## Exhibit 4.1: Average Science Achievement and Scale Score Distributions

Science • Grade 8

<b>EIEA</b>
TIMSS
2019

Country	Average Scale Score	•		Sc	ience Achieve	ment Distribut	ion		
<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)	<b>A</b>							
England	517 (4.8)	<b>A</b>						• • • • • • • • • • • • • • • • • • •	
Turkey	515 (3.7)	<u> </u>							
<sup>3</sup> Israel	513 (4.2)					-		•	
<sup>†</sup> Hong Kong SAR	504 (5.2)					-			
Italy	500 (2.6)								
TIMSS Scale Centerpoint	500								
<sup>†</sup> New Zealand	499 (3.5)					-			
<sup>†</sup> Norway (9)	495 (3.1)				_	-			
France	489 (2.7)	$\bigtriangledown$							
Bahrain	486 (1.9)	$\nabla$				-			
Cyprus	484 (1.9)	$\bigtriangledown$							
<sup>2</sup> Kazakhstan	478 (3.1)	$\bigtriangledown$				-			
Qatar	475 (4.4)	$\bigtriangledown$				_			
United Arab Emirates	473 (2.2)	$\bigtriangledown$				-		•	
Romania	470 (4.2)	$\bigtriangledown$				-			
Chile	462 (2.9)	$\bigtriangledown$				-			
Malaysia	460 (3.5)	$\bigtriangledown$		_		_			
Oman	457 (2.9)	$\nabla$							
Jordan	452 (4.7)	$\bigtriangledown$				_			
Iran, Islamic Rep. of	449 (3.6)	$\nabla$							
<sup>1</sup> Georgia	447 (3.9)	$\nabla$							
Kuwait	444 (5.7)	$\nabla$							
<sup>2</sup> Saudi Arabia	431 (2.6)	$\nabla$					_		
Morocco	394 (2.7)	$\nabla$							
<sup>2</sup> Egypt	389 (5.4)	$\nabla$					_		
Lebanon	377 (4.6)	V							
Ψ South Africa (9)	370 (3.1)	$\nabla$							
	570 (5.1)			-				-	
Benchmarking Participants			0 200	300	400	500	600	700	800
Moscow City, Russian Fed.	567 (2.9)						-		
<sup>2</sup> Dubai, UAE	548 (2.0)				-				
<sup>‡</sup> Quebec, Canada	537 (3.6)								
Ontario, Canada	522 (3.0)								
Western Cape, RSA (9)	439 (5.1)	$\bigtriangledown$							
Gauteng, RSA (9)	422 (3.9)	$\bigtriangledown$							
Abu Dhabi, UAE	420 (3.6)	$\bigtriangledown$							
		1	00 200	300	400	500	600	700	800
		▲	Average significantly hig the centerpoint of the TIM			5 <sup>th</sup>	Percentiles of Per 25 <sup>th</sup>	formance 75 <sup>th</sup> 95 <sup>th</sup>	
			Average significantly low						
		$\bigtriangledown$	the centerpoint of the TIM			95%	Confidence Interval for	or Average (+2SE)	

The TIMSS achievement scale was established in 1995 based on the combined achievement distribution of all countries that participated in TIMSS 1995. To provide a point of reference for country comparisons, the scale centerpoint of 500 was located at the mean of the combined achievement distribution. The units of the scale were chosen so that 100 scale score points corresponded to the standard deviation of the distribution.

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%. See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and Ξ.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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## Exhibit 4.2: Significance of Differences Between Countries' Average Science Achievement



Read across the row for a country to compare performance with the countries listed along the top of the chart. If no statistically significant difference was found, no symbol is present. If the difference is significant ( $\rho < 0.05$ ), a symbol indicates whether the estimated achievement of the country in the row is higher ( $\blacktriangle$ ) than that of the comparison country, or lower ( $\nabla$ ).

																																-
ountry	Average Scale Score	Singapore	Chinese Taipei		Korea, Rep. of Duccion Ecoloration	Finland	Lithuania	Hungary	Australia	Ireland	United States	Sweden	Portugal	England	Turkey	Islael	Hong Kong SAK Italv	New Zealand	Norway (9)	France	Bahrain	Cyprus	Kazakhstan	Qatar	United Arab Emirates	Romania	Chile	Malaysia	Oman		Iran, Islamic Rep. of	Georgia
Singapore	608 (3.9)															_	• •															2
Chinese Taipei	574 (1.9)	$\bigtriangledown$														•	• •															4
Japan	570 (2.1)	$\nabla$				▲										•														<b>A</b> :		,
Korea, Rep. of	561 (2.1)	_		$\nabla$	4																											4
Russian Federation	543 (4.2)	$\nabla$	$\nabla$		$\nabla$																									<b>A</b>		4
Finland	543 (3.1)		$\bigtriangledown$		$\bigtriangledown$	_																										4
Lithuania	534 (3.0)		$\nabla$				_					<b>A</b>		<b>A</b>							<b>A</b>	<b>A</b>	<b>A</b>	<b></b>					<b>A</b>	<b>A</b>	<b>A</b>	4
Hungary Australia	530 (2.6)		$\nabla$		7 \(\neg \)		_			-																						4
Ireland	528 (3.2) 523 (2.9)	$\nabla$	$\nabla$	_		_	_			-		-	<b>•</b> •																			í
United States	522 (4.7)	$\nabla$	$\nabla$	$\nabla$		-																										ĺ
Sweden	521 (3.2)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	_	_	$\nabla$				-		+																		į
Portugal	519 (2.9)	$\nabla$	$\nabla$		$\nabla$	_	_	$\nabla$	$\nabla$																							j,
England	517 (4.8)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	′ ▽	$\nabla$	$\nabla$																					<b>A</b> .		ļ
Turkey	515 (3.7)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	′ ▽	$\nabla$	$\nabla$																					<b>A</b> ,		Ī
Israel	513 (4.2)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	′ ▽	$\nabla$	$\bigtriangledown$																					<b>A</b> .		ļ
Hong Kong SAR	504 (5.2)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	′ ▽	$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$	$\nabla$	$\bigtriangledown$																	<b>A</b> .		ļ
Italy	500 (2.6)	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\nabla \mid \nabla$	7 🗸	′ ▽	$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$				$\nabla$																	4
New Zealand	499 (3.5)	$\nabla$	$\nabla$	$\bigtriangledown$	$\nabla$	_	_	$\nabla$		_		_		_	▽ 7	_														<b>A</b> <i>i</i>		,
Norway (9)	495 (3.1)	$\bigtriangledown$	$\nabla$	$\bigtriangledown$	$\nabla   \nabla$	_	-	$\bigtriangledown$		_					7																	
France	489 (2.7)		$\nabla$	$\bigtriangledown$		· ·		$\nabla$	Y	$\nabla$	_	_							_		_	_										-
Bahrain	486 (1.9)		$\nabla$	$\nabla$				$\nabla$				_		_						_		_										
Cyprus	484 (1.9)		$\nabla$	$\nabla$		-		$\nabla$	$\nabla$	$\nabla$		· .		_		_	$\nabla \nabla$	_	$\nabla$	$\nabla$	$\nabla$	_	_	_								ŕ
Kazakhstan Qatar	478 (3.1) 475 (4.4)		$\nabla$	$\nabla$		/ V 7 \[\[\]	/ \ /	$\nabla$	$\nabla$	$\nabla$	_	_		_			$\nabla$ $\nabla$	_	$\nabla$	$\nabla$	$\nabla$	_		-	_	-						1
United Arab Emirates	473 (2.2)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	' \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	$\nabla$	$\nabla$	$\nabla$		-	-	_		_	$\nabla$ $\nabla$		$\nabla$	$\nabla$	$\nabla$	$\nabla$		-								Í
Romania	470 (4.2)	_ ▼	$\overline{\nabla}$	$\overline{\nabla}$	$\nabla$	_	_	$\nabla$		_	_	_	_	_		_	$\nabla$ $\nabla$	_	$\nabla$	$\overline{\nabla}$	$\nabla$	$\nabla$					-	-				ii J
Chile	462 (2.9)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	_	′	$\nabla$	$\nabla$	_		_			$\nabla$		$\nabla$ $\nabla$	_	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$					_		į
Malaysia	460 (3.5)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	′ ▽	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\overline{}$	$\nabla$	7 1	$\nabla$ $\nabla$	′ ▽	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$							,
Oman	457 (2.9)	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	7 🗸	′ ▽	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$		7	7 1	$\nabla$ $\nabla$	′ ▽	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$						
Jordan	452 (4.7)	$\nabla$	$\nabla$	$\nabla$	$\nabla \mid \nabla$	7 🗸	′ ▽	$\nabla$	$\nabla$	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 '	$\nabla \mid \nabla$	′   ▽	$\nabla$	$\nabla$	$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$						1
Iran, Islamic Rep. of	449 (3.6)	$\bigtriangledown$	$\nabla$	$\bigtriangledown$	$\nabla$	7 🗸	′ ▽	$\bigtriangledown$	$\nabla$	$\bigtriangledown$	$\nabla$	_		_		_	$\nabla \mid \nabla$	_	$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$		$\bigtriangledown$				
Georgia	447 (3.9)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	_	_	$\nabla$	$\bigtriangledown$	_	_	_			$\nabla$	_	$\nabla \mid \nabla$	_	$\nabla$	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$		$\bigtriangledown$			_
Kuwait	444 (5.7)	$\bigtriangledown$	$\nabla$	$\nabla$		-		$\nabla$		_	_	_		_	7	_		_	$\nabla$	$\nabla$	$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Saudi Arabia	431 (2.6)	$\nabla$	$\bigtriangledown$	$\bigtriangledown$		7 🗸		$\nabla$		$\bigtriangledown$				· .		_			$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$	$\nabla$	_	_	_	7
Morocco	394 (2.7)		$\nabla$							_								_		$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$		$\nabla$			_	1
Egypt	389 (5.4)		$\nabla$	$\nabla$	7 \(\neg \)	_	_	$\nabla$		_									$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$				7
Lebanon South Africa (9)	377 (4.6) 370 (3.1)		$\nabla$	$\nabla$		_	_	$\nabla$		_						_	$\nabla$ $\nabla$	_	$\nabla$	$\nabla$	$\nabla$	V	V	V	$\nabla$	$\nabla$	$\nabla$	$\nabla$			_	7
	370 (3.1)		V	V	V   1		V	V	V	V	V	~	~	~	~ `	~	v i v	V	V	V	V	~	V	V	V				~	v	~	-
Benchmarking Participants Moscow City, Russian Fed.	567 (2.9)	$\nabla$	$\nabla$														<b>A A</b>															-
Dubai, UAE	548 (2.0)	$\nabla$	$\nabla$	$\nabla$	$\nabla$																								-			ĺ
Quebec, Canada	537 (3.6)	_ ▼			V		-																									i J
Ontario, Canada	522 (3.0)	$\nabla$	$\nabla$		7	7 🗸	′ ▽	$\nabla$																								
Western Cape, RSA (9)	439 (5.1)	$\nabla$	$\nabla$	$\nabla$	7	7 🗸	′ ▽	$\nabla$	$\nabla$	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 1	$\nabla$ $\nabla$	′ ▽	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$			Ĩ
Gauteng, RSA (9)	422 (3.9)	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$	7 🗸	′ ▽	$\bigtriangledown$	$\nabla$	$\bigtriangledown$	$\nabla$	$\nabla$	$\nabla$	$\bigtriangledown$	$\nabla$	7   1		′   ▽	$\nabla$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\bigtriangledown$	$\nabla$	$\bigtriangledown$	7
Abu Dhabi, UAE	420 (3.6)	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7 🗸	' V	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\overline{\nabla}$	$\nabla$	7 1	$\nabla$	· 🗸	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7

 $\bigstar$  Average achievement significantly higher than comparison country  $\bigtriangledown$  Average achievement significantly lower than comparison country

Significance tests were not adjusted for multiple comparisons. Five percent of the comparisons would be statistically significant by chance alone. () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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puntry	Average Scale Score	Saudi Arabia	Morocco	Egypt	Lebanon	South Africa (9)	Benchmarking Participants	Moscow City, Russian Fed.	Dubai, UAE	Quebec, Canada	Ontario, Canada	Western Cape, RSA (9)	Gauteng, RSA (9)	
Singapore	608 (3.9)					<b>A</b>	ä							
Chinese Taipei	574 (1.9)						1							4
Japan	570 (2.1)						1							4
Korea, Rep. of	561 (2.1)						]							
Russian Federation	543 (4.2)							$\bigtriangledown$						
Finland	543 (3.1)							$\nabla$						4
Lithuania	534 (3.0)							$\nabla$	$\nabla$					4
Hungary	530 (2.6)							$\nabla$	$\nabla$					4
Australia	528 (3.2)							$\nabla$	$\nabla$					4
Ireland	523 (2.9)							$\nabla$	$\nabla$	$\nabla$				4
United States	522 (4.7)								$\nabla$	$\nabla$				4
Sweden	521 (3.2)													4
Portugal	519 (2.9)													4
England	517 (4.8)													4
Turkey	515 (3.7)		<b>A</b>											4
Israel	513 (4.2)								$\nabla$	$\nabla$				4
Hong Kong SAR Italy	504 (5.2)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
New Zealand	500 (2.6) 499 (3.5)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Norway (9)	495 (3.1)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
France	489 (2.7)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Bahrain	486 (1.9)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Cyprus	484 (1.9)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Kazakhstan	478 (3.1)						1	$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Qatar	475 (4.4)						1	$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
United Arab Emirates	473 (2.2)						1	$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
Romania	470 (4.2)						]	$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
Chile	462 (2.9)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
Malaysia	460 (3.5)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
Oman	457 (2.9)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
Jordan	452 (4.7)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			4
Iran, Islamic Rep. of	449 (3.6)								$\nabla$	$\nabla$	$\nabla$			4
Georgia	447 (3.9)								$\nabla$	$\nabla$	$\nabla$			4
Kuwait	444 (5.7)													4
Saudi Arabia	431 (2.6)													
Morocco	394 (2.7)		_											7
Egypt Lebanon	389 (5.4)	$\nabla$	$\nabla$					$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	7
South Africa (9)	377 (4.6) 370 (3.1)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	$\nabla$	$\nabla$				$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$	V	7
	370 (3.1)	- <u> </u>	~							v		v	~	
Benchmarking Participants Moscow City, Russian Fed.	567 (2.9)						1							4
Dubai, UAE	548 (2.0)							$\nabla$	-					
Quebec, Canada	537 (3.6)						1	$\nabla$	$\nabla$	_				
Ontario, Canada	522 (3.0)							$\nabla$	$\nabla$	$\nabla$				
Western Cape, RSA (9)	439 (5.1)							$\nabla$	$\nabla$	$\nabla$	$\nabla$			
Gauteng, RSA (9)	422 (3.9)	$\nabla$					1	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$		
Abu Dhabi, UAE	420 (3.6)	$\nabla$					1	$\nabla$	$\nabla$	$\nabla$	$\nabla$	$\nabla$		Ē

 $\blacktriangle$  Average achievement significantly higher than comparison country  $\nabla$  Average achievement significantly lower than comparison country

Significance tests were not adjusted for multiple comparisons. Five percent of the comparisons would be statistically significant by chance alone. () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. **EXAMPLE TIMSS & PIRLS** International Study Center Lynch School of Education BOSTON COLLEGE

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