |
| † Hong Kong SAR              | 23 (2.3)        | ▽ |
| Chile                        | 20 (2.0)        | ▽ |
| † Belgium (Flemish)          | 18 (1.7)        | ▽ |
| <sup>2</sup> Philippines     | 15 (1.5)        | ▽ |
| Chinese Taipei               | 10 (1.2)        | ▽ |

# Four Levels of International Benchmarks

78



## **Advanced** International Benchmark

*Students communicate their understanding of life, physical and Earth sciences and demonstrate some knowledge of the process of scientific inquiry.*

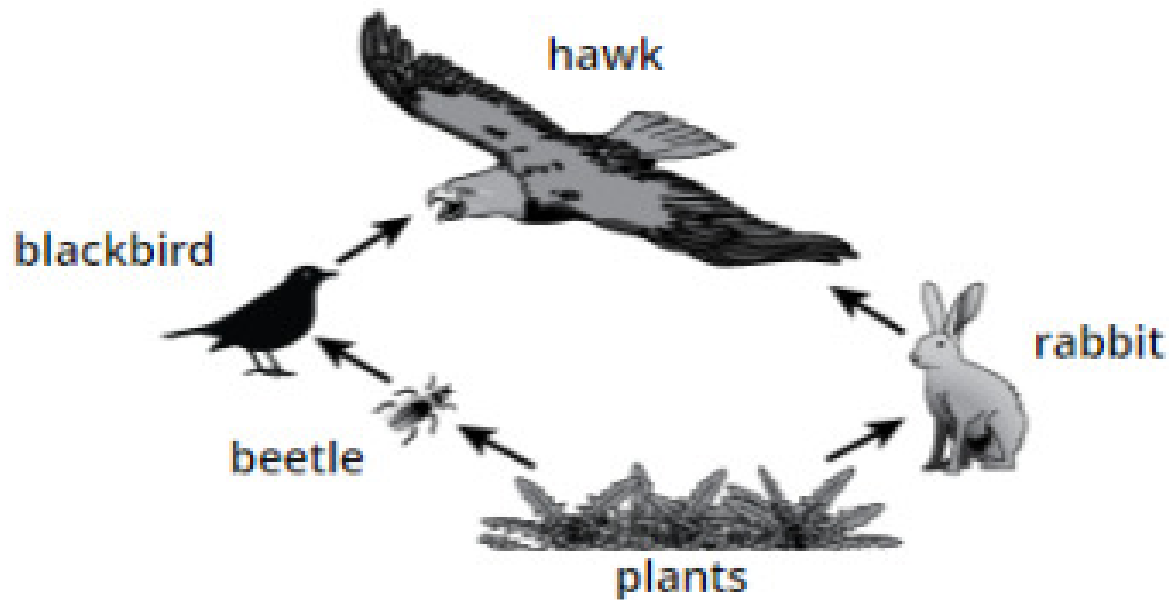
# Four Levels of International Benchmarks

79



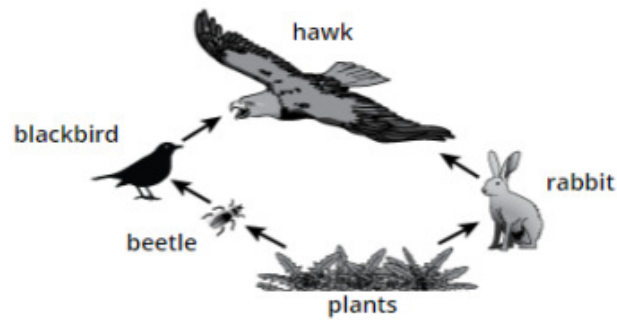
## Advanced International Benchmark

The picture below shows a food web in a forest ecosystem.



Based on what you see in the food web above, which two animals compete with each other for food?

The picture below shows a food web in a forest ecosystem.



Based on what you see in the food web above, which two animals compete with each other for food?

|                                 |          |   |
|---------------------------------|----------|---|
| Bulgaria                        | 69 (2.3) | ▲ |
| Korea, Rep. of                  | 56 (2.3) | ▲ |
| <sup>3</sup> Singapore          | 54 (2.0) | ▲ |
| Chinese Taipei                  | 45 (2.2) | ▲ |
| Sweden                          | 45 (2.6) | ▲ |
| † Norway (5)                    | 44 (2.2) | ▲ |
| Finland                         | 43 (1.7) | ▲ |
| <sup>2</sup> Slovak Republic    | 42 (2.3) | ▲ |
| <sup>2</sup> Serbia             | 40 (2.7) | ▲ |
| <sup>2</sup> † United States    | 40 (1.8) | ▲ |
| † Hong Kong SAR                 | 40 (2.6) | ▲ |
| † Denmark                       | 40 (2.4) | ▲ |
| † Northern Ireland              | 39 (2.8) | ▲ |
| Austria                         | 38 (2.9) | ▲ |
| Germany                         | 38 (2.3) | ▲ |
| Australia                       | 37 (2.3) | ▲ |
| <sup>2</sup> England            | 37 (2.7) | ▲ |
| Japan                           | 37 (1.9) | ▲ |
| <sup>2</sup> Russian Federation | 37 (2.4) | ▲ |
| Poland                          | 37 (2.2) | ▲ |
| France                          | 36 (2.8) | ▲ |
| Bahrain                         | 35 (1.8) | ▲ |
| Ireland                         | 35 (2.1) | ▲ |
| Czech Republic                  | 34 (2.2) |   |
| Spain                           | 34 (1.7) | ▲ |
| Malta                           | 33 (2.1) |   |
| Italy                           | 31 (2.6) |   |
| Hungary                         | 31 (2.0) |   |
| <sup>2</sup> New Zealand        | 31 (1.6) |   |
| <sup>2</sup> Portugal           | 31 (2.2) |   |
| <sup>1 2</sup> Canada           | 31 (1.9) |   |
| International Average           | 30 (0.3) |   |

# **Content domains and Cognitive domains**

## Cognitive domains

Reasoning  
20%

goes beyond the solution of familiar problems to encompass unfamiliar situations, complex contexts, and multistep problems.

Applying  
40%

focuses on students' ability to apply knowledge and conceptual understanding to solve practical problems or answer questions

Knowing  
40%

covers the facts, concepts, and procedures students need to know

P4

Life Science  
45%

Physics Science  
35%

Earth Science  
20%

S2

Biology  
35%

Physics  
25%

Chemistry  
20%

Earth Science  
20%

## Content domains

# Content and Cognitive Domains (S2)

|    |         |           |           |                  |
|----|---------|-----------|-----------|------------------|
|    | Biology | Chemistry | Physics   | Earth<br>Science |
| HK | 501     | 485       | 510       | 512              |
|    | Knowing | Applying  | Reasoning |                  |
| HK | 501     | 501       | 504       |                  |

# Trends: Cognitive Domains (S2)

84

| Country       | Average<br>Scale Score | Knowing                      |       |       |
|---------------|------------------------|------------------------------|-------|-------|
|               |                        | Differences<br>Between Years |       |       |
|               |                        | 2015                         | 2011  | 2007  |
| Hong Kong SAR |                        |                              |       |       |
| † 2019        | 501 (5.7)              | -46 ▼                        | -43 ▼ | -36 ▼ |

| Applying               |                              |       |       | Reasoning              |                              |       |       |
|------------------------|------------------------------|-------|-------|------------------------|------------------------------|-------|-------|
| Average<br>Scale Score | Differences<br>Between Years |       |       | Average<br>Scale Score | Differences<br>Between Years |       |       |
|                        | 2015                         | 2011  | 2007  |                        | 2015                         | 2011  | 2007  |
| 501 (5.2)              | -39 ▼                        | -27 ▼ | -21 ▼ | 504 (5.2)              | -47 ▼                        | -34 ▼ | -31 ▼ |

# Trends: Content Domains (S2)

85

| Country | Biology                |                              |       |       | Chemistry              |                              |       |       |
|---------|------------------------|------------------------------|-------|-------|------------------------|------------------------------|-------|-------|
|         | Average<br>Scale Score | Differences<br>Between Years |       |       | Average<br>Scale Score | Differences<br>Between Years |       |       |
|         |                        | 2015                         | 2011  | 2007  |                        | 2015                         | 2011  | 2007  |
| † 2019  | 501 (5.7)              | -48 ▼                        | -35 ▼ | -29 ▼ | 485 (5.5)              | -51 ▼                        | -41 ▼ | -36 ▼ |

|  | Physics                |                              |       |       | Earth Science          |                              |       |       |
|--|------------------------|------------------------------|-------|-------|------------------------|------------------------------|-------|-------|
|  | Average<br>Scale Score | Differences<br>Between Years |       |       | Average<br>Scale Score | Differences<br>Between Years |       |       |
|  |                        | 2015                         | 2011  | 2007  |                        | 2015                         | 2011  | 2007  |
|  | 510 (5.6)              | -30 ▼                        | -29 ▼ | -20 ▼ | 512 (5.6)              | -46 ▼                        | -28 ▼ | -24 ▼ |

# A Short Summary – S2

86

- There were drops in all cognitive domains and all content domains.
- 2019 was the worst of the past three cycles (2007, 2011, 2015)

## Attitudinal results

<https://padlet.com/mauricec/attitude>

88



You may be aware that HK students' attitude towards learning science has not been very positive.

- (1) What could we do to enhance it?
- (2) Respond to posts of others.
- (3) Like

**Attitudinal results**

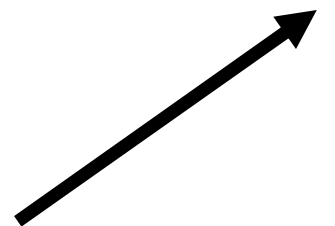
padlet

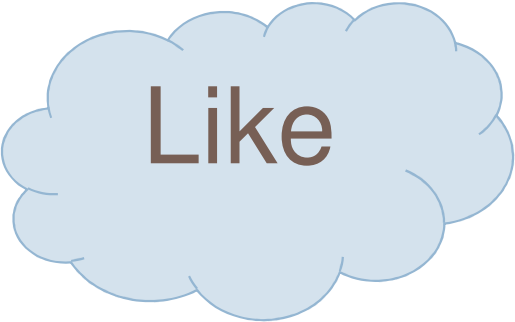
Maurice M.W. Cheng · 16h

## Enhancing attitude towards science

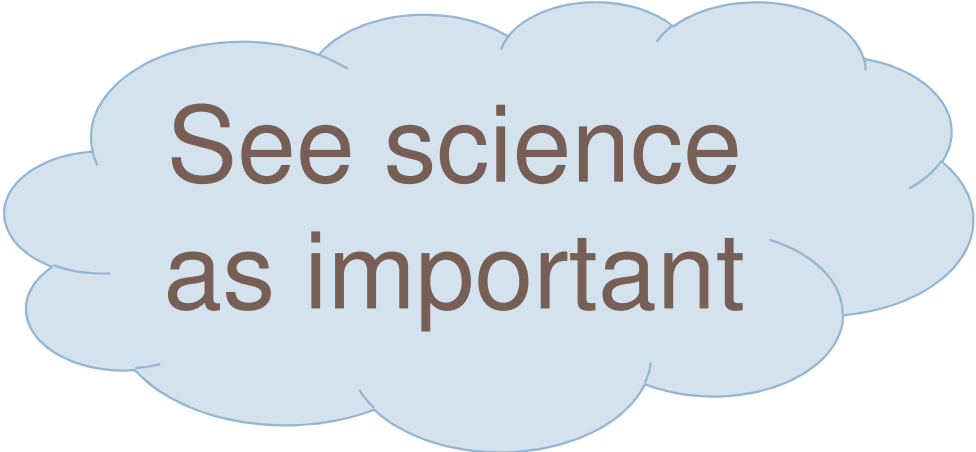
What could we do to enhance it? (be specific)

♡ REMAKE ↗ SHARE ⚙️ ⋮ M





Like



See science  
as important

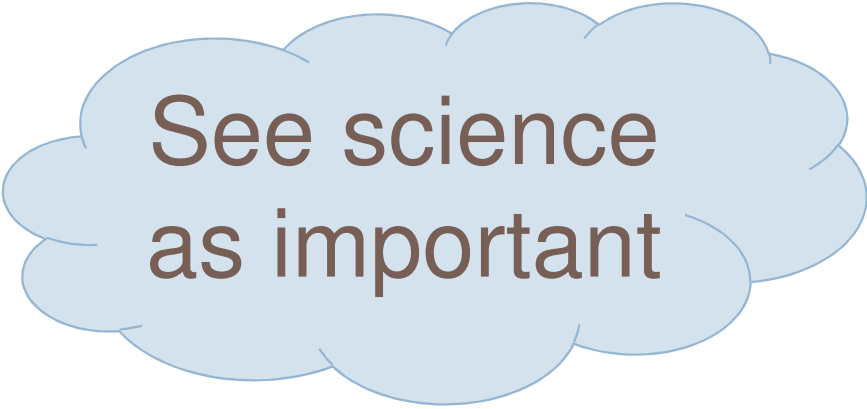
**Attitude**



Confidence  
in success

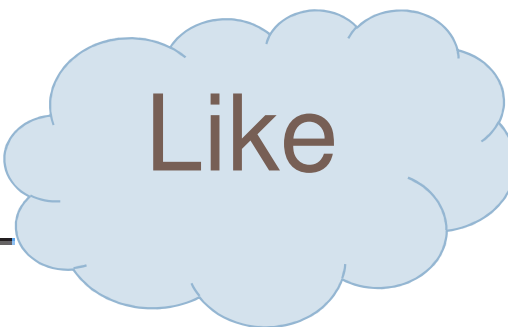
# Confidence in science

|                                                                                                | Agree<br>a lot        | Agree<br>a little     | Disagree<br>a little  | Disagree<br>a lot     |
|------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1) I usually do well in <science> - - - - -                                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2) <Science> is more difficult for me than for<br>many of my classmates <sup>R</sup> - - - - - | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3) <Science> is not one of my strengths <sup>R</sup> - - - - -                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4) I learn things quickly in <science> - - - - -                                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5) I am good at working out difficult <science><br>problems <sup>*</sup> - - - - -             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6) My teacher tells me I am good at <science> - -                                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7) <Science> is harder for me than any<br>other subject <sup>R</sup> - - - - -                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 8) <Science> makes me confused <sup>R</sup> - - - - -                                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |



## See science as important

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



Like

- 1) I enjoy learning <science> - - - - -
- 2) I wish I did not have to study <science> <sup>R</sup> - - - -
- 3) <Science> is boring <sup>R</sup> - - - - -
- 4) I learn many interesting things in <science> - -
- 5) I like <science> - - - - -
- 6) I look forward to learning <science> in school -
- 7) <Science> teaches me how things in the  
world work - - - - -
- 8) I like to conduct <science> experiments - - - -
- 9) <Science> is one of my favorite subjects - - - -

# Attitudinal Results (Secondary 2)

| <b>Secondary 2</b>   | Students<br>Very Much Like<br>Learning Science | Students<br>Somewhat Like<br>Learning Science | Students<br>Do Not Like<br>Learning Science |
|----------------------|------------------------------------------------|-----------------------------------------------|---------------------------------------------|
| HKSAR % (Scale Avg.) | <b>23% (541)</b>                               | <b>55% (501)</b>                              | <b>22% (472)</b>                            |
|                      |                                                |                                               |                                             |
| Int'l % (Scale Avg.) | <b>35% (524)</b>                               | <b>44% (484)</b>                              | <b>20% (460)</b>                            |

| <b>Secondary 2</b>   | Students<br>Very<br>Confident<br>in Science | Students<br>Somewhat<br>confident<br>in Science | Students<br>Not<br>Confident<br>in Science |
|----------------------|---------------------------------------------|-------------------------------------------------|--------------------------------------------|
| HKSAR % (Scale Avg.) | <b>11% (566)</b>                            | <b>38% (527)</b>                                | <b>50% (472)</b>                           |
|                      |                                             |                                                 |                                            |
| Int'l % (Scale Avg.) | <b>23% (547)</b>                            | <b>39% (500)</b>                                | <b>38% (456)</b>                           |

| General/Integrated Science | Very Much Like Learning Science |                     | Somewhat Like Learning Science |                     | Do Not Like Learning Science |                     |
|----------------------------|---------------------------------|---------------------|--------------------------------|---------------------|------------------------------|---------------------|
|                            | Percent of Students             | Average Achievement | Percent of Students            | Average Achievement | Percent of Students          | Average Achievement |
| Jordan                     | 56 (1.6)                        | 479 (3.8)           | 36 (1.4)                       | 426 (6.1)           | 8 (0.7)                      | 388 (8.0)           |
| Egypt                      | 54 (1.6)                        | 426 (5.0)           | 38 (1.3)                       | 358 (6.1)           | 8 (0.7)                      | 388 (8.0)           |
| Turkey                     | 54 (1.4)                        | 536 (3.3)           | 37 (0.9)                       | 494 (5.1)           | 9 (0.8)                      | 400 (7.2)           |
| Iran, Islamic Rep. of      | 53 (1.3)                        | 469 (3.9)           | 37 (1.0)                       | 428 (4.4)           | 10 (0.6)                     | 412 (7.0)           |
| Kuwait                     | 46 (1.7)                        | 468 (5.5)           | 39 (1.1)                       | 435 (6.1)           | 15 (0.4)                     | 412 (3.8)           |
| Malaysia                   | 46 (1.1)                        | 484 (3.3)           | 46 (0.8)                       | 450 (3.9)           | 8 (0.7)                      | 388 (8.0)           |
| Saudi Arabia               | 46 (1.3)                        | 454 (3.1)           | 40 (0.8)                       | 417 (3.3)           | 14 (0.9)                     | 417 (4.1)           |
| Oman                       | 46 (1.0)                        | 495 (3.0)           | 44 (0.8)                       | 438 (3.7)           | 10 (0.6)                     | 412 (7.0)           |
| United Arab Emirates       | 44 (0.6)                        | 523 (2.7)           | 41 (0.6)                       | 445 (2.6)           | 15 (0.4)                     | 412 (3.8)           |
| Bahrain                    | 44 (1.2)                        | 516 (2.4)           | 40 (0.9)                       | 474 (3.2)           | 16 (0.7)                     | 448 (4.6)           |
| South Africa (9)           | 42 (0.9)                        | 398 (3.4)           | 45 (0.6)                       | 352 (3.3)           | 13 (0.5)                     | 353 (4.2)           |
| Qatar                      | 38 (1.4)                        | 509 (5.0)           | 45 (1.2)                       | 459 (4.8)           | 17 (0.9)                     | 441 (5.7)           |
| Singapore                  | 37 (0.9)                        | 635 (3.8)           | 49 (0.8)                       | 601 (3.8)           | 14 (0.6)                     | 558 (6.0)           |
| United States              | 31 (0.9)                        | 550 (5.0)           | 46 (0.7)                       | 522 (4.9)           | 23 (0.7)                     | 499 (5.7)           |
| Italy                      | 29 (1.2)                        | 519 (3.4)           | 50 (1.0)                       | 499 (2.8)           | 20 (0.9)                     | 481 (3.8)           |
| Ireland                    | 27 (1.2)                        | 558 (3.5)           | 42 (1.0)                       | 532 (2.8)           | 30 (1.3)                     | 493 (4.3)           |
| Australia                  | 27 (1.1)                        | 569 (4.1)           | 45 (0.8)                       | 526 (3.5)           | 28 (1.3)                     | 499 (3.6)           |
| Israel                     | 27 (1.2)                        | 547 (4.8)           | 42 (0.8)                       | 512 (5.0)           | 31 (1.1)                     | 496 (5.2)           |
| Chile                      | 26 (1.2)                        | 482 (4.7)           | 53 (1.0)                       | 460 (3.4)           | 22 (1.2)                     | 450 (3.9)           |
| New Zealand                | 25 (1.1)                        | 532 (4.8)           | 49 (0.9)                       | 499 (4.2)           | 25 (1.2)                     | 471 (4.6)           |
| Norway (9)                 | 25 (1.1)                        | 530 (4.5)           | 51 (1.0)                       | 495 (3.3)           | 25 (1.0)                     | 467 (4.3)           |
| England                    | 24 (1.3)                        | 556 (5.9)           | 45 (1.1)                       | 524 (5.0)           | 30 (1.3)                     | 485 (5.7)           |
| Hong Kong SAR              | 23 (1.0)                        | 541 (6.1)           | 55 (1.1)                       | 501 (6.1)           | 22 (1.1)                     | 472 (7.5)           |
| Chinese Taipei             | 20 (0.8)                        | 616 (3.2)           | 51 (0.9)                       | 576 (2.5)           | 30 (1.0)                     | 544 (2.6)           |
| Japan                      | 16 (0.8)                        | 605 (4.2)           | 49 (1.1)                       | 577 (2.4)           | 35 (1.4)                     | 544 (2.6)           |
| Korea, Rep. of             | 12 (0.5)                        | 625 (4.6)           | 41 (1.0)                       | 577 (3.0)           | 47 (1.2)                     | 531 (2.4)           |
| International Average      | 35 (0.2)                        | 524 (0.8)           | 44 (0.2)                       | 484 (0.8)           | 20 (0.2)                     | 460 (1.1)           |

**Secondary 2**  
**Students Like Learning Science Scale**

| General/Integrated Science | Very Confident in Science |                     | Somewhat Confident in Science |                     | Not Confident in Science |                     |
|----------------------------|---------------------------|---------------------|-------------------------------|---------------------|--------------------------|---------------------|
| Country                    | Percent of Students       | Average Achievement | Percent of Students           | Average Achievement | Percent of Students      | Average Achievement |
| Iran, Islamic Rep. of      | 38 (1.1)                  | 490 (3.9)           | 40 (0.9)                      | 434 (4.3)           | 22 (0.8)                 | 407 (4.0)           |
| Turkey                     | 38 (1.2)                  | 569 (3.5)           | 37 (0.8)                      | 502 (4.2)           | 25 (0.9)                 | 487 (4.5)           |
| Jordan                     | 37 (1.4)                  | 502 (3.6)           | 38 (0.6)                      | 448 (4.5)           | 25 (0.9)                 | 487 (4.5)           |
| Bahrain                    | 36 (1.3)                  | 531 (2.4)           | 38 (0.7)                      | 487 (3.8)           | 26 (0.7)                 | 408 (4.3)           |
| Egypt                      | 35 (1.1)                  | 445 (5.1)           | 38 (0.7)                      | 384 (5.7)           | 27 (1.1)                 | 471 (3.6)           |
| Saudi Arabia               | 33 (1.0)                  | 474 (3.4)           | 42 (0.8)                      | 425 (3.1)           | 25 (1.0)                 | 399 (3.7)           |
| Israel                     | 31 (1.2)                  | 568 (4.4)           | 37 (0.9)                      | 513 (4.3)           | 32 (1.2)                 | 471 (5.0)           |
| Kuwait                     | 31 (1.3)                  | 490 (5.1)           | 42 (0.7)                      | 440 (5.6)           | 27 (1.2)                 | 410 (7.6)           |
| Oman                       | 29 (1.0)                  | 516 (4.1)           | 46 (0.8)                      | 457 (3.5)           | 26 (0.7)                 | 408 (4.3)           |
| United Arab Emirates       | 29 (0.6)                  | 541 (2.6)           | 41 (0.6)                      | 476 (2.7)           | 30 (0.5)                 | 413 (2.9)           |
| Qatar                      | 28 (1.3)                  | 527 (4.7)           | 39 (1.1)                      | 480 (4.6)           | 33 (1.2)                 | 427 (5.2)           |
| United States              | 26 (0.9)                  | 570 (5.4)           | 41 (0.7)                      | 528 (4.9)           | 33 (0.9)                 | 487 (4.5)           |
| Norway (9)                 | 24 (0.9)                  | 548 (4.1)           | 43 (0.8)                      | 503 (3.0)           | 34 (1.1)                 | 454 (4.2)           |
| Italy                      | 23 (1.0)                  | 536 (3.6)           | 50 (1.1)                      | 501 (2.5)           | 27 (1.1)                 | 471 (3.6)           |
| Ireland                    | 19 (0.9)                  | 581 (3.7)           | 36 (1.1)                      | 543 (3.1)           | 45 (1.3)                 | 492 (3.3)           |
| South Africa (9)           | 18 (0.6)                  | 425 (4.0)           | 45 (0.5)                      | 370 (3.5)           | 37 (0.8)                 | 349 (3.1)           |
| Singapore                  | 17 (0.6)                  | 652 (3.9)           | 37 (0.8)                      | 621 (4.2)           | 46 (1.0)                 | 581 (4.1)           |
| Australia                  | 16 (0.7)                  | 586 (4.2)           | 39 (0.8)                      | 543 (3.3)           | 45 (1.1)                 | 499 (3.6)           |
| England                    | 15 (1.0)                  | 581 (6.9)           | 38 (1.2)                      | 539 (4.6)           | 48 (1.7)                 | 488 (5.5)           |
| New Zealand                | 12 (0.7)                  | 567 (5.5)           | 40 (1.0)                      | 517 (4.5)           | 47 (1.2)                 | 470 (4.0)           |
| Chile                      | 12 (0.8)                  | 511 (5.4)           | 45 (1.1)                      | 469 (3.2)           | 43 (1.4)                 | 445 (3.2)           |
| Hong Kong SAR              | 11 (0.6)                  | 566 (6.2)           | 38 (1.1)                      | 527 (5.8)           | 50 (1.2)                 | 472 (6.3)           |
| Chinese Taipei             | 10 (0.5)                  | 645 (3.5)           | 27 (0.7)                      | 609 (2.7)           | 63 (0.9)                 | 548 (2.1)           |
| Korea, Rep. of             | 9 (0.5)                   | 639 (4.9)           | 25 (0.9)                      | 602 (2.9)           | 65 (1.1)                 | 533 (2.2)           |
| Malaysia                   | 8 (0.4)                   | 523 (5.0)           | 47 (0.9)                      | 469 (3.7)           | 45 (1.1)                 | 441 (4.0)           |
| Japan                      | 6 (0.4)                   | 636 (3.9)           | 28 (0.8)                      | 601 (2.8)           | 66 (0.9)                 | 550 (2.3)           |
| International Average      | 23 (0.2)                  | 547 (0.9)           | 39 (0.2)                      | 500 (0.8)           | 38 (0.2)                 | 456 (0.9)           |

**Secondary 2**  
**Students Confident**  
**in Science Scale**

# Attitudinal Results (Secondary 2)

| <b>Secondary 2</b>          | <b>Students<br/>Strongly Value<br/>Science</b> | <b>Students<br/>Somewhat Value<br/>Science</b> | <b>Students<br/>Do Not Value<br/>Science</b> |
|-----------------------------|------------------------------------------------|------------------------------------------------|----------------------------------------------|
| <b>HKSAR % (Scale Avg.)</b> | <b>23% (526)</b>                               | <b>49% (509)</b>                               | <b>29% (478)</b>                             |
|                             |                                                |                                                |                                              |
| <b>Int'l % (Scale Avg.)</b> | <b>36% (511)</b>                               | <b>42% (487)</b>                               | <b>22% (467)</b>                             |

| Country               | Strongly Value Science |                     | Somewhat Value Science |                     | Do Not Value Science |                     |
|-----------------------|------------------------|---------------------|------------------------|---------------------|----------------------|---------------------|
|                       | Percent of Students    | Average Achievement | Percent of Students    | Average Achievement | Percent of Students  | Average Achievement |
| Egypt                 | 67 (1.1)               | 412 (5.2)           | 26 (0.9)               | 362 (6.7)           | 7 (0.5)              | 344 (7.8)           |
| Jordan                | 64 (1.2)               | 468 (4.4)           | 29 (0.9)               | 438 (4.8)           | 7 (0.5)              | 418 (8.6)           |
| Oman                  | 57 (0.9)               | 483 (3.0)           | 35 (0.8)               | 440 (3.7)           | 8 (0.6)              | 409 (7.9)           |
| Iran, Islamic Rep. of | 57 (1.2)               | 462 (4.3)           | 33 (1.0)               | 434 (3.8)           | 11 (0.6)             | 436 (7.3)           |
| United Arab Emirates  | 55 (0.7)               | 501 (2.6)           | 34 (0.6)               | 453 (2.8)           | 11 (0.3)             |                     |
| Saudi Arabia          | 55 (1.3)               | 442 (3.3)           | 34 (0.9)               | 427 (3.4)           | 11 (0.7)             |                     |
| Kuwait                | 54 (1.2)               | 460 (5.5)           | 34 (1.1)               | 439 (5.9)           | 12 (0.7)             |                     |
| South Africa (9)      | 54 (0.7)               | 380 (3.5)           | 34 (0.5)               | 353 (3.1)           | 12 (0.4)             |                     |
| Bahrain               | 51 (0.9)               | 507 (1.8)           | 36 (0.7)               | 479 (3.5)           | 13 (0.6)             |                     |
| Morocco               | 49 (0.9)               | 409 (2.7)           | 39 (0.7)               | 383 (3.2)           | 12 (0.6)             |                     |
| Qatar                 | 49 (1.0)               | 495 (5.4)           | 37 (0.8)               | 467 (5.0)           | 15 (0.9)             | 436 (5.8)           |
| Lebanon               | 49 (1.1)               | 404 (5.3)           | 39 (0.9)               | 360 (5.0)           | 12 (0.6)             | 350 (9.2)           |
| Turkey                | 46 (1.2)               | 529 (4.1)           | 38 (0.8)               | 506 (4.4)           | 15 (0.9)             | 499 (5.8)           |
| Malaysia              | 45 (1.2)               | 492 (3.0)           | 46 (0.9)               | 445 (4.2)           | 9 (0.7)              | 384 (6.9)           |
| Georgia               | 43 (1.2)               | 457 (4.2)           | 43 (1.1)               | 445 (4.3)           | 14 (0.9)             | 430 (5.6)           |
| Singapore             | 42 (1.0)               | 632 (3.5)           | 48 (0.8)               | 598 (4.1)           | 11 (0.6)             | 557 (6.3)           |
| United States         | 36 (0.9)               | 540 (5.9)           | 43 (0.7)               | 526 (4.7)           | 21 (0.6)             | 503 (4.3)           |
| Israel                | 36 (1.3)               | 531 (5.2)           | 36 (0.9)               | 518 (4.7)           | 29 (1.2)             | 498 (5.6)           |
| England               | 33 (1.1)               | 540 (5.3)           | 45 (1.1)               | 523 (5.6)           | 22 (1.0)             | 491 (5.5)           |
| Cyprus                | 33 (1.0)               | 510 (2.9)           | 43 (1.2)               | 485 (2.5)           | 24 (0.9)             | 458 (3.4)           |
| Russian Federation    | 32 (1.0)               | 548 (4.8)           | 50 (0.8)               | 540 (4.7)           | 18 (0.9)             | 545 (4.5)           |
| Romania               | 31 (1.3)               | 487 (5.3)           | 41 (1.1)               | 468 (4.6)           | 28 (1.2)             | 462 (4.5)           |
| Kazakhstan            | 30 (1.0)               | 487 (4.0)           | 51 (0.9)               | 477 (3.4)           | 19 (0.8)             | 471 (5.1)           |
| Australia             | 28 (0.9)               | 561 (4.1)           | 42 (0.6)               | 530 (3.5)           | 29 (0.8)             | 501 (3.1)           |
| Portugal              | 27 (1.1)               | 542 (4.2)           | 44 (1.1)               | 517 (3.4)           | 28 (1.1)             | 503 (3.0)           |
| Lithuania             | 27 (1.0)               | 549 (4.3)           | 51 (1.1)               | 531 (3.4)           | 21 (0.8)             | 526 (4.0)           |
| New Zealand           | 26 (0.9)               | 520 (5.0)           | 47 (0.8)               | 503 (3.9)           | 28 (1.0)             | 479 (4.2)           |
| Chile                 | 25 (0.9)               | 471 (3.8)           | 48 (0.8)               | 462 (3.4)           | 27 (1.0)             | 459 (3.9)           |
| Ireland               | 25 (1.0)               | 555 (3.9)           | 42 (1.1)               | 534 (2.8)           | 33 (1.1)             | 500 (3.7)           |
| Hong Kong SAR         | 23 (0.9)               | 526 (7.6)           | 49 (1.1)               | 509 (5.5)           | 29 (1.1)             | 478 (6.4)           |
| Norway (9)            | 21 (0.9)               | 516 (5.4)           | 48 (0.9)               | 501 (3.1)           | 31 (1.1)             | 478 (4.4)           |
| Hungary               | 21 (1.1)               | 553 (4.8)           | 47 (0.9)               | 527 (3.5)           | 33 (1.1)             | 519 (3.0)           |
| Sweden                | 20 (0.9)               | 541 (5.7)           | 48 (1.1)               | 527 (3.9)           | 32 (1.0)             | 510 (3.6)           |
| Italy                 | 19 (0.8)               | 515 (4.0)           | 45 (1.0)               | 506 (2.9)           | 35 (1.1)             | 487 (2.9)           |
| France                | 19 (0.8)               | 516 (4.5)           | 47 (0.9)               | 496 (3.2)           | 34 (1.1)             | 465 (2.7)           |
| Finland               | 18 (0.9)               | 586 (4.3)           | 48 (0.9)               | 550 (3.2)           | 35 (1.1)             | 514 (3.0)           |
| Korea, Rep. of        | 16 (0.7)               | 611 (4.2)           | 50 (0.9)               | 573 (2.6)           | 34 (1.1)             | 519 (2.7)           |
| Chinese Taipei        | 14 (0.7)               | 609 (4.4)           | 41 (0.8)               | 589 (2.5)           | 45 (1.0)             | 551 (2.4)           |
| Japan                 | 11 (0.6)               | 598 (4.9)           | 48 (1.0)               | 581 (2.5)           | 41 (1.1)             | 550 (2.5)           |
| International Average | 36 (0.2)               | 511 (0.7)           | 42 (0.1)               | 487 (0.6)           | 22 (0.1)             | 467 (0.8)           |

## Secondary 2

## Students Value Science Scale

# Trends in Valuing Science

| <b>Students Value Science – Secondary 2</b> |                               |                       |
|---------------------------------------------|-------------------------------|-----------------------|
|                                             | <b>Strongly Value Science</b> |                       |
|                                             | <b>Hong Kong</b>              | <b>International</b>  |
| 2019                                        | 23 (0.9)                      | 36 (0.2)              |
| 2015                                        | 24 (1.0)                      | 40 <sup>^</sup> (0.2) |
| 2011                                        | 26 <sup>^</sup> (1.0)         | 41 <sup>^</sup> (0.2) |

<sup>^</sup> Result significantly higher than 2019

|      | Very Much Like Learning Science |               | Very Confident in Science |               |
|------|---------------------------------|---------------|---------------------------|---------------|
|      | % of P4 Students                |               | % of P4 Students          |               |
|      | Hong Kong                       | International | Hong Kong                 | International |
| 2019 | 49 (1.5)                        | 52 (0.2)      | 23 (0.9)                  | 38 (0.2)      |
| 2015 | 57^ (1.0)                       | 56^ (0.2)     | 25 (1.2)                  | 40^ (0.2)     |
| 2011 | 52 (1.3)                        | 53^ (0.2)     | 25 (0.9)                  | 43^ (0.2)     |

|      | Very Much Like Learning Science |               | Very Confident in Science |               |
|------|---------------------------------|---------------|---------------------------|---------------|
|      | % of S2 Students                |               | % of S2 Students          |               |
|      | Hong Kong                       | International | Hong Kong                 | International |
| 2019 | 23 (1.0)                        | 35 (0.2)      | 11 (0.6)                  | 23 (0.2)      |
| 2015 | 30^ (1.0)                       | 37^ (0.2)     | 13^ (0.6)                 | 22^ (0.2)     |
| 2011 | 28 (1.3)                        | 35^ (0.2)     | 8^ (0.6)                  | 20^ (0.2)     |

<https://padlet.com/mauricec/attitude>

101



Expand on your strategies based on the items and data

- (1) What could we do to enhance it?
- (2) Respond to posts of others.
- (3) Like

Further data for  
your consideration:



# Science Labs, Science Experiments

# School Resources for Conducting Experiment (Secondary 2)

103

|                       | Having a Science Lab in<br>Schools | Teachers Having Assistance<br>When Students Are<br>Conducting Experiments |
|-----------------------|------------------------------------|---------------------------------------------------------------------------|
| <b>Hong Kong</b>      | <b>99% (504)</b>                   | <b>98% (504)</b>                                                          |
| <b>Chinese Taipei</b> | <b>99% (575)</b>                   | <b>92% (577)</b>                                                          |
| <b>Japan</b>          | <b>99% (570)</b>                   | <b>35% (570)</b>                                                          |
| <b>Korea</b>          | <b>100% (561)</b>                  | <b>46% (565)</b>                                                          |
| <b>Singapore</b>      | <b>100% (608)</b>                  | <b>99% (609)</b>                                                          |
| <b>International</b>  | <b>85% (494)</b>                   | <b>54% (494)</b>                                                          |

# Frequency on Conducting Experiments in Science Lessons (Secondary 2)

104

|                | At least once<br>a week | Once or twice<br>a month | A few times<br>a year | Never            |
|----------------|-------------------------|--------------------------|-----------------------|------------------|
| Hong Kong      | <b>57% (510)</b>        | <b>37% (504)</b>         | <b>4% (460)</b>       | <b>2% (~ ~)</b>  |
| Chinese Taipei | <b>13% (558)</b>        | <b>53% (579)</b>         | <b>25% (586)</b>      | <b>9% (542)</b>  |
| Japan          | <b>35% (575)</b>        | <b>60% (569)</b>         | <b>5% (546)</b>       | <b>0% (~ ~)</b>  |
| Korea          | <b>6% (547)</b>         | <b>49% (559)</b>         | <b>39% (571)</b>      | <b>6% (522)</b>  |
| Singapore      | <b>12% (612)</b>        | <b>42% (617)</b>         | <b>43% (602)</b>      | <b>3% (541)</b>  |
| International  | <b>28% (478)</b>        | <b>37% (502)</b>         | <b>24% (501)</b>      | <b>11% (451)</b> |

# Take Home / Stay Home Message (S2)

105

- Students' achievement in 2019 was the worst in the past 20 years
- Switching to e-test negatively impacted on students' achievement. But the drop can't be abundantly explained by the mode effect
- There's no gender differences overall
- The association between Socioeconomic status and achievement in HK perhaps is weaker than the international association
  - ▣ But this is definitely weaker in P4
- Issues of well-beings and absence

# Take Home / Stay Home Message (S2)

106

- Benchmarking levels are a useful tool for our curriculum planning
- The % of advanced students remained the same
- The % of students achieved intermediate and high levels were lower than the previous years
- The % of students who didn't achieve low is alarming (15%)
- Different components of 'attitude':
  - Like science
  - Value science
  - Confidence in learning science
- Doing experiments is important in science. But more doesn't directly translate into better learning.
  - ▣□ Situational interest vs personal interest



# Now we look at items...

**[Go to Part 2](#)**

# Summary

108

- What is TIMSS?
- What does it test? And what does it measure?
  - ▣ More than achievement
  - ▣ Benchmarks
  - ▣ Three components of attitude:
    - like, confidence, value of science
  - ▣ SES, absence, well-being
- Findings in TIMSS 2019 HK study

# Summary

109

- HK students performance in selected items
  - ▣ Pedagogies (card sorting/ talk)
  - ▣ Curriculum

祝大家牛年  
身體健康, 教學相長!

# Learning Opportunities

## *Who*

- Junior science teachers who are interested in enhancing student learning

## *When*

- From Now to November

## *What to do:*

- Willing to devote time to collaboratively plan and try out teaching the teaching units
- Willing to collect some kinds of student evidence of learning

Please fill in the <[Google Form](#)>



# TIMSS Materials

- ❖ International reports of TIMSS 2019 may be downloaded at:  
→ <https://timss.bc.edu>
- ❖ Enquiries concerning TIMSS 2019:
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