

Exhibit 2.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years[◇]

Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▽) than the performance in the column year.

Country	Average Scale Score	Knowing			Average Scale Score	Applying			Average Scale Score	Reasoning		
		Differences Between Years				Differences Between Years				Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
Armenia												
2019	463 (3.4)	18 ▲	51 ▲		453 (3.3)	13 ▲	35 ▲		486 (3.6)	50 ▲	83 ▲	
2015	445 (4.1)		33 ▲		440 (4.8)		22 ▲		435 (4.2)		33 ▲	
2011	412 (4.3)				418 (3.9)				402 (5.1)			
Australia												
2019	538 (3.0)	15 ▲	20 ▲	6	524 (3.2)	1	10 ▲	2	538 (3.0)	10 ▲	20 ▲	9
2015	523 (3.3)		5	-9	522 (2.7)		9 ▲	0	527 (3.0)		10 ▲	-1
2011	517 (2.8)			-14 ▽	513 (3.0)			-9	518 (3.4)			-11 ▽
2007	532 (3.5)				522 (3.8)				528 (4.2)			
Austria												
2019	523 (3.1)		-9 ▽	-8 ▽	523 (2.4)		-10 ▽	-3	518 (3.3)		-7	4
2011	532 (3.0)			1	533 (2.9)			7	525 (3.1)			11 ▲
2007	531 (2.4)				527 (2.7)				514 (2.8)			
Azerbaijan												
2019	425 (4.0)		-20 ▽		419 (4.5)		-20 ▽		430 (3.5)		28 ▲	
² 2011	445 (6.4)				439 (5.3)				402 (5.9)			
Bahrain												
2019	496 (3.7)	41 ▲	43 ▲		494 (3.4)	33 ▲	51 ▲		481 (3.6)	26 ▲	39 ▲	
² 2015	456 (2.5)		2		462 (3.0)		18 ▲		455 (3.0)		13 ▲	
2011	454 (3.8)				443 (3.8)				442 (4.8)			
Belgium (Flemish)												
[†] 2019	493 (2.7)	-5	-14 ▽		501 (2.2)	-12 ▽	-10 ▽		511 (2.4)	-15 ▽	3	
[†] 2015	498 (2.7)		-9 ▽		513 (2.5)		2		526 (2.9)		17 ▲	
2011	507 (2.2)				511 (1.9)				508 (2.6)			
Bulgaria												
2019	526 (5.4)	-25 ▽			523 (5.4)	-14			507 (5.5)	1		
2015	551 (6.5)				536 (6.2)				507 (6.4)			
Canada												
^{1,2} 2019	524 (1.9)	2			520 (2.0)	-8 ▽			525 (1.8)	1		
^{1,2} 2015	523 (3.1)				528 (2.6)				524 (2.6)			
Chile												
2019	473 (3.7)	-5	-10 ▽		461 (3.4)	-15 ▽	-19 ▽		472 (2.7)	-5	-5	
2015	477 (3.2)		-5		476 (3.0)		-4		477 (2.5)		0	
2011	483 (2.8)				479 (2.3)				477 (2.8)			
Chinese Taipei												
2019	560 (1.9)	4	18 ▲	17 ▲	561 (2.0)	7 ▲	8 ▲	1	552 (2.7)	-6	-15 ▽	-21 ▽
2015	557 (2.5)		15 ▲	13 ▲	553 (2.6)		1	-6	558 (3.1)		-10 ▽	-16 ▽
2011	542 (2.6)			-1	552 (3.2)			-7	568 (3.1)			-6
2007	544 (2.7)				560 (2.1)				574 (3.3)			
Croatia												
2019	526 (2.4)	-8 ▽	1		521 (2.3)	-9 ▽	11 ▲		522 (2.5)	-14 ▽	10 ▲	
2015	534 (2.9)		9 ▲		530 (2.2)		20 ▲		536 (2.4)		23 ▲	
² 2011	526 (2.0)				510 (2.4)				512 (3.5)			
Cyprus												
2019	503 (3.3)	35 ▲			519 (3.0)	30 ▲			511 (3.2)	21 ▲		
2015	467 (3.2)				489 (3.4)				490 (3.6)			
Czech Republic												
2019	538 (2.9)	-6	-12 ▽	18 ▲	526 (2.5)	-2	-8 ▽	11 ▲	539 (3.2)	10 ▲	22 ▲	31 ▲
2015	545 (3.0)		-6	24 ▲	528 (2.1)		-6	13 ▲	529 (2.4)		12 ▲	21 ▲
2011	551 (3.2)			30 ▲	534 (2.7)			19 ▲	516 (3.9)			9
2007	521 (3.0)				515 (3.3)				507 (3.6)			
Denmark												
[†] 2019	521 (2.0)	-3	-4	4	519 (2.5)	-10 ▽	-12 ▽	6	527 (2.7)	2	0	3
² 2015	524 (2.6)		0	7	529 (2.4)		-2	16 ▲	526 (2.9)		-2	1
² 2011	524 (2.6)			7	532 (2.5)			19 ▲	527 (2.9)			3
[†] 2007	517 (3.3)				513 (3.4)				524 (4.4)			
England												
² 2019	544 (3.3)	10 ▲	15 ▲	-4	526 (3.0)	-12 ▽	-7	-11 ▽	544 (3.7)	5	17 ▲	3
2015	533 (2.6)		5	-14 ▽	538 (2.7)		5	1	539 (2.7)		12 ▲	-1
2011	529 (3.4)			-19 ▽	532 (3.2)			-4	526 (4.5)			-14 ▽
2007	547 (3.3)				537 (3.4)				540 (2.8)			

▲ Average from more recent year significantly higher
 ▽ Average from more recent year significantly lower

[◇] Trend reporting in cognitive domains using current methodology began with TIMSS 2007. See Appendix B.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and §. () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years^o

(Continued)

Country	Average Scale Score	Knowing			Average Scale Score	Applying			Average Scale Score	Reasoning		
		Differences Between Years				Differences Between Years				Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
Finland												
2019	553 (2.5)	-3	-26 ▽		551 (2.5)	-2	-17 ▽		563 (2.4)	11 ▲	3	
2015	556 (3.1)		-23 ▽		553 (2.4)		-15 ▽		552 (2.3)		-8 ▽	
2011	579 (2.5)				568 (2.4)				560 (3.0)			
France												
2019	485 (3.6)	4			495 (3.0)	1			475 (4.7)	-6		
2015	482 (3.8)				494 (3.1)				481 (2.8)			
Georgia												
¹ 2019	452 (3.9)	-8	-14 ▽	23 ▲	445 (3.7)	-4	-7	31 ▲	465 (4.4)	40 ▲	43 ▲	86 ▲
¹ 2015	460 (4.2)		-6	31 ▲	449 (4.8)		-3	35 ▲	426 (4.0)		3	46 ▲
¹ 2011	466 (3.8)			37 ▲	452 (4.3)			38 ▲	422 (4.8)			43 ▲
¹ 2007	429 (4.3)				415 (4.7)				379 (6.1)			
Germany												
2019	520 (2.3)	-8 ▽	-5	-9 ▽	516 (2.5)	-13 ▽	-17 ▽	-10 ▽	518 (2.9)	-13 ▽	-8	-7
2015	527 (2.8)		3	-1	529 (2.4)		-4	3	532 (2.3)		6	6
2011	524 (4.0)			-4	533 (2.5)			7 ▲	526 (3.7)			1
2007	529 (2.4)				526 (2.5)				525 (2.8)			
Hong Kong SAR												
[†] 2019	537 (3.2)	-25 ▽	0	-15 ▽	526 (3.1)	-28 ▽	-3	-26 ▽	531 (3.6)	-22 ▽	-11	-32 ▽
[†] 2015	562 (3.0)		25 ▲	9	554 (3.3)		25 ▲	1	552 (4.1)		11	-10
² 2011	537 (3.7)			-16 ▽	529 (3.5)			-24 ▽	541 (4.2)			-21 ▽
2007	553 (4.0)				552 (3.5)				563 (4.9)			
Hungary												
2019	533 (2.7)	-17 ▽	-13 ▽	-11 ▽	526 (3.1)	-13 ▽	-4	-6	532 (2.6)	-1	7	4
2015	550 (3.8)		4	6	539 (3.4)		9	7	533 (3.9)		8	5
2011	547 (3.7)			2	530 (3.5)			-2	525 (4.7)			-3
2007	544 (3.5)				532 (3.9)				528 (4.1)			
Iran, Islamic Rep. of												
2019	444 (4.6)	28 ▲	-4	13	440 (4.3)	23 ▲	-11	-2	432 (4.9)	10	-27 ▽	6
2015	416 (4.1)		-32 ▽	-15 ▽	417 (4.5)		-34 ▽	-25 ▽	422 (4.9)		-37 ▽	-5
2011	448 (4.2)			17 ▲	452 (3.8)			9	459 (3.8)			32 ▲
2007	431 (5.0)				443 (4.9)				427 (4.6)			
Ireland												
2019	532 (3.4)	3	14 ▲		525 (3.0)	-5	8		525 (3.8)	0	16 ▲	
2015	529 (2.5)		11 ▲		530 (2.5)		13 ▲		526 (2.9)		17 ▲	
2011	518 (3.8)				517 (3.6)				509 (3.3)			
Italy												
2019	515 (3.0)	-6	-17 ▽	-20 ▽	504 (2.7)	-10 ▽	-19 ▽	-37 ▽	508 (2.7)	-3	-2	-15 ▽
² 2015	521 (3.1)		-11 ▽	-14 ▽	513 (3.1)		-10 ▽	-28 ▽	511 (3.5)		2	-12 ▽
2011	532 (3.1)			-3	523 (2.8)			-18 ▽	510 (2.9)			-14 ▽
2007	535 (4.1)				541 (3.3)				523 (3.5)			
Japan												
2019	535 (2.6)	-9 ▽	-3	1	576 (2.2)	0	14 ▲	30 ▲	579 (2.4)	-15 ▽	-12 ▽	6 ▲
2015	544 (2.3)		6 ▲	9 ▲	576 (1.8)		14 ▲	31 ▲	594 (1.8)		3	21 ▲
2011	538 (1.8)			3	562 (1.6)			16 ▲	591 (1.9)			18 ▲
2007	534 (2.6)				546 (3.1)				573 (2.1)			
Kazakhstan												
² 2019	489 (2.9)		2		494 (3.4)		-5		502 (3.4)		6	
² 2011	486 (5.4)				499 (5.2)				496 (5.8)			
Korea, Rep. of												
2019	584 (2.5)	3	15 ▲		596 (2.6)	2	3		581 (2.4)	-13 ▽	-23 ▽	
2015	582 (2.2)		12 ▲		594 (1.9)		0		594 (2.2)		-11 ▽	
2011	570 (2.1)				593 (2.0)				605 (3.0)			
Lithuania												
² 2019	539 (3.1)	16 ▲	32 ▲	28 ▲	531 (2.3)	5	10 ▲	18 ▲	548 (2.9)	10 ▲	32 ▲	27 ▲
² 2015	524 (3.0)		16 ▲	12 ▲	526 (2.4)		6	13 ▲	538 (3.0)		22 ▲	17 ▲
^{1,2} 2011	508 (2.8)			-4	521 (2.5)			7	515 (2.7)			-5
¹ 2007	511 (2.3)				513 (3.3)				521 (2.9)			
Malta												
2019	496 (1.6)		60 ▲		496 (2.7)		47 ▲		490 (3.8)		31 ▲	
2011	437 (3.1)				449 (1.7)				459 (4.2)			

▲ Average from more recent year significantly higher
 ▽ Average from more recent year significantly lower

Exhibit 2.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years^o

(Continued)

Country	Average Scale Score	Knowing			Average Scale Score	Applying			Average Scale Score	Reasoning		
		Differences Between Years				Differences Between Years				Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
Morocco												
^ψ 2019	362 (6.1)	31 ▲	125 ▲		378 (6.2)	21 ▲	122 ▲		365 (5.5)	12	125 ▲	
^ψ 2015	331 (5.6)		94 ▲		357 (4.7)		101 ▲		354 (4.7)		114 ▲	
^κ 2011	237 (6.0)				256 (4.9)				240 (5.1)			
Netherlands												
[≡] 2019	515 (2.8)	6	-13 ▽	-6	517 (3.1)	-2	-17 ▽	-7	523 (3.2)	-2	-9 ▽	-2
† 2015	508 (2.4)		-19 ▽	-12 ▽	519 (2.4)		-15 ▽	-6	526 (2.9)		-6	0
† 2011	528 (2.2)			7 ▲	534 (2.0)			10 ▲	532 (3.0)			6
‡ 2007	521 (2.7)				525 (2.4)				526 (2.7)			
New Zealand												
² 2019	505 (2.7)	1	9 ▲	-6	497 (2.6)	-5	0	1	505 (2.6)	-9 ▽	8 ▲	2
2015	504 (2.8)		8 ▲	-7	502 (3.1)		5	6	514 (2.4)		17 ▲	11 ▲
2011	496 (2.7)			-15 ▽	497 (2.8)			1	497 (3.0)			-6
2007	511 (3.4)				496 (2.8)				503 (4.2)			
Northern Ireland												
† 2019	523 (2.9)	5	6		514 (2.3)	-5	-7 ▽		519 (3.2)	-1	16 ▲	
‡ 2015	518 (2.9)		1		519 (2.9)		-3		520 (2.6)		17 ▲	
† 2011	517 (3.1)				521 (2.8)				503 (3.2)			
Norway (5)												
† 2019	540 (2.5)	8 ▲			537 (2.4)	-5			540 (2.5)	3		
2015	533 (3.0)				542 (2.9)				537 (3.8)			
Poland												
2019	524 (2.6)	-19 ▽			538 (2.5)	-16 ▽			525 (2.6)	-17 ▽		
2015	544 (2.5)				554 (2.8)				542 (3.2)			
Portugal												
² 2019	502 (2.8)	-4	-25 ▽		502 (3.1)	-6	-13 ▽		504 (2.0)	-2	-21 ▽	
² 2015	507 (2.9)		-21 ▽		508 (1.9)		-7		506 (1.9)		-19 ▽	
2011	528 (4.4)				515 (4.2)				524 (4.3)			
Qatar												
2019	455 (4.4)	18 ▲	67 ▲		451 (4.2)	20 ▲	62 ▲		434 (4.3)	0	29 ▲	
2015	437 (4.5)		49 ▲		430 (4.7)		41 ▲		433 (4.4)		29 ▲	
² 2011	388 (5.2)				389 (5.4)				404 (4.7)			
Russian Federation												
² 2019	562 (3.3)	-7	9	16 ▲	572 (3.4)	3	16 ▲	22 ▲	569 (2.8)	9	27 ▲	27 ▲
2015	569 (3.9)		15 ▲	23 ▲	568 (3.3)		12 ▲	19 ▲	561 (3.8)		19 ▲	18 ▲
2011	553 (3.8)			7	556 (3.5)			6	542 (4.3)			0
2007	546 (5.5)				550 (5.3)				542 (5.3)			
Serbia												
² 2019	506 (3.3)	-20 ▽	-18 ▽		526 (3.9)	4	20 ▲		518 (3.9)	-3	-2	
³ 2015	527 (3.9)		3		522 (4.5)		16 ▲		521 (3.9)		1	
² 2011	524 (2.9)				506 (3.1)				519 (3.0)			
Singapore												
³ 2019	588 (3.7)	13 ▲	18 ▲	-11	595 (3.7)	-4	6	8	604 (3.5)	-1	7	27 ▲
² 2015	574 (4.1)		4	-24 ▽	599 (4.0)		10	12 ▲	605 (3.6)		8	29 ▲
² 2011	570 (3.4)			-29 ▽	590 (4.0)			2	597 (3.8)			20 ▲
2007	599 (4.5)				587 (4.2)				576 (4.1)			
Slovak Republic												
² 2019	527 (3.9)	-2	-20 ▽	-4	515 (4.3)	-1	-12 ▽	-11	516 (4.2)	9	2	4
2015	530 (3.3)		-17 ▽	-2	517 (2.8)		-11 ▽	-10	507 (3.4)		-7	-4
2011	547 (3.9)			15 ▲	528 (3.9)			1	514 (4.0)			2
2007	531 (4.9)				527 (5.0)				512 (5.4)			
Spain												
2019	514 (2.2)	-8 ▽	-2		511 (2.0)	-3	12 ▲		507 (1.8)	-10 ▽	11 ▲	
² 2015	522 (3.3)		6		514 (3.3)		15 ▲		517 (2.6)		21 ▲	
2011	516 (3.2)				499 (3.1)				496 (3.0)			
Sweden												
2019	540 (3.4)	2	4	12 ▲	532 (3.1)	-8	2	12 ▲	541 (3.2)	-1	4	13 ▲
² 2015	538 (3.8)		3	10 ▲	540 (3.4)		9 ▲	20 ▲	542 (3.8)		5	14 ▲
2011	536 (2.8)			8	531 (3.0)			11 ▲	537 (3.0)			9
2007	528 (3.1)				520 (3.2)				528 (4.3)			

▲ Average from more recent year significantly higher
 ▽ Average from more recent year significantly lower

^ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
^κ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.

Exhibit 2.18: Differences in Achievement for Science Cognitive Domains Across Assessment Years[◇]

(Continued)

Country	Average Scale Score	Knowing			Average Scale Score	Applying			Average Scale Score	Reasoning		
		Differences Between Years				Differences Between Years				Differences Between Years		
		2015	2011	2007		2015	2011	2007		2015	2011	2007
United Arab Emirates												
2019	482 (2.2)	28 ▲	49 ▲		470 (2.1)	18 ▲	49 ▲		461 (1.9)	17 ▲	36 ▲	
2015	453 (3.3)		21 ▲		452 (3.2)		31 ▲		444 (3.0)		19 ▲	
2011	433 (2.8)				421 (2.6)				426 (2.6)			
United States												
^{2†} 2019	542 (2.7)	-6	-4	-4	535 (3.1)	-11 ▽	-9 ▽	1	538 (2.7)	-3	1	3
^{2†} 2015	548 (2.5)		2	3	546 (2.2)		2	12 ▲	542 (2.7)		4	6
² 2011	546 (1.9)			1	544 (2.2)			10 ▲	537 (2.4)			2
^{2†} 2007	546 (2.7)				534 (3.1)				535 (3.0)			
Benchmarking Participants												
Ontario, Canada												
² 2019	525 (3.1)	-3	-4	-18 ▽	520 (3.1)	-15 ▽	-6	-9	528 (3.0)	-1	-1	-13 ▽
2015	527 (2.8)		-1	-15 ▽	534 (2.5)		9 ▲	6	529 (2.8)		0	-11 ▽
2011	529 (3.0)			-14 ▽	526 (3.3)			-3	529 (3.6)			-11 ▽
² 2007	542 (3.6)				529 (3.7)				540 (3.4)			
Quebec, Canada												
2019	523 (2.8)	-1	4	6	520 (3.6)	-6	6	5	525 (3.0)	-1	5	-1
[≡] 2015	524 (4.3)		5	7	525 (4.5)		12 ▲	11 ▲	526 (4.6)		7	0
2011	519 (2.7)			2	514 (2.5)			-1	520 (3.8)			-6
² 2007	517 (2.8)				515 (3.0)				526 (3.6)			
Abu Dhabi, UAE												
2019	422 (2.9)	12	7		415 (3.0)	-2	10		411 (2.7)	-1	-5	
² 2015	410 (6.6)		-4		417 (5.9)		11		412 (5.3)		-5	
2011	415 (5.7)				405 (5.3)				416 (5.2)			
Dubai, UAE												
² 2019	560 (2.1)	37 ▲	92 ▲	99 ▲	541 (2.3)	24 ▲	88 ▲	83 ▲	531 (2.1)	21 ▲	76 ▲	76 ▲
2015	523 (2.3)		55 ▲	62 ▲	517 (2.8)		64 ▲	59 ▲	510 (2.9)		55 ▲	54 ▲
2011	467 (2.5)			7	453 (2.2)			-5	455 (3.7)			-1
[‡] 2007	461 (2.8)				458 (3.7)				456 (3.1)			

▲ Average from more recent year significantly higher
 ▽ Average from more recent year significantly lower

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