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



Smallpox - a deadly disease throughout history



- Deadly airborne viral infection
- During 19th century, the deal 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.







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







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

□ 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

- 13
- 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

National, social and educational contexts Home, school, teacher, and classroom contexts Student achievement and attitudes

Participating Countries/Regions

15

- □ ~70 countries/regions participated in TIMSS 2019
- ~60 countries/regions participated in the 4th grade (Year 5) assessment
- ~45 countries/regions participated in the 8th grade (Year 9) assessment

□ More than 580,000 students were tested worldwide

From paperTIMSS to eTIMSS

- 16
- 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

TIMSS 2019 electronic

Comparable?

70% correct

50% correct

Bridge Study in TIMSS 2019





TIMSS 2019 in Hong Kong

- 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

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		(

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

Why do I cover Grade 4 and Grade 8 results?

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2 % Phäppines 249 (7.5) V	2 X Pakistan	290 (13.4) 🗸	
	2 ³ Philippines	249 (7.5) 🗸	
Renchmarking Participants 100 200 300 400 500 600 700 800	Renchmarking Participants	100	200 200 400 500 600 700 800

Primary 4 Science

	Science • Grade 4	₿ IEA
Exhibit 2.1: Average Science Achievement and Scale Score Distributions		TIMSS
		2019

Country	Average Scale Score	Science Achievement Distribution					
³ Singapore	595 (3.4)						
Korea, Rep. of	588 (2.1)						
² Russian Federation	567 (3.0)						
Japan	562 (1.8)						
Chinese Taipei	558 (1.8)						
Finland	555 (2.6)						
² Latvia	542 (2.4)						
† Norway (5)	539 (2.2)						
^{2†} United States	539 (2.7)						
² Lithuania	538 (2.5)						
Sweden	537 (3.3)						
² England	537 (2.7)						
Czech Republic	534 (2.6)						
Australia	533 (2.4)						
[†] Hong Kong SAR 1	5 th 531 (3.3) ▲						

9th-20th: no stat. sign. diff.

Trends in Primary 4 Science



•	Average Scale	Differences Between Years				;			
Country	Score 2015 2011 2007 2003 1995		Science Achievement Distribution						
Hong Kong SAR	1 7								
† 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)								







27

Secondary 2

Secondary 2 Science

Exhibit 4.1: Average Science A	chievement and Scal	e Score Distributions
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Country	Average Scale Score	Science Achievement Distribution
² Singapore	608 (3.9)	
Chinese Taipei	574 (1.9)	
Japan	570 (2.1)	
Korea, Rep. of	561 (2.1)	
² Russian Federation	543 (4.2)	Percentiles of Performance
Finland	543 (3.1)	5 th 25 th 75 th 95 th
Lithuania	534 (3.0)	
Hungary	530 (2.6)	
Australia	528 (3.2)	95% Confidence Interval for Average (±2SE)
Ireland	523 (2.9)	
† United States	522 (4.7)	
² Sweden	521 (3.2)	
Portugal	519 (2.9)	
England	517 (4.8)	
Turkey	515 (3.7)	
³ Israel	513 (4.2)	
[†] Hong Kong SAR 17 th	504 (5.2)	
Italy	500 (2.6)	
TIMSS Scale Centerpoint	500	

14th-20th: no stat. sign. diff.

Science • Grade 8

€iea TIMSS 2019

Trends in Secondary 2 Science



a 1	Average Scale	Differences Between Years											
Country	Score	2015	2011	2007	2003	1999	1995	Science Achievement Distributi				Distributio	'n
Hong Kong SAR													
† 2019	504 (5.2)	-4 2 ⊽	-3 2 ⊽	-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)											29	•
							10	0 200	300	400	500	600	70

Trend: Bridge & Previous Cycles (S2)

Bridge 2019	vs. Previous	TIMSS Cy	vcles (Seco	ondary 2)
-------------	--------------	----------	-------------	-----------

	Science						
	Scale scores	s.e.					
2019 eTIMSS	504	5.2					
2019 Bridge Study	531	5.3					
2015	546#	3.9					
2011	535	3.4					
2007	530	5.0					
2003	556#	3.0					
1999	530	3.5					
1995	510^	5.9					

[^] TIMSS 2019 Bridge result significantly higher

[#] TIMSS 2019 Bridge result significantly lower

31

Secondary 2: Gender

	G	irls	B	oys	Difference	Gene	der Difference	•	
Country	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score	(Absolute Value)	Girls Scored Highe	er Score	Boys ed 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)				TIMSS 2019
Bahrain	49 (0.9)	512 (2.6)	51 (0.9)	461 (2.8)	51 (3.7)				
² Saudi Arabia	49 (0.9)	455 (3.3)	51 (0.9)	408 (3.9)	47 (5.0)				Condon 8.
Kuwait	53 (2.2)	461 (5.7)	47 (2.2)	426 (9.4)	35 (10.3)				Genuer &
Qatar	50 (2.4)	488 (5.2)	50 (2.4)	461 (6.0)	28 (7.4)				
² Egypt	55 (2.0)	402 (6.1)	45 (2.0)	374 (8.2)	27 (9.2)				Science
United Arab Emirates	48 (1.8)	486 (3.9)	52 (1.8)	461 (4.0)	25 (6.5)				Derence
Finland	48 (0.8)	552 (3.1)	52 (0.8)	533 (3.9)	19 (3.5)				A ale: arrange and
Iran, Islamic Rep. of	47 (1.3)	459 (4.6)	53 (1.3)	441 (5.4)	17 (7.2)				Achievement
Cyprus	49 (0.6)	491 (2.4)	51 (0.6)	476 (2.5)	15 (3.1)				
Ψ South Africa (9)	52 (0.6)	376 (3.2)	48 (0.6)	364 (3.6)	12 (2.8)				(Secondary 2)
² Sweden	49 (0.9)	527 (3.7)	51 (0.9)	516 (3.8)	11 (4.0)				(Secondary 2)
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)		-		
² 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)				
† 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)		1		
[†] Hong Kong SAR	46 (2.1)	505 (5.9)	54 (2.1)	503 (6.3)	2 (6.5)		I		
Morocco	50 (0.7)	395 (2.9)	50 (0.7)	393 (2.9)	2 (2.4)		1		
¹ Georgia	48 (1.2)	447 (4.4)	52 (1.2)	446 (4.5)	1 (4.3)		1		
Australia	49 (1.5)	529 (3.1)	51 (1.5)	528 (4.6)	0 (4.7)				
† Norway (9)	49 (0.7)	495 (3.5)	51 (0.7)	496 (3.8)	1 (3.9)				
† New Zealand	48 (2.1)	497 (3.6)	52 (2.1)	500 (4.9)	3 (5.0)				Difference statistically significant
³ Israel	52 (1.7)	512 (4.5)	48 (1.7)	515 (5.0)	3 (4.6)				Difference not statistically significant
France	49 (0.8)	487 (2.6)	51 (0.8)	490 (3.6)	4 (3.4)				-
Chinese Taipei	50 (0.9)	5/2 (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)				
2 Singapore	49 (0.7)	604 (4.5)	51 (0.7)	611 (4.5)	7 (4.4)				
 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)	1 (2.7)				
Japan Kasa Par of	52 (1.0)	505 (Z.4)	48 (1.0)	5/5 (2.5)	10 (2.5)				
Norea, Rep. of	48 (1.4)	000 (Z.9)	52 (1.4)	000 (2.0)	10 (3.5)				
Unite	49 (1.0)	407 (3.0)	51 (1.0)	400 (3.9)	11 (4.7)				
nungary	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)	8	0 40	0	40 8	30

Gender and Achievement (S2)





Primary 4: Socioeconomic status; resources

0

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

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

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)






Mean Science Score

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



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

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

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



41

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



Mean Science Score



Percentage of Secondary 2 Students

Average Science Achievement by Home Educational Resources



Average Home Educational Resources Scale Score

A Short Summary

- 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.

48

Secondary 2: Students' well-being and absence



Students Feel This Way When They Arrive At School



* % too low for score estimation

A short summary – S2

- 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 tied.
- □ These all may relate to SES but we need to further investigate.

What do the scores mean? (Secondary 2)



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.



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.

Crocodiles have an angle of vision of 290° 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 ye	
2. Crocodiles today look like ancient crococ	

 Crocodiles have an angle of vision of 290 diagram.



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

Give one reason.

Japan	85 (1.6)	
² Singapore	84 (1.5)	
Portugal	79 (1.9)	
Ireland	76 (2.2)	
Korea, Rep. of	75 (2.1)	
Turkey	75 (2.0)	
³ Israel	72 (1.9)	
Finland	72 (1.8)	
France	69 (2.2)	
Australia	68 (1.9)	
Lithuania	68 (2.4)	
² Sweden	68 (2.2)	
England	67 (2.7)	
[†] United States	66 (1.5)	
² 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)	
² Kazakhstan	54 (2.9)	
Bahrain	54 (1.6)	
Romania	49 (2.8)	\bigtriangledown
Chile	48 (2.5)	\bigtriangledown
Qatar	44 (1.8)	\bigtriangledown
Jordan	44 (2.3)	\bigtriangledown
United Arab Emirates	44 (1.0)	\bigtriangledown
Iran Islamic Rep. of	44 (2 1)	∇
[†] Hong Kong SAR	40 (2.7)	\bigtriangledown



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)
1	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 HK students	56 (2.3)
	this is not true twriting.	53 (2.7)
50	always poor at me	52 (2.3)
are	Since 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)
	International Average	48 (0.4)
	Jordan	48 (2.6)
-	Portugal	47 (3.0)



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.

• .



Advanced International Benchmark

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



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 dolphin	ant earthworm fish frog jellyfish		

Japan	75 (1.9)	
Chinese Taipei	63 (1.9)	
² Singapore	62 (2.0)	
Hungary	52 (2.8)	
[†] Hong Kong SAR	46 (2.6)	
2 Russian Federation	44 (2.5)	
¹ Georgia	42 (3.2)	
Italy	41 (2.6)	
Romania	40 (2.4)	
Finland	37 (1.7)	
Lithuania	37 (2.7)	
² Kazakhstan	35 (2.6)	
Australia	35 (1.6)	
Portugal	35 (2.6)	
³ Israel	33 (2.5)	
Korea, Rep. of	31 (2.1)	
[†] New Zealand	30 (2.0)	
[†] United States	30 (1.9)	
International Average	30 (0.3)	
England	27 (2.5)	
Cyprus	27 (2.0)	
United Arab Emirates	27 (1.2)	\bigtriangledown
Labaraa	00 (0.0)	



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		
² Singapore	90 (1.2)		
Korea, Rep. of	86 (1.5)		
Hungary	84 (1.4)		
Ireland	84 (1.7)		
² 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)		
² Sweden	72 (2.1)		
Malaysia	72 (1.9)		
³ Israel	71 (2.1)		
Oman	71 (1.9)		
Bahrain	70 (1.9)		
Romania	69 (2.2)		
International Average	69 (0.3)		
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?



The vehicle lost mass when it was transported from Earth to Mars.



The vehicle gained mass when it began moving on Mars.



The magnetic attraction on Earth is different from Mars.



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)
² 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)
² Sweden	46 (2.3)
France	44 (2.5)
Finland	44 (2.1)
Hungary	43 (2.2)
² Russian Federation	42 (2.8)
² Kazakhstan	42 (2.0)
² Saudi Arabia	41 (2.2)
¹ Georgia	40 (2.8)
United Arab Emirates	39 (1.1)
International Average	38 (0.4)
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) 🛛 🖓
² 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



Explain your answer.

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

International Benchmarks (S2)

Country		tages of Students Reaching ernational Benchmarks		 Advanced High Intermediate Low 	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
² Singapore		•		0-0	48 (1.9)	77 (2.0)	91 (1.2)	98 (0.5)
Chinese Taipei		•	0	• •	29 (1.0)	64 (1.0)	88 (0.7)	97 (0.3)
Japan	•		0	• •	22 (1.4)	63 (1.1)	90 (0.6)	99 (0.3)
Korea, Rep. of	•		0	• 0	22 (0.9)	56 (1.1)	86 (0.8)	96 (0.4)
Finiano	•	(• •	16 (1.0)	50 (1.5)	80 (1.4)	94 (0.7)
[†] United States	•	O	•	0	15 (1.1)	43 (1.8)	70 (1.8)	88 (1.4)
² Russian Federation	•			• •	13 (1.4)	48 (2.3)	82 (1.7)	97 (0.8)
² Sweden	•	O	•	0	13 (1.1)	41 (1.5)	71 (1.5)	89 (0.9)
Turkey	•		•	0	13 (0.9)	38 (1.8)	66 (1.6)	88 (1.0)
Australia	•	O		• • •	13 (1.2)	43 (1.6)	74 (1.2)	92 (0.7)
³ Israel	•	0	•	0	12 (1.3)	38 (1.9)	67 (1.9)	87 (1.2)
Hungary	•	O		• 0	12 (1.1)	42 (1.5)	75 (1.3)	93 (0.7)
Lithuania	•	O		• •	11 (1.0)	43 (1.6)	78 (1.2)	95 (0.6)
England	•	0	•	0	11 (1.3)	38 (2.1)	69 (2.1)	89 (1.4)
United Arab Emirates	•	0	• •		10 (0.4)	30 (0.8)	53 (0.9)	72 (0.7)
Ireland	•			• •	10 (0.8)	40 (1.4)	73 (1.5)	92 (0.9)
† Hong Kong SAR	•	0	•	0	9 (1.2)	33 (2.1)	64 (2.3)	85 (1.9)
Bahrain	•	0	•	0	8 (0.5)	29 (0.8)	57 (0.9)	79 (0.9)
† New Zealand	•	0	•	0	8 (0.6)	30 (1.4)	63 (1.6)	85 (1.2)
Portugal	•			• •	7 (0.7)	34 (1.5)	73 (1.7)	95 (1.0)
A ·	- I		_		7 (0.0)	05 4 0		70 14 1
International Median	• •	-0	•	0	7	29	61	85

International Benchmarks: Trend

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

A Short Summary – S2

- □ 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)

69

What do the scores mean? (Primary 4)



Low International Benchmark

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

Which animal has a backbone?



Which animal has a backbone?





octopus



butterfly





spider

Hungary

² Latvia 88 (1.6) 87 (1.6) Croatia Korea, Rep. of 87 (1.6) 86 (2.5) Albania 85 (1.7) Armenia 85 (1.4) Chinese Taipei ² Slovak Republic 84 (1.7) [†] Norway (5) 83 (2.0) 83 (1.8) ¹ Georgia Bulgaria 83 (2.1) ^{2†} United States 82 (1.2) ² Serbia 82 (1.9) Poland 81 (1.6) Bosnia and Herzegovina 81 (1.7) ² Turkey (5) 81 (1.8) Czech Republic 81 (1.9) North Macedonia 81 (2.1) ² Russian Federation 80 (1.9) 80 (1.5) Japan 79 (2.0) [†] Denmark Malta 79 (1.7) Finland 79 (1.7) Sweden 79 (1.9) Australia 78 (1.7) ² New Zealand 78 (1.8) 78 (1.5) ¹² Canada ² Kazakhstan 77 (1.8) ² England 77 (2.4) 76 (2.0) France Azerbaijan 76 (2.0) 76 (2.0) [†] Northern Ireland 76 (2.1) Ireland Montenegro 75 (1.7) Cyprus 75 (1.8) 74 (2.0) ² Lithuania International Average 74 (0.3) 74 (1.7) Morocco ² Kosovo 74 (1.8) [†] Hong Kong SAR 74 (2.3)

89 (1.6)



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)	
³ Singapore	83 (1.2)	
Cyprus	83 (1.7)	
² England	81 (2.1)	
Ireland	81 (1.9)	
^{2†} 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)	
12 Canada	75 (1.6)	
² Russian Federation	74 (2.3)	
Czech Republic	73 (1.9)	
Germany	73 (2.1)	
Korea, Rep. of	73 (2.1)	
² Lithuania	71 (1.9)	
Spain	70 (2.0)	
² New Zealand	70 (1.7)	
² Portugal	70 (2.2)	
Austria	70 (2.2)	
Hungary	68 (2.0)	
Poland	67 (1.9)	
Italy	65 (2.1)	
² Slovak Republic	63 (2.4)	
France	62 (2.6)	
[†] Hong Kong SAR	62 (3.0)	
Chile	61 (2.1)	
² Latvia	60 (2.2)	
² Turkey (5)	58 (2.4)	
International Average	57 (0.3)	
2 0	E4 (0.7)	

Four Levels of International Benchmarks



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. Camel	
2. Cactus	
What are two non-living things shown in the pictur	e?
1. Rock	

2. Sand

Kuwait	40 (2.3)
International Average	45 (0.3)
Albania	39 (2.8) 🗸
² 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) ▽
² Pakistan	34 (3.6) 🗸
Azerbaijan	33 (2.0) 🗸
² New Zealand	32 (2.0) 🗸
Spain	32 (2.2) 🗸
1 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) 🛛
² Philippines	15 (1.5) 🗸
Chinese Taipei	10 (1.2) 🗸

Four Levels of International Benchmarks



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





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)	
³ Singapore	54 (2.0)	
Chinese Taipei	45 (2.2)	
Sweden	45 (2.6)	
† Norway (5)	44 (2.2)	
Finland	43 (1.7)	
² Slovak Republic	42 (2.3)	
² Serbia	40 (2.7)	
2† 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)	
² England	37 (2.7)	
Japan	37 (1.9)	
² 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)	
² New Zealand	31 (1.6)	
² Portugal	31 (2.2)	
¹² Canada	31 (1.9)	
International Average	30 (0.3)	
-		

Content domains and Cognitive domains

Reasoning	goes beyond the solution of familiar problems to encompass					
20%	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	s, concepts, ar	nd procedures st	udents need to know		
P4	Life Science	Physics	s Science	Earth Science		
	45%	3	35%	20%		
S2	Biology	Physics	Chemistry	Earth Science		
	35%	25%	20%	20%		

Content domains

Content and Cognitive Domains (S2)

	Biology	Ch	emistry	Ph	ysics	Earth Science
HK	501		485		510	512
	Knowing		Appl	ying		Reasoning
HK	501		50	1		504

Trends: Cognitive Domains (S2)

84

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

Applying				Reasoning					
Average	Differences Between Years		Differen Je Between '		s Average		Di Bet	ifferences ween Yea	s Irs
Scale Score	2015	2011	2007	Scale Score	2015	2011	2007		
501 (5.2)	-39 🗸	-27 🗸	-21 🗸	504 (5.2)	-47 ▽	-34 🗸	-31 🗸		

Trends: Content Domains (S2)

85

	Biology			С				
Country	Average	Differences Between Years		Average Between		fferenc ween Y	es ears	
	Scale Score		2011	2007	Scale Score	2015	2011	2007
† 2019	501 (5.7)	-48 🗸	-35 🗸	-29 🗸	485 (5.5)	-51 🗸	-41 🗸	-36 🗸

Physics				Earth Science			
Average	Di Bet	fferenc ween Y	es ears	Average	Di Betv	fferenc ween Ye	es ears
Scale Score	2015	2011	2007	Scale Score	2015	2011	2007
510 (5.6)	-30 🗸	-29 🗸	-20 🗸	512 (5.6)	-46 🗸	-28 🗸	-24 🗸

A Short Summary – S2

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

87

Attitudinal results

https://padlet.com/mauricec/attitude



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

♡ 🛱 REMAKE 🎓 SHARE 🏚 … M

Enhancing attitude towards science What could we do to enhance it? (be specific)





See science as important



Attitude

Confidence in success



- 3) <Science> is not one of my strengths R ----
- 4) I learn things quickly in <science> - - -
- 6) My teacher tells me I am good at <science> -
- 8) <Science> makes me confused ^R - - - -



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

- 1) I enjoy learning <science> - - - -
- 2) I wish I did not have to study <science> R - -

Ike

- 4) I learn many interesting things in <science> -
- 6) I look forward to learning <science> in school -
- 8) I like to conduct <science> experiments - -
- 9) <Science> is one of my favorite subjects - -

Attitudinal Results (Secondary 2)

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

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

General/Integrated Science	Very Much Like Learning Science L		Somew Learning	rhat Like g Science	Do N Learning	ot Like g Science	
Country	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.			
Egypt	54 (1.6)	426 (5.0)	38 (1.3)	358 (6.	Secor	ndary 2	
Turkey	54 (1.4)	536 (3.3)	37 (0.9)	494 (5.	Stude	nts Like	
Iran, Islamic Rep. of	53 (1.3)	469 (3.9)	37 (1.0)	428 (4.	Stude		_
Kuwait	46 (1.7)	468 (5.5)	39 (1.1)	435 (6.	earning S	Science So	cale
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)	95
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)	

General/Integrated Science	Very Co in Sc	onfident ience	Somewhat Confident Not Cor in Science in Sci		onfident sience	
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	00 (0.0)	407 (4.0)
Turkey	38 (1.2)	569 (3.5)	37 (0.8)	502 (4.2	Second	ary 2
Jordan	37 (1.4)	502 (3.6)	38 (0.6)	448 (4.5	tudonte (onfidant
Bahrain	36 (1.3)	531 (2.4)	38 (0.7)	487 (3.8	tuuents C	onnuent
Egypt	35 (1.1)	445 (5.1)	38 (0.7)	384 (5.7	in Scienc	e Scale
Saudi Arabia	33 (1.0)	474 (3.4)	42 (0.8)	425 (3.1)	20 (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)

Attitudinal Results (Secondary 2)

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

Country	Strong Sci	lly Value ence	Somew Sci	hat Value ence	Do No Sci	ot Value ence	
	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)	Seco	ondary 2
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)	Stude	ents Value
Bahrain	51 (0.9)	507 (1.8)	36 (0.7)	479 (3.5)	13 (0.6)	Scio	nco Scolo
Morocco	49 (0.9)	409 (2.7)	39 (0.7)	383 (3.2)	12 (0.6)	SUE	ille Stale
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)	00
Chinese Taipei	14 (0.7)	609 (4.4)	41 (0.8)	589 (2.5)	45 (1.0)	551 (2.4)	98
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)	

Trends in Valuing Science

Students Value Science – Secondary 2						
	Strongly Value Science					
	Hong Kong	International				
2019	23 (0.9)	36 (0.2)				
2015	24 (1.0)	40^ (0.2)				
2011	26^(1.0)	41^ (0.2)				

[^] Result significantly higher than 2019

	Very Much L Scie	like Learning ence	Very Confide	ent 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		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



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





Science Labs, Science Experiments

School Resources for Conducting Experiment (Secondary 2)

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

Frequency on Conducting Experiments in Science Lessons (Secondary 2)

104

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

Take Home / Stay Home Message (S2)

- 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...

Summary

□ 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


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



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 <<u>Google Form</u>>



TIMSS Materials

International reports of TIMSS 2019 may be downloaded at:

→ <u>https://timss.bc.edu</u>

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