

Chapter 3

International Student Achievement in the TIMSS Science Content and Cognitive Domains

Generally, TIMSS 2011 participants with the highest achievement overall also had the highest achievement in the science content domains (e.g., biology and physics). Internationally, more countries demonstrated relative strengths in knowing science than in applying scientific knowledge and reasoning.

As described in the *TIMSS 2011 Assessment Frameworks*, the science assessment is organized around two dimensions: a content dimension specifying the subject matter or content domains to be assessed in science, and a cognitive dimension specifying the thinking processes that students are likely to use as they engage with the content. Each item in the science assessment is associated with one content domain and one cognitive domain, providing for both content-based and cognitive-oriented perspectives on student achievement in science.

There are three content domains at the fourth grade: life science, physical science, and earth science; and there are four domains at the eighth grade: biology, chemistry, physics, and earth science. The same three cognitive domains—knowing, applying, and reasoning—were used at both the fourth and eighth grades. Knowing covers the student’s knowledge of science facts, procedures, and concepts. Applying focuses on the student’s ability to apply knowledge and conceptual understanding in a science problem situation. Reasoning goes beyond the solution of routine science problems to encompass unfamiliar situations, complex contexts, and multi-step problems.

Chapter 3 presents the TIMSS 2011 results at the fourth and eighth grades for the content and cognitive domains. Previous TIMSS assessments have found that most countries performed relatively better in one or another of the content domains, and similarly, that countries can have relative strengths in one content domain compared to another. In addition to providing TIMSS 2011 average achievement for the content and cognitive domains, the chapter provides changes in achievement in the domains compared to TIMSS 2007, and achievement differences by gender.

Relative Achievement by Science Content Domains

Exhibit 3.1 presents the average achievement for TIMSS 2011 participants in the fourth grade content domains of life science, physical science, and earth science relative to overall fourth grade science achievement. To provide a way for the TIMSS 2011 participants to examine relative performance in the content domains, IRT scaling was used to place achievement in each of the three domains on the TIMSS fourth grade science scale. The items on which the content domains were based varied in difficulty, as shown in Appendix B.3, which displays the average percent correct across the items in each domain. For example, internationally, the fourth grade students found the life science and physical science items to be somewhat less difficult (48% and 49% correct) than the earth science items (46%), on average. As shown in Appendix B.4, there

was larger variation in the difficulty of the eighth grade content domains, with physics most difficult (38% correct, on average), followed by biology (42%), chemistry (43%), and earth science (45%). However, the scaling process took the differences in difficulty into account, so that average achievement for each of the content domains can be compared relative to overall science achievement at each grade level.

In Exhibit 3.1, the first column presents average overall science achievement, and the next columns show average achievement in the three content domains of life science, physical science, and earth science. TIMSS 2011 participants are presented in order by overall science achievement, first for the fourth grade, followed by the sixth grade and the benchmarking participants. The average scale score for each content domain is shown, together with the difference between achievement in overall science and achievement in the content domain. Up and down arrows are used to indicate whether a country's average content domain score is significantly higher or lower than its overall science average score.

Generally, the TIMSS 2011 participants with the highest achievement overall also had the highest achievement in the content domains. However, many countries performed relatively higher in one or two of the content domains compared to their overall performance; and relatively lower in one or two others. For example, among the top-performing countries, Korea performed relatively better in physical science and earth science than in science overall, and relatively less well in life science; Singapore performed relatively better in life science and physical science, but relatively less well in earth science; and Finland performed equally well in all three domains. Looking across the results in Exhibit 3.1, there is considerable diversity among countries with regard to their relative strengths and weaknesses in the content domains. At the fourth grade, in only four countries and one benchmarking participant was performance in each of the three content areas relatively the same as in science overall (Denmark, Finland, Ireland, Romania, and the Canadian province of Alberta).

Exhibit 3.2 presents average achievement in the eighth grade content domains of biology, chemistry, physics, and earth science. Similar to the fourth grade, there is considerable diversity in countries' strengths and weaknesses in the content domains, even among the high-achieving Asian countries. For example, although the differences were sometimes small, Singapore performed somewhat better in biology and physics than in science overall, and less well

Exhibit 3.1: Achievement in Science Content Domains

Country	Overall Science Average Scale Score	Life Science		Physical Science		Earth Science	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
Korea, Rep. of	587 (2.0)	571 (2.2)	-16 (1.2) ▼	597 (2.6)	10 (1.1) ▲	603 (1.8)	16 (2.0) ▲
² Singapore	583 (3.4)	597 (4.3)	14 (2.1) ▲	598 (3.5)	15 (1.7) ▲	541 (3.0)	-42 (1.1) ▼
Finland	570 (2.6)	574 (2.8)	4 (3.4)	568 (2.8)	-2 (2.1)	566 (2.9)	-5 (2.4)
Japan	559 (1.9)	540 (1.9)	-19 (0.9) ▼	589 (1.9)	30 (1.5) ▲	551 (1.8)	-7 (1.2) ▼
Russian Federation	552 (3.5)	556 (3.6)	4 (1.7) ▲	548 (4.0)	-4 (1.5) ▼	552 (4.1)	0 (1.7)
Chinese Taipei	552 (2.2)	538 (2.4)	-14 (1.5) ▼	569 (2.0)	17 (1.2) ▲	553 (2.5)	1 (2.0)
² United States	544 (2.1)	547 (2.1)	3 (1.1) ▲	544 (2.0)	0 (1.0)	539 (2.1)	-5 (1.1) ▼
Czech Republic	536 (2.5)	550 (3.0)	13 (2.5) ▲	519 (3.1)	-17 (1.7) ▼	537 (3.4)	1 (1.8)
² Hong Kong SAR	535 (3.8)	524 (3.7)	-11 (1.8) ▼	539 (4.4)	4 (2.2)	548 (3.3)	13 (1.4) ▲
Hungary	534 (3.7)	552 (3.5)	17 (1.6) ▲	520 (3.8)	-14 (2.5) ▼	524 (4.4)	-11 (1.6) ▼
Sweden	533 (2.7)	534 (2.7)	0 (2.6)	528 (2.5)	-6 (2.0) ▼	538 (3.2)	5 (2.0) ▲
Slovak Republic	532 (3.8)	534 (3.5)	2 (1.0) ▲	527 (4.0)	-4 (2.0) ▼	535 (3.8)	3 (1.5) ▲
Austria	532 (2.8)	526 (2.6)	-5 (1.3) ▼	535 (2.9)	3 (1.2) ▲	539 (3.6)	7 (1.9) ▲
[†] Netherlands	531 (2.2)	537 (1.8)	6 (1.6) ▲	526 (2.0)	-5 (1.0) ▼	525 (2.7)	-6 (2.8) ▼
England	529 (2.9)	530 (2.8)	1 (1.5)	535 (3.5)	7 (2.2) ▲	522 (3.8)	-7 (2.2) ▼
² Denmark	528 (2.8)	530 (2.8)	2 (1.5)	526 (2.5)	-2 (1.3)	527 (3.0)	-1 (1.7)
Germany	528 (2.9)	525 (2.6)	-3 (1.9)	535 (3.1)	7 (1.2) ▲	520 (3.7)	-8 (2.5) ▼
Italy	524 (2.7)	535 (2.7)	11 (1.1) ▲	509 (3.0)	-15 (1.3) ▼	523 (3.6)	-1 (2.5)
Portugal	522 (3.9)	520 (4.2)	-1 (1.3)	517 (4.2)	-5 (1.0) ▼	531 (4.4)	9 (2.1) ▲
Slovenia	520 (2.7)	524 (2.6)	4 (1.5) ▲	524 (3.4)	3 (1.8)	506 (2.7)	-14 (1.5) ▼
[†] Northern Ireland	517 (2.6)	519 (2.9)	2 (1.3)	520 (3.2)	3 (2.5)	507 (2.7)	-9 (1.6) ▼
Ireland	516 (3.4)	513 (3.6)	-3 (1.8)	517 (3.1)	1 (2.7)	520 (3.8)	4 (2.3)
² Croatia	516 (2.1)	525 (2.0)	9 (1.2) ▲	502 (2.7)	-14 (1.2) ▼	521 (2.7)	5 (1.3) ▲
Australia	516 (2.8)	516 (3.1)	0 (1.5)	514 (3.2)	-2 (1.6)	520 (3.5)	4 (1.5) ▲
² Serbia	516 (3.1)	518 (2.9)	3 (2.3)	523 (3.8)	7 (1.5) ▲	497 (3.6)	-18 (1.5) ▼
^{1 2} Lithuania	515 (2.4)	520 (2.9)	6 (2.3) ▲	514 (3.1)	-1 (1.5)	501 (3.0)	-14 (1.7) ▼
Belgium (Flemish)	509 (2.0)	510 (2.4)	2 (1.3)	507 (2.1)	-1 (1.1)	505 (2.8)	-4 (1.6) ▼
Romania	505 (5.9)	504 (6.1)	-1 (1.3)	508 (5.7)	3 (1.6)	502 (6.0)	-3 (1.9)
Spain	505 (3.0)	513 (2.8)	8 (1.7) ▲	497 (2.7)	-8 (1.7) ▼	499 (3.8)	-6 (1.3) ▼
Poland	505 (2.6)	514 (2.5)	9 (1.2) ▲	495 (3.3)	-10 (2.4) ▼	496 (3.3)	-9 (1.4) ▼
New Zealand	497 (2.3)	497 (2.5)	1 (1.2)	493 (2.7)	-3 (1.3) ▼	499 (3.2)	2 (2.2)
² Kazakhstan	495 (5.1)	500 (5.1)	5 (2.1) ▲	486 (5.2)	-9 (1.9) ▼	491 (5.8)	-4 (3.3)
[‡] Norway	494 (2.3)	496 (3.0)	2 (2.8)	482 (3.4)	-12 (2.2) ▼	506 (3.0)	12 (1.7) ▲
Chile	480 (2.4)	490 (2.2)	9 (1.5) ▲	471 (2.5)	-9 (1.4) ▼	475 (2.7)	-5 (2.2) ▼
Thailand	472 (5.6)	480 (6.1)	8 (2.5) ▲	462 (5.9)	-9 (1.6) ▼	460 (5.9)	-12 (1.7) ▼
Turkey	463 (4.5)	460 (4.5)	-2 (1.3)	466 (4.7)	4 (1.0) ▲	456 (5.1)	-7 (1.3) ▼
¹ Georgia	455 (3.8)	461 (3.6)	6 (1.4) ▲	440 (4.2)	-15 (2.0) ▼	458 (4.3)	3 (2.3)
Iran, Islamic Rep. of	453 (3.7)	449 (4.1)	-4 (1.5) ▼	453 (4.0)	0 (1.9)	457 (3.5)	4 (2.2)
Bahrain	449 (3.5)	444 (4.1)	-6 (2.2) ▼	453 (4.6)	3 (2.9)	445 (3.7)	-4 (2.0) ▼
Malta	446 (1.9)	439 (2.4)	-7 (1.1) ▼	453 (2.5)	7 (1.9) ▲	447 (2.2)	1 (1.9)
² Azerbaijan	438 (5.6)	440 (5.2)	2 (2.3)	436 (5.9)	-2 (2.3)	408 (7.2)	-30 (3.5) ▼
Saudi Arabia	429 (5.4)	415 (6.4)	-14 (2.3) ▼	439 (6.0)	10 (2.4) ▲	432 (6.3)	3 (3.0)
United Arab Emirates	428 (2.5)	420 (2.7)	-8 (1.5) ▼	429 (2.7)	1 (1.1)	435 (2.4)	7 (1.1) ▲
Armenia	416 (3.8)	424 (3.9)	8 (2.8) ▲	399 (3.8)	-17 (1.5) ▼	398 (4.1)	-18 (2.6) ▼
² Qatar	394 (4.3)	383 (5.0)	-11 (2.8) ▼	397 (5.0)	3 (2.8)	401 (4.8)	7 (1.8) ▲
Oman	377 (4.3)	370 (3.8)	-7 (2.1) ▼	370 (4.8)	-7 (1.9) ▼	371 (4.6)	-6 (3.4)
¹ ^ψ Kuwait	347 (4.7)	323 (5.0)	-25 (3.2) ▼	348 (4.5)	1 (2.8)	352 (4.7)	5 (2.2) ▲
^ψ Tunisia	346 (5.3)	342 (5.1)	-3 (2.0)	342 (5.6)	-4 (2.3)	319 (6.6)	-27 (4.0) ▼
[‡] Morocco	264 (4.5)	245 (4.5)	-19 (1.8) ▼	256 (5.3)	-7 (3.1) ▼	208 (4.7)	-55 (2.3) ▼
[‡] Yemen	209 (7.3)	172 (6.9)	-37 (2.5) ▼	198 (6.9)	-11 (3.9) ▼	186 (6.3)	-23 (5.8) ▼

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Subscale score significantly higher than overall science score
▼ Subscale score significantly lower than overall science score

‡ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
^ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
 See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and ‡.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 3.1: Achievement in Science Content Domains (Continued)

Country	Overall Science Average Scale Score	Life Science		Physical Science		Earth Science		
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	
Sixth Grade Participants								
Honduras	432 (5.8)	441 (5.5)	9 (1.4) ▲	417 (6.4)	-16 (2.4) ▼	429 (5.8)	-3 (1.7)	
Botswana	367 (5.5)	345 (6.3)	-23 (2.4) ▼	380 (5.5)	12 (1.7) ▲	376 (5.7)	9 (2.6) ▲	
Yemen	345 (7.0)	313 (7.7)	-33 (3.2) ▼	367 (6.8)	21 (3.5) ▲	350 (7.4)	5 (3.8)	
Benchmarking Participants								
^{1 3} Florida, US	545 (3.7)	549 (4.2)	5 (2.6)	542 (3.9)	-2 (1.3)	537 (4.4)	-8 (3.5) ▼	
² Alberta, Canada	541 (2.4)	542 (2.6)	1 (1.4)	542 (3.0)	0 (3.0)	539 (3.2)	-3 (1.8)	
^{1 2} North Carolina, US	538 (4.6)	541 (4.6)	3 (1.4)	541 (5.1)	2 (2.7)	529 (6.2)	-10 (3.9) ▼	
Ontario, Canada	528 (3.0)	535 (3.4)	7 (1.4) ▲	528 (3.2)	0 (1.3)	514 (3.9)	-14 (2.2) ▼	
Quebec, Canada	516 (2.7)	524 (2.5)	8 (2.5) ▲	507 (3.1)	-9 (1.2) ▼	516 (3.5)	-1 (2.5)	
Dubai, UAE	461 (2.3)	455 (2.9)	-6 (2.7) ▼	460 (3.2)	-1 (2.4)	469 (3.0)	8 (1.4) ▲	
Abu Dhabi, UAE	411 (4.9)	403 (5.6)	-8 (1.9) ▼	415 (5.2)	4 (2.0)	418 (5.1)	6 (2.2) ▲	

- ▲ Subscale score significantly higher than overall science score
- ▼ Subscale score significantly lower than overall science score

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.2: Achievement in Science Content Domains

Country	Overall Science Average Scale Score	Biology		Chemistry	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
² Singapore	590 (4.3)	594 (4.8)	4 (1.8) ▲	590 (4.7)	0 (1.5)
Chinese Taipei	564 (2.3)	557 (2.5)	-7 (0.8) ▼	585 (3.9)	22 (2.9) ▲
Korea, Rep. of	560 (2.0)	561 (2.4)	1 (1.6)	551 (2.2)	-9 (1.0) ▼
Japan	558 (2.4)	561 (2.3)	3 (0.9) ▲	560 (2.6)	2 (2.0)
Finland	552 (2.5)	548 (2.9)	-4 (1.7) ▼	554 (2.5)	1 (1.1)
Slovenia	543 (2.7)	532 (2.7)	-11 (1.7) ▼	558 (3.2)	15 (2.3) ▲
² Russian Federation	542 (3.2)	537 (3.3)	-6 (1.0) ▼	554 (3.5)	11 (1.1) ▲
Hong Kong SAR	535 (3.4)	535 (3.5)	0 (1.1)	526 (3.6)	-9 (1.9) ▼
[‡] England	533 (4.9)	533 (4.9)	0 (1.1)	529 (5.2)	-4 (1.6) ▼
² United States	525 (2.6)	530 (2.5)	6 (1.0) ▲	520 (2.6)	-5 (0.8) ▼
Hungary	522 (3.1)	520 (3.0)	-3 (1.0) ▼	534 (3.4)	12 (1.2) ▲
Australia	519 (4.8)	527 (4.7)	8 (1.2) ▲	501 (5.1)	-18 (1.2) ▼
³ Israel	516 (4.0)	523 (4.1)	7 (1.3) ▲	514 (5.1)	-2 (2.8)
¹ Lithuania	514 (2.6)	517 (2.8)	3 (2.0)	517 (2.3)	3 (2.2)
New Zealand	512 (4.6)	514 (4.7)	2 (1.4)	501 (5.1)	-11 (2.3) ▼
Sweden	509 (2.5)	513 (3.0)	3 (1.5) ▲	502 (2.7)	-7 (1.5) ▼
Italy	501 (2.5)	503 (3.0)	2 (1.8)	491 (3.1)	-10 (2.1) ▼
Ukraine	501 (3.4)	492 (3.1)	-9 (1.7) ▼	512 (3.9)	11 (2.2) ▲
Norway	494 (2.6)	491 (2.5)	-3 (1.2) ▼	488 (2.8)	-6 (1.4) ▼
Kazakhstan	490 (4.3)	483 (4.3)	-6 (1.6) ▼	508 (4.8)	19 (1.8) ▲
Turkey	483 (3.4)	484 (3.7)	1 (1.5)	477 (4.0)	-6 (1.6) ▼
Iran, Islamic Rep. of	474 (4.0)	466 (3.8)	-8 (0.9) ▼	469 (4.4)	-5 (2.4) ▼
Romania	465 (3.5)	458 (3.8)	-6 (1.7) ▼	469 (4.3)	4 (2.4)
United Arab Emirates	465 (2.4)	463 (2.4)	-1 (0.8) ▼	464 (2.2)	-1 (1.1)
Chile	461 (2.5)	462 (2.5)	0 (0.9)	447 (3.0)	-14 (1.4) ▼
Bahrain	452 (2.0)	449 (2.1)	-4 (1.1) ▼	448 (2.7)	-5 (1.4) ▼
Thailand	451 (3.9)	460 (4.3)	9 (1.2) ▲	436 (4.6)	-15 (1.3) ▼
Jordan	449 (4.0)	447 (4.3)	-2 (1.7) ▼	463 (4.4)	14 (1.4) ▲
Tunisia	439 (2.5)	449 (3.0)	11 (1.7) ▲	434 (3.3)	-5 (1.8) ▼
Armenia	437 (3.1)	420 (3.2)	-17 (1.5) ▼	452 (3.9)	15 (2.3) ▲
Saudi Arabia	436 (3.9)	430 (4.5)	-7 (2.5) ▼	428 (4.4)	-9 (2.4) ▼
Malaysia	426 (6.3)	427 (6.2)	0 (1.2)	426 (6.6)	0 (2.1)
Syrian Arab Republic	426 (3.9)	425 (4.3)	-2 (2.0)	424 (3.7)	-2 (2.2)
Palestinian Nat'l Auth.	420 (3.2)	407 (3.9)	-14 (1.9) ▼	432 (4.0)	12 (2.3) ▲
¹ Georgia	420 (3.0)	435 (3.3)	15 (2.0) ▲	395 (3.2)	-25 (2.1) ▼
Oman	420 (3.2)	407 (3.6)	-12 (1.7) ▼	408 (3.5)	-12 (2.5) ▼
Qatar	419 (3.4)	411 (4.2)	-7 (2.2) ▼	416 (4.1)	-3 (2.2)
Macedonia, Rep. of	407 (5.4)	400 (6.0)	-8 (2.6) ▼	416 (5.5)	8 (1.9) ▲
Lebanon	406 (4.9)	395 (5.2)	-11 (1.3) ▼	435 (5.3)	29 (1.8) ▲
Indonesia	406 (4.5)	410 (4.7)	4 (2.3)	378 (4.9)	-27 (2.7) ▼
Morocco	376 (2.2)	378 (3.0)	2 (2.2)	374 (2.2)	-2 (1.3)
^ψ Ghana	306 (5.2)	290 (6.2)	-16 (2.6) ▼	331 (5.9)	25 (2.3) ▲

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

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

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.2: Achievement in Science Content Domains (Continued)

Country	Physics		Earth Science	
	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
² Singapore	602 (4.2)	12 (1.0) ▲	566 (4.5)	-24 (1.8) ▼
Chinese Taipei	552 (3.4)	-11 (2.5) ▼	568 (2.9)	5 (2.0) ▲
Korea, Rep. of	577 (2.8)	16 (2.0) ▲	548 (3.2)	-13 (2.3) ▼
Japan	558 (2.7)	0 (1.7)	548 (2.8)	-9 (1.9) ▼
Finland	540 (2.7)	-12 (1.4) ▼	574 (3.0)	22 (2.0) ▲
Slovenia	532 (2.8)	-11 (1.3) ▼	560 (3.2)	17 (2.7) ▲
² Russian Federation	547 (3.5)	4 (1.4) ▲	535 (3.7)	-7 (2.0) ▼
Hong Kong SAR	539 (3.6)	4 (1.7) ▲	539 (3.7)	4 (1.9) ▲
⁴ England	533 (4.6)	0 (2.0)	536 (5.3)	3 (2.8)
² United States	513 (2.5)	-11 (0.7) ▼	533 (2.8)	9 (0.8) ▲
Hungary	525 (3.7)	3 (1.7)	511 (3.3)	-11 (1.1) ▼
Australia	511 (5.1)	-8 (1.4) ▼	533 (5.4)	14 (2.1) ▲
³ Israel	514 (4.1)	-2 (1.2)	504 (4.4)	-11 (1.8) ▼
¹ Lithuania	503 (3.3)	-11 (2.0) ▼	517 (3.5)	3 (2.8)
New Zealand	509 (4.6)	-3 (1.8)	523 (4.8)	11 (1.5) ▲
Sweden	498 (3.2)	-12 (1.9) ▼	520 (2.8)	10 (1.4) ▲
Italy	490 (2.8)	-11 (1.7) ▼	513 (3.8)	12 (2.5) ▲
Ukraine	503 (3.8)	2 (1.9)	495 (3.6)	-6 (1.4) ▼
Norway	481 (3.6)	-13 (2.4) ▼	516 (3.5)	21 (2.0) ▲
Kazakhstan	489 (4.2)	-1 (1.8)	472 (4.9)	-18 (1.6) ▼
Turkey	494 (3.7)	11 (1.2) ▲	468 (3.5)	-14 (1.9) ▼
Iran, Islamic Rep. of	483 (4.1)	9 (1.6) ▲	477 (3.9)	3 (1.4) ▲
Romania	456 (3.9)	-8 (1.6) ▼	470 (3.6)	5 (1.2) ▲
United Arab Emirates	461 (2.3)	-3 (0.6) ▼	466 (2.5)	2 (1.0) ▲
Chile	453 (2.6)	-9 (1.7) ▼	476 (2.8)	15 (2.2) ▲
Bahrain	457 (1.8)	4 (1.5) ▲	451 (1.8)	-1 (1.8)
Thailand	430 (4.5)	-21 (1.8) ▼	466 (4.1)	15 (1.6) ▲
Jordan	446 (4.2)	-3 (1.3) ▼	436 (4.2)	-13 (1.8) ▼
Tunisia	436 (2.6)	-3 (1.5)	414 (3.6)	-25 (2.1) ▼
Armenia	441 (3.7)	4 (2.0)	421 (3.3)	-16 (1.3) ▼
Saudi Arabia	437 (4.2)	1 (1.8)	441 (3.5)	5 (2.4) ▲
Malaysia	435 (6.6)	8 (1.6) ▲	401 (6.5)	-25 (1.2) ▼
Syrian Arab Republic	426 (4.4)	-1 (1.9)	414 (4.8)	-12 (1.6) ▼
Palestinian Nat'l Auth.	432 (3.8)	12 (1.3) ▲	406 (3.3)	-14 (1.9) ▼
¹ Georgia	401 (4.2)	-19 (2.6) ▼	417 (3.7)	-2 (2.3)
Oman	427 (3.3)	7 (1.5) ▲	431 (3.0)	11 (1.8) ▲
Qatar	426 (3.8)	8 (2.1) ▲	408 (3.8)	-11 (1.6) ▼
Macedonia, Rep. of	398 (6.0)	-9 (2.5) ▼	403 (6.5)	-5 (2.8)
Lebanon	405 (5.4)	-1 (2.0)	365 (6.4)	-41 (3.0) ▼
Indonesia	397 (5.4)	-9 (2.2) ▼	412 (5.6)	6 (2.0) ▲
Morocco	349 (2.5)	-27 (1.6) ▼	377 (3.3)	1 (2.9)
Ψ Ghana	292 (5.9)	-14 (1.7) ▼	265 (6.5)	-41 (2.8) ▼

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.2: Achievement in Science Content Domains (Continued)

Country	Overall Science Average Scale Score	Biology		Chemistry	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
Ninth Grade Participants					
Botswana	404 (3.6)	401 (3.9)	-3 (2.5)	403 (3.6)	-1 (2.0)
² Honduras	369 (4.0)	364 (3.9)	-5 (2.3) ▼	368 (3.5)	-1 (2.9)
^ψ South Africa	332 (3.7)	318 (3.5)	-14 (1.8) ▼	336 (3.8)	4 (2.1) ▲
Benchmarking Participants					
^{1 2} Massachusetts, US	567 (5.1)	575 (5.2)	8 (1.2) ▲	568 (6.0)	1 (2.3)
¹ Minnesota, US	553 (4.6)	563 (5.5)	10 (1.7) ▲	538 (5.0)	-15 (1.5) ▼
² Alberta, Canada	546 (2.4)	554 (2.7)	9 (1.5) ▲	521 (2.6)	-24 (1.8) ▼
¹ Colorado, US	542 (4.4)	551 (4.6)	9 (1.4) ▲	528 (5.1)	-14 (2.2) ▼
^{1 2} Indiana, US	533 (4.8)	540 (5.0)	7 (1.4) ▲	526 (5.0)	-7 (1.8) ▼
^{1 2} Connecticut, US	532 (4.6)	539 (5.0)	7 (2.2) ▲	520 (5.3)	-11 (1.8) ▼
^{1 3} North Carolina, US	532 (6.3)	541 (6.0)	10 (2.3) ▲	531 (7.2)	0 (3.5)
^{1 2} Florida, US	530 (7.3)	529 (7.9)	-1 (2.6) ▼	525 (8.2)	-5 (2.7) ▼
² Ontario, Canada	521 (2.5)	531 (2.6)	10 (1.5) ▲	495 (2.5)	-26 (0.9) ▼
Quebec, Canada	520 (2.5)	525 (2.9)	5 (1.0) ▲	515 (3.1)	-5 (1.2) ▼
^{1 2} California, US	499 (4.6)	500 (4.7)	1 (1.5) ▲	503 (6.0)	5 (2.2) ▲
¹ Alabama, US	485 (6.2)	491 (6.1)	5 (1.6) ▲	480 (6.6)	-6 (3.1)
Dubai, UAE	485 (2.5)	485 (2.7)	0 (1.4)	487 (2.3)	2 (1.7)
Abu Dhabi, UAE	461 (4.0)	459 (4.3)	-2 (2.0)	461 (3.9)	-1 (1.6)

Country	Overall Science Average Scale Score	Physics		Earth Science	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
Ninth Grade Participants					
Botswana	404 (3.6)	417 (3.6)	13 (2.1) ▲	384 (4.2)	-20 (4.0) ▼
² Honduras	369 (4.0)	351 (3.7)	-17 (2.9) ▼	374 (4.9)	6 (2.1) ▲
^ψ South Africa	332 (3.7)	351 (3.7)	20 (1.5) ▲	294 (3.8)	-38 (2.0) ▼
Benchmarking Participants					
^{1 2} Massachusetts, US	567 (5.1)	555 (5.7)	-12 (2.4) ▼	577 (6.0)	11 (3.4) ▲
¹ Minnesota, US	553 (4.6)	541 (5.6)	-12 (3.5) ▼	574 (6.2)	21 (2.6) ▲
² Alberta, Canada	546 (2.4)	545 (2.4)	0 (1.1)	559 (2.7)	14 (1.3) ▲
¹ Colorado, US	542 (4.4)	530 (5.3)	-12 (4.4) ▼	555 (4.6)	13 (1.6) ▲
^{1 2} Indiana, US	533 (4.8)	522 (5.1)	-11 (1.4) ▼	540 (5.8)	7 (1.8) ▲
^{1 2} Connecticut, US	532 (4.6)	520 (5.4)	-11 (2.8) ▼	542 (5.6)	10 (1.9) ▲
^{1 3} North Carolina, US	532 (6.3)	510 (6.0)	-21 (1.8) ▼	540 (6.5)	8 (2.3) ▲
^{1 2} Florida, US	530 (7.3)	530 (7.2)	0 (2.1)	536 (7.7)	6 (3.3)
² Ontario, Canada	521 (2.5)	521 (2.7)	0 (1.4)	528 (3.4)	7 (2.2) ▲
Quebec, Canada	520 (2.5)	502 (3.2)	-18 (1.3) ▼	536 (2.9)	16 (1.2) ▲
^{1 2} California, US	499 (4.6)	487 (4.6)	-12 (1.8) ▼	499 (4.8)	1 (1.9)
¹ Alabama, US	485 (6.2)	476 (5.9)	-9 (2.4) ▼	487 (7.9)	2 (2.7)
Dubai, UAE	485 (2.5)	482 (2.1)	-3 (1.2) ▼	487 (3.1)	2 (2.6)
Abu Dhabi, UAE	461 (4.0)	459 (3.9)	-2 (1.8)	461 (4.7)	0 (2.4)

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

in earth science. Chinese Taipei performed better in chemistry and earth science than in science overall and less well in biology and physics, while Korea performed better in physics relative to science overall and less well in chemistry and earth science. Japan performed better in biology relative to overall science and less well in earth science. Looking across all of the countries, only the UAE emirate of Abu Dhabi had performance in each of the four content areas that was no different than in science overall.

Relative Achievement by Science Cognitive Domains

Exhibits 3.3 and 3.4 present average achievement at the fourth and eighth grades, respectively, in the cognitive domains of knowing, applying, and reasoning relative to overall science achievement for TIMSS 2011 participants. Because these three scales represent quite different skills, it was expected that the assessment items would have different difficulty levels. The average percent correct in the cognitive domains shown in Appendix E were 53 percent for knowing, 46 percent for applying, and 41 percent for reasoning at the fourth grade, and 49 percent, 41 percent, and 33 percent, respectively, at the eighth grade. However, as with the content domains, the IRT scaling adjusts for these difficulty levels and allows achievement in the three cognitive domains to be placed on the overall science scales for the fourth and eighth grades, so that TIMSS 2011 participants can compare performance in each of the three cognitive domains relative to overall science achievement.

The presentation of results for the cognitive domains in Exhibits 3.3 and 3.4 follows the layout of results for the content domains (Exhibits 3.1 and 3.2). Similar to the results for the content domains, in general, the TIMSS 2011 participants with the highest science achievement overall also had highest achievement in the cognitive domains, although most countries showed a relative strength in one cognitive domain or another.

Among the top-performing countries at the fourth grade, there was no consistent pattern of strength or weakness in the cognitive domains; with regard to science overall, some countries performed relatively well in knowing, some performed relatively well in applying, and some performed relatively well in reasoning. In only four countries and three benchmarking participants was performance in each of the three cognitive domains no different from science performance overall: Australia, Belgium (Flemish), New Zealand, and Chile, and the Canadian provinces of Alberta, Ontario, and Québec.

Exhibit 3.3: Achievement in Science Cognitive Domains

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
Korea, Rep. of	587 (2.0)	570 (2.0)	-17 (1.5) ▼	593 (1.9)	7 (1.3) ▲	605 (3.0)	18 (3.6) ▲
² Singapore	583 (3.4)	570 (3.4)	-13 (1.2) ▼	590 (4.0)	6 (1.6) ▲	597 (3.8)	13 (1.8) ▲
Finland	570 (2.6)	579 (2.5)	9 (1.7) ▲	568 (2.3)	-2 (1.9) ▼	560 (3.2)	-10 (2.4) ▼
Japan	559 (1.9)	538 (1.8)	-21 (1.4) ▼	562 (1.6)	4 (1.8) ▲	591 (2.0)	33 (2.2) ▲
Russian Federation	552 (3.5)	553 (3.8)	1 (1.2)	556 (3.6)	4 (1.2) ▲	542 (4.2)	-11 (2.9) ▼
Chinese Taipei	552 (2.2)	542 (2.7)	-10 (1.5) ▼	552 (3.1)	1 (2.1)	568 (3.2)	16 (2.4) ▲
² United States	544 (2.1)	546 (1.9)	2 (0.8) ▲	544 (2.1)	0 (0.9)	537 (2.3)	-7 (1.1) ▼
Czech Republic	536 (2.5)	551 (3.3)	14 (1.7) ▲	534 (2.6)	-2 (1.7) ▼	516 (4.0)	-20 (2.4) ▼
² Hong Kong SAR	535 (3.8)	537 (3.6)	2 (1.4)	529 (3.5)	-6 (1.3) ▼	541 (4.2)	6 (2.2) ▲
Hungary	534 (3.7)	547 (3.7)	12 (1.8) ▲	530 (3.6)	-5 (1.4) ▼	525 (4.5)	-9 (1.7) ▼
Sweden	533 (2.7)	536 (2.8)	2 (1.2) ▲	531 (3.0)	-3 (1.9) ▼	537 (3.0)	3 (1.4) ▲
Slovak Republic	532 (3.8)	547 (3.8)	15 (0.9) ▲	528 (4.0)	-4 (0.9) ▼	514 (4.2)	-18 (1.4) ▼
Austria	532 (2.8)	532 (3.1)	1 (1.0)	533 (2.9)	2 (1.5)	525 (3.1)	-6 (1.7) ▼
[†] Netherlands	531 (2.2)	528 (2.3)	-3 (1.3) ▼	534 (2.0)	3 (1.4) ▲	532 (2.9)	1 (2.0)
England	529 (2.9)	529 (3.2)	0 (1.9)	532 (3.1)	4 (1.4) ▲	526 (4.4)	-2 (3.6)
² Denmark	528 (2.8)	524 (2.6)	-4 (1.0) ▼	532 (2.5)	4 (1.0) ▲	527 (3.1)	-1 (1.6)
Germany	528 (2.9)	524 (4.0)	-4 (2.0)	533 (2.6)	5 (2.2) ▲	526 (3.6)	-2 (1.9)
Italy	524 (2.7)	532 (3.0)	8 (1.3) ▲	523 (2.7)	-1 (1.5)	510 (2.9)	-14 (1.8) ▼
Portugal	522 (3.9)	528 (4.4)	6 (1.3) ▲	515 (4.3)	-7 (1.6) ▼	524 (4.6)	3 (3.3)
Slovenia	520 (2.7)	518 (2.2)	-2 (1.3)	518 (2.8)	-2 (1.8)	525 (3.6)	5 (2.3) ▲
[†] Northern Ireland	517 (2.6)	517 (2.9)	1 (2.1)	521 (2.6)	5 (1.4) ▲	503 (3.1)	-14 (2.2) ▼
Ireland	516 (3.4)	518 (3.9)	2 (1.9)	517 (3.6)	1 (1.4)	509 (3.4)	-7 (2.2) ▼
² Croatia	516 (2.1)	526 (1.9)	10 (1.5) ▲	510 (2.3)	-6 (1.6) ▼	512 (3.5)	-4 (3.6)
Australia	516 (2.8)	517 (2.8)	2 (1.2)	513 (3.0)	-2 (1.2)	518 (3.4)	2 (2.5)
² Serbia	516 (3.1)	524 (2.9)	8 (1.9) ▲	506 (3.2)	-9 (2.0) ▼	519 (3.0)	4 (1.9) ▲
^{1 2} Lithuania	515 (2.4)	508 (2.9)	-7 (2.1) ▼	521 (2.5)	6 (1.6) ▲	515 (2.8)	1 (1.2)
Belgium (Flemish)	509 (2.0)	507 (2.2)	-2 (1.2)	511 (1.8)	3 (1.5)	508 (2.5)	0 (1.3)
Romania	505 (5.9)	511 (6.1)	6 (2.3) ▲	502 (5.9)	-3 (1.4) ▼	497 (6.0)	-8 (1.8) ▼
Spain	505 (3.0)	516 (3.2)	11 (1.4) ▲	499 (3.0)	-7 (1.7) ▼	496 (3.1)	-9 (1.6) ▼
Poland	505 (2.6)	500 (3.2)	-5 (1.6) ▼	514 (2.6)	9 (1.1) ▲	487 (3.2)	-18 (1.9) ▼
New Zealand	497 (2.3)	496 (2.7)	-1 (1.3)	497 (2.6)	1 (1.2)	497 (2.9)	0 (1.6)
² Kazakhstan	495 (5.1)	486 (5.6)	-8 (1.5) ▼	499 (5.1)	4 (1.5) ▲	496 (5.7)	1 (3.2)
[‡] Norway	494 (2.3)	502 (2.8)	8 (1.3) ▲	487 (2.8)	-7 (1.7) ▼	493 (3.7)	-1 (2.8)
Chile	480 (2.4)	483 (2.7)	3 (1.5)	479 (2.3)	-1 (1.5)	477 (2.8)	-3 (2.0)
Thailand	472 (5.6)	473 (5.9)	2 (1.9)	471 (5.4)	-1 (1.3)	463 (6.0)	-9 (2.1) ▼
Turkey	463 (4.5)	457 (4.7)	-5 (1.3) ▼	463 (4.8)	0 (1.3)	472 (5.3)	9 (1.7) ▲
¹ Georgia	455 (3.8)	466 (3.9)	11 (1.6) ▲	452 (4.4)	-3 (1.3) ▼	422 (5.0)	-33 (2.8) ▼
Iran, Islamic Rep. of	453 (3.7)	448 (4.3)	-5 (1.9) ▼	452 (3.8)	-1 (1.0)	459 (3.9)	6 (1.5) ▲
Bahrain	449 (3.5)	454 (3.6)	4 (1.7) ▲	443 (3.5)	-6 (1.7) ▼	442 (4.7)	-7 (3.3) ▼
Malta	446 (1.9)	437 (3.0)	-9 (2.1) ▼	449 (1.6)	3 (1.8)	459 (4.2)	13 (3.3) ▲
² Azerbaijan	438 (5.6)	445 (6.4)	7 (2.2) ▲	439 (5.2)	1 (2.1)	402 (5.9)	-36 (1.9) ▼
Saudi Arabia	429 (5.4)	432 (6.0)	3 (2.2)	427 (6.1)	-3 (2.3)	416 (5.8)	-14 (2.4) ▼
United Arab Emirates	428 (2.5)	433 (2.7)	5 (1.2) ▲	421 (2.6)	-7 (0.8) ▼	426 (2.6)	-2 (1.0) ▼
Armenia	416 (3.8)	412 (4.3)	-4 (2.1) ▼	418 (3.9)	2 (2.1)	402 (4.9)	-14 (2.9) ▼
² Qatar	394 (4.3)	388 (5.1)	-6 (2.2) ▼	389 (5.4)	-5 (2.6)	404 (4.4)	10 (2.8) ▲
Oman	377 (4.3)	376 (4.5)	-1 (1.4)	372 (4.2)	-5 (1.2) ▼	354 (4.4)	-23 (2.3) ▼
¹ Ψ Kuwait	347 (4.7)	342 (5.7)	-5 (2.9) ▼	334 (4.9)	-14 (2.6) ▼	336 (5.0)	-11 (3.0) ▼
Ψ Tunisia	346 (5.3)	336 (5.3)	-9 (2.3) ▼	343 (4.7)	-3 (2.5)	337 (4.9)	-9 (2.7) ▼
* Morocco	264 (4.5)	237 (6.1)	-27 (2.7) ▼	256 (5.1)	-8 (2.5) ▼	240 (5.0)	-24 (3.1) ▼
* Yemen	209 (7.3)	182 (6.7)	-27 (4.9) ▼	183 (6.6)	-26 (3.4) ▼	180 (7.3)	-29 (3.6) ▼

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- ▲ Subscale score significantly higher than overall science score
- ▼ Subscale score significantly lower than overall science score

* Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
 Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 3.3: Achievement in Science Cognitive Domains (Continued)

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning		
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	
Sixth Grade Participants								
Honduras	432 (5.8)	445 (6.0)	13 (1.9) ▲	429 (5.0)	-3 (2.0)	392 (7.4)	-40 (3.2) ▼	
Botswana	367 (5.5)	344 (6.2)	-24 (1.6) ▼	379 (5.5)	12 (1.8) ▲	377 (5.9)	10 (2.3) ▲	
Yemen	345 (7.0)	338 (7.4)	-7 (2.0) ▼	338 (6.8)	-7 (1.9) ▼	337 (7.0)	-8 (3.2) ▼	
Benchmarking Participants								
^{1 3} Florida, US	545 (3.7)	550 (4.0)	5 (2.0) ▲	543 (3.6)	-2 (2.2)	536 (3.8)	-9 (2.1) ▼	
² Alberta, Canada	541 (2.4)	543 (3.1)	2 (1.5)	541 (2.8)	-1 (2.2)	540 (2.9)	-1 (2.0)	
^{1 2} North Carolina, US	538 (4.6)	539 (4.6)	1 (1.9)	539 (4.4)	1 (2.1)	533 (5.1)	-6 (2.1) ▼	
Ontario, Canada	528 (3.0)	529 (3.1)	1 (1.4)	526 (3.3)	-2 (1.0)	529 (3.7)	1 (1.4)	
Quebec, Canada	516 (2.7)	519 (2.7)	2 (1.1)	514 (2.5)	-3 (1.7)	520 (3.7)	3 (3.0)	
Dubai, UAE	461 (2.3)	467 (2.5)	6 (2.3) ▲	453 (2.0)	-8 (1.8) ▼	455 (3.7)	-6 (2.3) ▼	
Abu Dhabi, UAE	411 (4.9)	415 (5.7)	3 (2.6)	405 (5.3)	-6 (1.9) ▼	416 (5.1)	5 (3.0)	

- ▲ Subscale score significantly higher than overall science score
- ▼ Subscale score significantly lower than overall science score

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.4: Achievement in Science Cognitive Domains

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
² Singapore	590 (4.3)	588 (4.9)	-2 (1.7)	589 (4.4)	-1 (0.9)	592 (4.5)	2 (1.6)
Chinese Taipei	564 (2.3)	569 (2.7)	5 (1.9) ▲	570 (2.7)	6 (1.0) ▲	551 (2.9)	-13 (1.6) ▼
Korea, Rep. of	560 (2.0)	554 (2.9)	-7 (2.2) ▼	561 (2.0)	1 (0.8)	564 (2.2)	3 (1.7) ▲
Japan	558 (2.4)	541 (2.7)	-17 (2.2) ▼	561 (2.4)	3 (1.2) ▲	568 (2.3)	10 (1.0) ▲
Finland	552 (2.5)	564 (3.0)	12 (2.1) ▲	549 (2.5)	-4 (1.1) ▼	547 (3.4)	-5 (2.8)
Slovenia	543 (2.7)	551 (2.7)	8 (1.9) ▲	542 (2.6)	-1 (1.7) ▼	536 (2.7)	-7 (1.9) ▼
² Russian Federation	542 (3.2)	557 (3.9)	15 (1.9) ▲	539 (3.5)	-4 (1.3) ▼	533 (3.3)	-10 (1.5) ▼
Hong Kong SAR	535 (3.4)	544 (3.3)	9 (1.6) ▲	529 (3.5)	-6 (1.2) ▼	538 (4.1)	3 (2.0)
[‡] England	533 (4.9)	533 (5.1)	0 (1.6)	531 (4.7)	-2 (1.3)	537 (4.8)	4 (1.5) ▲
² United States	525 (2.6)	527 (2.8)	3 (1.3) ▲	522 (2.3)	-2 (0.7) ▼	524 (2.5)	-1 (0.7)
Hungary	522 (3.1)	511 (3.3)	-12 (1.6) ▼	532 (3.5)	10 (1.3) ▲	518 (3.4)	-4 (1.2) ▼
Australia	519 (4.8)	514 (5.4)	-5 (1.4) ▼	517 (4.8)	-2 (0.9) ▼	526 (5.2)	7 (2.0) ▲
³ Israel	516 (4.0)	518 (4.2)	2 (1.1)	512 (4.1)	-4 (1.2) ▼	519 (4.4)	3 (1.7) ▲
¹ Lithuania	514 (2.6)	516 (2.3)	2 (1.4)	512 (2.3)	-2 (1.3)	513 (2.6)	-1 (1.5)
New Zealand	512 (4.6)	511 (5.0)	-1 (1.7)	509 (4.3)	-3 (1.3) ▼	515 (4.7)	3 (1.6) ▲
Sweden	509 (2.5)	512 (2.4)	2 (1.6)	508 (2.6)	-2 (0.8) ▼	510 (2.9)	0 (1.6)
Italy	501 (2.5)	512 (2.7)	11 (1.7) ▲	500 (2.4)	-1 (0.9)	489 (2.7)	-12 (1.5) ▼
Ukraine	501 (3.4)	505 (3.9)	4 (1.9) ▲	496 (3.8)	-5 (2.4) ▼	500 (3.9)	-1 (2.7)
Norway	494 (2.6)	490 (2.6)	-4 (2.0) ▼	496 (3.0)	1 (1.6)	494 (3.0)	0 (1.3)
Kazakhstan	490 (4.3)	483 (5.0)	-7 (1.5) ▼	491 (4.1)	1 (1.5)	487 (4.2)	-3 (1.8)
Turkey	483 (3.4)	490 (3.8)	7 (0.9) ▲	478 (3.4)	-5 (0.9) ▼	483 (3.4)	0 (1.3)
Iran, Islamic Rep. of	474 (4.0)	479 (4.7)	5 (1.5) ▲	470 (3.9)	-4 (1.3) ▼	475 (3.9)	1 (1.3)
Romania	465 (3.5)	457 (3.9)	-8 (1.2) ▼	468 (3.6)	3 (1.1) ▲	460 (3.9)	-5 (2.0) ▼
United Arab Emirates	465 (2.4)	471 (2.5)	7 (1.2) ▲	464 (2.1)	0 (1.1)	456 (2.6)	-9 (1.0) ▼
Chile	461 (2.5)	476 (3.2)	14 (1.8) ▲	454 (2.3)	-8 (1.2) ▼	459 (2.8)	-2 (1.1) ▼
Bahrain	452 (2.0)	457 (3.6)	5 (3.1)	450 (2.0)	-3 (1.5) ▼	449 (1.9)	-4 (1.9)
Thailand	451 (3.9)	443 (4.7)	-8 (1.6) ▼	451 (4.1)	0 (1.8)	453 (4.2)	2 (1.6)
Jordan	449 (4.0)	453 (4.3)	4 (1.2) ▲	451 (4.0)	2 (0.9) ▲	441 (4.5)	-8 (1.2) ▼
Tunisia	439 (2.5)	424 (2.3)	-14 (1.8) ▼	437 (2.2)	-1 (1.4)	446 (2.7)	8 (1.1) ▲
Armenia	437 (3.1)	464 (3.1)	27 (1.5) ▲	428 (3.4)	-9 (1.8) ▼	419 (3.6)	-18 (2.2) ▼
Saudi Arabia	436 (3.9)	448 (4.4)	11 (1.5) ▲	432 (3.9)	-4 (1.5) ▼	424 (3.5)	-13 (1.7) ▼
Malaysia	426 (6.3)	403 (7.0)	-24 (2.0) ▼	424 (6.2)	-2 (1.1) ▼	439 (5.8)	13 (2.4) ▲
Syrian Arab Republic	426 (3.9)	441 (4.3)	14 (2.1) ▲	426 (4.4)	0 (2.5)	402 (5.1)	-25 (2.7) ▼
Palestinian Nat'l Auth.	420 (3.2)	431 (3.6)	10 (1.6) ▲	422 (3.6)	1 (1.3)	404 (3.6)	-16 (1.4) ▼
¹ Georgia	420 (3.0)	428 (3.9)	8 (3.0) ▲	418 (3.8)	-2 (3.0)	412 (3.6)	-8 (2.8) ▼
Oman	420 (3.2)	416 (3.4)	-3 (2.2)	419 (3.3)	0 (1.5)	417 (3.0)	-3 (1.4) ▼
Qatar	419 (3.4)	418 (4.3)	-1 (2.9)	420 (3.5)	1 (2.2)	409 (4.4)	-9 (2.8) ▼
Macedonia, Rep. of	407 (5.4)	417 (6.0)	9 (1.7) ▲	408 (5.4)	0 (2.4)	391 (6.0)	-17 (2.2) ▼
Lebanon	406 (4.9)	381 (5.8)	-25 (2.1) ▼	408 (5.2)	2 (2.1)	408 (5.6)	2 (1.9)
Indonesia	406 (4.5)	402 (5.4)	-4 (3.3) ▼	398 (4.7)	-8 (2.1) ▼	413 (5.2)	8 (2.6) ▲
Morocco	376 (2.2)	363 (2.7)	-13 (1.6) ▼	381 (1.9)	5 (1.1) ▲	366 (2.3)	-10 (1.4) ▼
□ Ghana	306 (5.2)	292 (6.1)	-14 (2.1) ▼	295 (6.3)	-10 (3.0) ▼	315 (4.9)	9 (1.9) ▲

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.4: Achievement in Science Cognitive Domains (Continued)

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning		
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	
Ninth Grade Participants								
Botswana	404 (3.6)	397 (3.7)	-7 (2.0) ▼	404 (3.3)	-1 (2.0)	404 (3.2)	0 (2.9)	
² Honduras	369 (4.0)	373 (4.4)	4 (2.8)	369 (4.0)	0 (3.0)	358 (4.6)	-11 (2.7) ▼	
^ψ South Africa	332 (3.7)	282 (4.1)	-49 (1.3) ▼	335 (3.5)	4 (1.1) ▲	338 (5.0)	7 (2.9) ▲	
Benchmarking Participants								
^{1 2} Massachusetts, US	567 (5.1)	576 (6.5)	9 (2.8) ▲	561 (4.8)	-6 (1.1) ▼	567 (5.9)	0 (1.7)	
¹ Minnesota, US	553 (4.6)	552 (5.2)	-1 (1.8)	553 (4.9)	0 (1.4)	556 (5.0)	2 (1.8)	
² Alberta, Canada	546 (2.4)	542 (2.8)	-3 (1.5) ▼	543 (2.5)	-3 (1.4)	552 (2.6)	6 (1.2) ▲	
¹ Colorado, US	542 (4.4)	542 (5.0)	1 (2.6)	538 (4.4)	-4 (2.6)	545 (4.7)	3 (1.6) ▲	
^{1 2} Indiana, US	533 (4.8)	537 (5.4)	4 (1.4) ▲	531 (4.5)	-2 (1.3)	530 (5.2)	-2 (1.2) ▼	
^{1 2} Connecticut, US	532 (4.6)	537 (5.4)	5 (1.9) ▲	527 (5.0)	-5 (1.8) ▼	530 (5.0)	-1 (1.5)	
^{1 3} North Carolina, US	532 (6.3)	536 (6.7)	5 (2.1) ▲	528 (6.1)	-3 (2.5)	530 (6.6)	-1 (2.5)	
^{1 2} Florida, US	530 (7.3)	541 (7.6)	11 (2.5) ▲	526 (7.2)	-4 (2.6)	524 (7.5)	-6 (1.5) ▼	
² Ontario, Canada	521 (2.5)	513 (2.9)	-8 (1.6) ▼	518 (2.4)	-4 (1.2) ▼	532 (3.1)	11 (1.8) ▲	
Quebec, Canada	520 (2.5)	519 (2.7)	0 (1.5)	518 (2.8)	-2 (1.2)	522 (3.1)	2 (1.8)	
^{1 2} California, US	499 (4.6)	495 (5.6)	-4 (2.6)	498 (4.4)	0 (2.0)	499 (4.9)	0 (2.1)	
¹ Alabama, US	485 (6.2)	490 (7.6)	5 (1.9) ▲	484 (6.3)	-1 (2.3)	480 (6.6)	-6 (3.5)	
Dubai, UAE	485 (2.5)	492 (2.8)	7 (2.7) ▲	486 (2.7)	1 (1.4)	479 (2.5)	-6 (1.7) ▼	
Abu Dhabi, UAE	461 (4.0)	466 (4.2)	4 (1.4) ▲	461 (3.9)	-1 (1.9)	455 (4.4)	-7 (1.7) ▼	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

Similar to the fourth grade, at the eighth grade there was much variability across countries in relative strengths or weaknesses in the cognitive domains, and only in two countries and three benchmarking participants was performance in each of the three cognitive domains relatively the same as in science overall: the top-performing country of Singapore, Lithuania, the province of Québec, and the states of California and Minnesota. More eighth and ninth grade participants had better performance relative to overall science in the knowing domain (19 countries and 8 benchmarking entities) than in the applying (6 countries and 1 benchmarking entity) and reasoning (10 countries and 4 benchmarking entities) domains.

Trends in Achievement in Science Content Domains

Exhibits 3.5 and 3.6 show changes from 2007 to 2011 in average achievement in the science content domains for fourth and eighth grade students, respectively. Countries are shown in alphabetical order, followed by the benchmarking participants.

Of the TIMSS 2011 fourth grade participants that also participated in 2007 and have comparable data, some had increases and some had decreases in average science achievement over the period. From Exhibit 1.5 it can be seen that nine countries (Czech Republic, Denmark, Georgia, Iran, Japan, the Netherlands, Norway, Sweden, and Tunisia) had higher average science achievement in 2011 than in 2007, and five countries (Australia, England, Hong Kong SAR, Italy, and New Zealand) had lower achievement. Exhibit 3.5 shows that in three of the countries with an overall increase—Czech Republic, Georgia, and Norway—the increase was due to improved performance in all three science content domains. However, in Denmark, the Netherlands, and Sweden, the increase was due mainly to improvement in physical science, and in Iran and Japan due to increased performance in both physical and earth science. In Tunisia, the increase was due to improvement in life science and earth science. Among the countries with a decrease in overall science achievement, only Hong Kong SAR decreased in all three content domains. Of the others, the decline in Australia and New Zealand was due mainly to a drop in life and earth science performance; in England it was due to lower physical and earth science achievement; and in Italy it was due to a decrease in life and physical science achievement.

Although not showing overall increases in science achievement between 2007 and 2011, Austria and the Slovak Republic both had increased achievement

in physical science. Slovenia also had no overall science achievement difference, but had increased achievement in life science and a decrease in earth science. Singapore and the two Canadian provinces of Alberta and Ontario, also with no overall difference, had a decrease in earth science achievement.

Of the TIMSS 2011 eighth grade participants with comparable data from 2007, some had increased average science achievement over the period and some decreased. From Exhibit 1.6 it can be seen that seven countries (Iran, Korea, Norway, Palestinian Authority, Russian Federation, Singapore, and the Ukraine as well as the province of Québec and the state of Minnesota) had higher average science achievement in 2011 than in 2007, and seven countries had lower achievement (Bahrain, Hungary, Indonesia, Jordan, Malaysia, Syria, and Thailand). Exhibit 3.6 shows that only in Singapore and the province of Quebec was the overall increase due to improved performance in all four science content domains. In Iran, the increase was due to improved achievement in biology, chemistry, and physics; in Korea due to improved biology and chemistry; in Norway due to improved earth science; in the Palestinian Authority due to improved chemistry and physics; in the Russian Federation due to increased achievement in biology, chemistry, and physics; in the Ukraine due to improved biology, chemistry, and earth science; and in the state of Minnesota due to improved chemistry, physics, and earth science. In six of the seven countries with an overall decrease in science achievement, including Bahrain, Indonesia, Jordan, Malaysia, Syria, and Thailand, the decrease was evident in all four content domains. In Hungary, the remaining country, the decline was due to a drop in achievement in biology, physics, and earth science.

Although showing no change in overall in eighth grade science achievement between 2007 and 2011, several countries had improved performance in one or more content domains, including Chinese Taipei (earth science), Ghana (physics), Italy and Slovenia (chemistry, earth science), Japan (biology, earth science), and the United States as well as its state of Massachusetts (chemistry, physics). There were also several participants with lower achievement in one or more content domains in 2011 without having lower overall science achievement, including England, Lebanon, Oman, and Sweden (physics), and the province of Ontario (chemistry). Finally, a number of countries had a mixture of increases and decreases among the science content domains, including Georgia (increase in biology, decrease in chemistry); Lithuania (decrease in biology, increase in chemistry); and Tunisia (decrease in chemistry and earth science, increase in physics).

Exhibit 3.5: Trends in Achievement for Science Content Domains

Country	Life Science			Physical Science		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	516 (3.1)	529 (3.6)	-14 (4.7) ▼	514 (3.2)	521 (3.8)	-7 (5.0)
Austria	526 (2.6)	528 (2.3)	-2 (3.5)	535 (2.9)	517 (3.1)	18 (4.2) ▲
Chinese Taipei	538 (2.4)	547 (2.8)	-9 (3.7) ▼	569 (2.0)	564 (2.5)	5 (3.3)
Czech Republic	550 (3.0)	522 (3.5)	27 (4.6) ▲	519 (3.1)	509 (3.4)	10 (4.6) ▲
Denmark	530 (2.8)	527 (3.2)	3 (4.3)	526 (2.5)	502 (2.8)	24 (3.7) ▲
England	530 (2.8)	536 (3.1)	-6 (4.2)	535 (3.5)	546 (3.3)	-10 (4.8) ▼
Georgia	461 (3.6)	421 (4.0)	39 (5.4) ▲	440 (4.2)	403 (4.9)	37 (6.4) ▲
Germany	525 (2.6)	531 (2.2)	-6 (3.4)	535 (3.1)	527 (3.2)	8 (4.4)
Hong Kong SAR	524 (3.7)	540 (4.0)	-16 (5.4) ▼	539 (4.4)	562 (4.0)	-23 (5.9) ▼
Hungary	552 (3.5)	553 (3.3)	-1 (4.8)	520 (3.8)	529 (3.7)	-8 (5.3)
Iran, Islamic Rep. of	449 (4.1)	437 (5.2)	11 (6.6)	453 (4.0)	440 (4.9)	13 (6.3) ▲
Italy	535 (2.7)	555 (3.6)	-20 (4.5) ▼	509 (3.0)	520 (3.7)	-11 (4.8) ▼
Japan	540 (1.9)	536 (2.3)	4 (2.9)	589 (1.9)	571 (2.9)	18 (3.4) ▲
Lithuania	520 (2.9)	518 (2.2)	2 (3.7)	514 (3.1)	511 (2.0)	3 (3.7)
Netherlands	537 (1.8)	539 (2.7)	-3 (3.3)	526 (2.0)	503 (3.1)	22 (3.7) ▲
New Zealand	497 (2.5)	506 (2.8)	-8 (3.7) ▼	493 (2.7)	494 (3.4)	-1 (4.3)
Norway	496 (3.0)	482 (3.0)	13 (4.3) ▲	482 (3.4)	461 (3.5)	21 (4.9) ▲
Russian Federation	556 (3.6)	545 (4.7)	12 (5.9)	548 (4.0)	552 (5.4)	-4 (6.7)
Singapore	597 (4.3)	595 (4.7)	3 (6.4)	598 (3.5)	597 (4.3)	2 (5.6)
Slovak Republic	534 (3.5)	535 (4.6)	-1 (5.8)	527 (4.0)	512 (5.2)	15 (6.6) ▲
Slovenia	524 (2.6)	511 (2.0)	13 (3.3) ▲	524 (3.4)	528 (2.3)	-5 (4.1)
Sweden	534 (2.7)	532 (2.8)	2 (3.9)	528 (2.5)	509 (3.2)	19 (4.0) ▲
Ψ Tunisia	342 (5.1)	307 (6.5)	36 (8.3) ▲	342 (5.6)	325 (7.0)	16 (9.0)
United States	547 (2.1)	544 (2.9)	3 (3.5)	544 (2.0)	535 (3.1)	9 (3.7) ▲
Benchmarking Participants						
Alberta, Canada	542 (2.6)	545 (4.2)	-3 (5.0)	542 (3.0)	536 (4.2)	6 (5.1)
Ontario, Canada	535 (3.4)	539 (4.0)	-4 (5.2)	528 (3.2)	535 (3.3)	-7 (4.6)
Quebec, Canada	524 (2.5)	524 (3.0)	0 (3.8)	507 (3.1)	509 (3.1)	-2 (4.4)
Dubai, UAE	455 (2.9)	456 (2.8)	-1 (4.0)	460 (3.2)	456 (3.5)	4 (4.8)

▲ 2011 average significantly higher
▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.5: Trends in Achievement for Science Content Domains (Continued)

Country	Earth Science		
	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	520 (3.5)	536 (4.5)	-17 (5.7) ▼
Austria	539 (3.6)	535 (2.5)	4 (4.4)
Chinese Taipei	553 (2.5)	563 (2.9)	-10 (3.9) ▼
Czech Republic	537 (3.4)	514 (3.5)	24 (4.9) ▲
Denmark	527 (3.0)	519 (3.3)	8 (4.5)
England	522 (3.8)	542 (3.4)	-19 (5.1) ▼
Georgia	458 (4.3)	416 (5.4)	42 (6.9) ▲
Germany	520 (3.7)	524 (2.8)	-4 (4.6)
Hong Kong SAR	548 (3.3)	568 (4.2)	-20 (5.4) ▼
Hungary	524 (4.4)	517 (4.3)	7 (6.1)
Iran, Islamic Rep. of	457 (3.5)	416 (5.0)	40 (6.1) ▲
Italy	523 (3.6)	527 (4.1)	-3 (5.5)
Japan	551 (1.8)	532 (3.5)	20 (4.0) ▲
Lithuania	501 (3.0)	508 (2.9)	-8 (4.1)
Netherlands	525 (2.7)	524 (3.3)	1 (4.2)
New Zealand	499 (3.2)	513 (3.4)	-14 (4.7) ▼
Norway	506 (3.0)	490 (3.8)	17 (4.9) ▲
Russian Federation	552 (4.1)	541 (5.5)	11 (6.8)
Singapore	541 (3.0)	565 (4.0)	-24 (5.0) ▼
Slovak Republic	535 (3.8)	532 (6.5)	3 (7.5)
Slovenia	506 (2.7)	516 (3.2)	-10 (4.2) ▼
Sweden	538 (3.2)	539 (3.7)	-1 (4.9)
Ψ Tunisia	319 (6.6)	297 (6.1)	22 (9.0) ▲
United States	539 (2.1)	537 (3.2)	2 (3.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Benchmarking Participants

Alberta, Canada	539 (3.2)	551 (4.2)	-13 (5.3) ▼
Ontario, Canada	514 (3.9)	533 (4.2)	-19 (5.8) ▼
Quebec, Canada	516 (3.5)	522 (3.0)	-6 (4.7)
Dubai, UAE	469 (3.0)	461 (3.8)	8 (4.8)

▲ 2011 average significantly higher

▼ 2011 average significantly lower

Country	Biology			Chemistry		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	527 (4.7)	519 (3.7)	8 (6.0)	501 (5.1)	504 (4.0)	-3 (6.5)
Bahrain	449 (2.1)	470 (2.1)	-22 (3.0) ▼	448 (2.7)	467 (2.9)	-19 (3.9) ▼
Chinese Taipei	557 (2.5)	554 (3.8)	3 (4.5)	585 (3.9)	585 (4.8)	1 (6.2)
England	533 (4.9)	544 (4.8)	-11 (6.9)	529 (5.2)	539 (4.6)	-11 (6.9)
Georgia	435 (3.3)	419 (4.1)	16 (5.2) ▲	395 (3.2)	408 (5.3)	-13 (6.2) ▼
Ψ Ghana	290 (6.2)	296 (5.5)	-6 (8.3)	331 (5.9)	324 (5.6)	7 (8.1)
Hong Kong SAR	535 (3.5)	529 (5.1)	6 (6.2)	526 (3.6)	521 (5.3)	5 (6.4)
Hungary	520 (3.0)	535 (3.0)	-15 (4.3) ▼	534 (3.4)	540 (4.1)	-6 (5.3)
Indonesia	410 (4.7)	424 (3.3)	-14 (5.8) ▼	378 (4.9)	408 (3.7)	-30 (6.2) ▼
Iran, Islamic Rep. of	466 (3.8)	445 (3.8)	21 (5.3) ▲	469 (4.4)	457 (4.0)	12 (5.9) ▲
Italy	503 (3.0)	502 (3.2)	1 (4.3)	491 (3.1)	478 (3.3)	13 (4.5) ▲
Japan	561 (2.3)	554 (1.9)	6 (3.0) ▲	560 (2.6)	559 (2.4)	1 (3.5)
Jordan	447 (4.3)	476 (4.2)	-29 (6.1) ▼	463 (4.4)	493 (4.7)	-30 (6.5) ▼
Korea, Rep. of	561 (2.4)	552 (2.0)	9 (3.1) ▲	551 (2.2)	539 (3.1)	12 (3.8) ▲
Lebanon	395 (5.2)	399 (6.5)	-4 (8.3)	435 (5.3)	440 (6.2)	-5 (8.2)
Lithuania	517 (2.8)	530 (2.6)	-13 (3.8) ▼	517 (2.3)	506 (2.5)	11 (3.4) ▲
Malaysia	427 (6.2)	466 (6.4)	-39 (8.9) ▼	426 (6.6)	475 (5.9)	-49 (8.9) ▼
Norway	491 (2.5)	485 (2.8)	6 (3.7)	488 (2.8)	480 (2.9)	8 (4.1)
Oman	407 (3.6)	408 (3.2)	0 (4.8)	408 (3.5)	408 (4.4)	0 (5.6)
Palestinian Nat'l Auth.	407 (3.9)	396 (4.2)	11 (5.7)	432 (4.0)	405 (4.8)	28 (6.2) ▲
Romania	458 (3.8)	457 (3.6)	2 (5.2)	469 (4.3)	458 (5.0)	11 (6.6)
Russian Federation	537 (3.3)	527 (3.9)	10 (5.1) ▲	554 (3.5)	540 (4.1)	13 (5.4) ▲
Singapore	594 (4.8)	567 (4.5)	27 (6.6) ▲	590 (4.7)	566 (4.8)	24 (6.7) ▲
Slovenia	532 (2.7)	532 (2.5)	0 (3.7)	558 (3.2)	546 (3.0)	11 (4.4) ▲
Sweden	513 (3.0)	515 (2.6)	-3 (3.9)	502 (2.7)	499 (2.6)	3 (3.8)
Syrian Arab Republic	425 (4.3)	457 (3.0)	-33 (5.2) ▼	424 (3.7)	445 (3.4)	-21 (5.0) ▼
Thailand	460 (4.3)	476 (4.8)	-16 (6.4) ▼	436 (4.6)	455 (4.7)	-19 (6.6) ▼
Tunisia	449 (3.0)	447 (2.5)	2 (3.9)	434 (3.3)	452 (2.6)	-19 (4.2) ▼
Ukraine	492 (3.1)	475 (3.6)	18 (4.8) ▲	512 (3.9)	490 (3.9)	22 (5.5) ▲
United States	530 (2.5)	531 (3.1)	0 (4.0)	520 (2.6)	510 (3.1)	10 (4.1) ▲

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Benchmarking Participants

Ontario, Canada	531 (2.6)	537 (4.0)	-6 (4.7)	495 (2.5)	504 (4.0)	-9 (4.7) ▼
Quebec, Canada	525 (2.9)	512 (3.1)	12 (4.2) ▲	515 (3.1)	495 (3.5)	20 (4.6) ▲
Dubai, UAE	485 (2.7)	483 (3.6)	2 (4.5)	487 (2.3)	492 (4.0)	-5 (4.6)
Massachusetts, US	575 (5.2)	565 (4.8)	10 (7.1)	568 (6.0)	546 (5.2)	22 (7.9) ▲
Minnesota, US	563 (5.5)	556 (5.8)	7 (8.0)	538 (5.0)	518 (5.6)	20 (7.5) ▲

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

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

Exhibit 3.6: Trends in Achievement for Science Content Domains (Continued)

Country	Physics			Earth Science		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	511 (5.1)	509 (4.4)	2 (6.7)	533 (5.4)	521 (4.5)	13 (7.1)
Bahrain	457 (1.8)	463 (1.6)	-7 (2.4) ▼	451 (1.8)	460 (2.8)	-9 (3.3) ▼
Chinese Taipei	552 (3.4)	559 (4.0)	-6 (5.2)	568 (2.9)	552 (3.4)	16 (4.5) ▲
England	533 (4.6)	549 (4.4)	-15 (6.4) ▼	536 (5.3)	531 (5.0)	5 (7.3)
Georgia	401 (4.2)	411 (6.4)	-9 (7.7)	417 (3.7)	416 (4.6)	2 (5.9)
Ψ Ghana	292 (5.9)	259 (6.9)	33 (9.1) ▲	265 (6.5)	279 (6.8)	-14 (9.4)
Hong Kong SAR	539 (3.6)	530 (5.3)	9 (6.4)	539 (3.7)	535 (5.2)	4 (6.4)
Hungary	525 (3.7)	544 (3.6)	-19 (5.2) ▼	511 (3.3)	535 (3.3)	-24 (4.7) ▼
Indonesia	397 (5.4)	426 (3.2)	-29 (6.3) ▼	412 (5.6)	434 (3.7)	-23 (6.7) ▼
Iran, Islamic Rep. of	483 (4.1)	467 (4.1)	16 (5.9) ▲	477 (3.9)	472 (4.3)	5 (5.8)
Italy	490 (2.8)	489 (3.6)	2 (4.6)	513 (3.8)	502 (3.6)	11 (5.3) ▲
Japan	558 (2.7)	563 (2.1)	-5 (3.5)	548 (2.8)	536 (3.3)	12 (4.4) ▲
Jordan	446 (4.2)	478 (4.5)	-31 (6.2) ▼	436 (4.2)	481 (4.1)	-46 (5.9) ▼
Korea, Rep. of	577 (2.8)	576 (2.7)	0 (3.9)	548 (3.2)	543 (2.4)	5 (4.0)
Lebanon	405 (5.4)	424 (5.6)	-19 (7.8) ▼	365 (6.4)	378 (7.0)	-14 (9.4)
Lithuania	503 (3.3)	507 (3.2)	-4 (4.6)	517 (3.5)	517 (3.0)	0 (4.6)
Malaysia	435 (6.6)	482 (6.5)	-47 (9.3) ▼	401 (6.5)	457 (6.1)	-56 (8.9) ▼
Norway	481 (3.6)	474 (3.4)	8 (5.0)	516 (3.5)	502 (2.7)	14 (4.5) ▲
Oman	427 (3.3)	439 (3.0)	-12 (4.5) ▼	431 (3.0)	432 (2.8)	-1 (4.2)
Palestinian Nat'l Auth.	432 (3.8)	407 (4.1)	26 (5.6) ▲	406 (3.3)	399 (3.9)	7 (5.1)
Romania	456 (3.9)	454 (3.8)	2 (5.4)	470 (3.6)	466 (3.9)	4 (5.3)
Russian Federation	547 (3.5)	521 (4.4)	26 (5.6) ▲	535 (3.7)	528 (4.1)	7 (5.5)
Singapore	602 (4.2)	582 (4.2)	19 (5.9) ▲	566 (4.5)	547 (4.8)	19 (6.6) ▲
Slovenia	532 (2.8)	528 (2.2)	4 (3.6)	560 (3.2)	548 (2.6)	13 (4.1) ▲
Sweden	498 (3.2)	507 (3.0)	-9 (4.4) ▼	520 (2.8)	511 (3.3)	8 (4.3)
Syrian Arab Republic	426 (4.4)	442 (3.1)	-16 (5.4) ▼	414 (4.8)	440 (3.4)	-26 (5.9) ▼
Thailand	430 (4.5)	454 (4.7)	-25 (6.5) ▼	466 (4.1)	485 (4.4)	-20 (6.0) ▼
Tunisia	436 (2.6)	427 (2.7)	9 (3.8) ▲	414 (3.6)	440 (1.9)	-26 (4.1) ▼
Ukraine	503 (3.8)	493 (3.8)	10 (5.4)	495 (3.6)	480 (4.3)	15 (5.6) ▲
United States	513 (2.5)	503 (3.0)	10 (3.9) ▲	533 (2.8)	526 (3.8)	7 (4.7)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

Benchmarking Participants

Ontario, Canada	521 (2.7)	523 (4.4)	-1 (5.2)	528 (3.4)	533 (4.8)	-5 (5.9)
Quebec, Canada	502 (3.2)	492 (3.6)	10 (4.8) ▲	536 (2.9)	514 (4.3)	21 (5.2) ▲
Dubai, UAE	482 (2.1)	489 (3.6)	-7 (4.2)	487 (3.1)	488 (3.7)	-1 (4.9)
Massachusetts, US	555 (5.7)	539 (5.4)	16 (7.9) ▲	577 (6.0)	567 (4.8)	10 (7.7)
Minnesota, US	541 (5.6)	516 (5.2)	25 (7.7) ▲	574 (6.2)	549 (6.4)	24 (8.9) ▲

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

Trends in Achievement in Science Cognitive Domains

Exhibits 3.7 and 3.8 show changes from 2007 to 2011 in average achievement in the science cognitive domains for fourth and eighth grade students, respectively. As with the content domains, overall increases or decreases in science achievement since 2007 were reflected in increases or decreases in the cognitive domains. As shown in Exhibit 3.7, the overall increase in science achievement was the result of increases in all three cognitive domains in just two countries: Georgia and Norway. In the Czech Republic, the Netherlands, and Tunisia, the overall increase was due to increases in the knowing and applying domains, whereas in Denmark and Sweden it was the result of improvement in the applying domain. In Iran, the overall science increase was due to improved performance in knowing and reasoning, and in Japan due to improvements in applying and reasoning. Among countries with an overall decrease in science achievement, only in Hong Kong SAR was this decrease the result of lower achievement in all three cognitive domains. In Australia and England, the overall decrease was due to a decrease in knowing and reasoning, in Italy due to a decrease in applying and reasoning, and in New Zealand due to a decrease in knowing.

A number of countries had improved performance in one or more cognitive domains at the fourth grade without having an overall difference in science achievement between 2007 and 2011, including Austria (reasoning), the Slovak Republic and Slovenia (knowing), and the United States (applying). Singapore performed less well in knowing but better in reasoning. The Canadian provinces of Alberta and Ontario, while not having lower overall science achievement, performed less well in knowing, and Ontario also performed less well in reasoning.

Exhibit 3.8 shows that for three of the seven countries with higher average science achievement in 2011 than in 2007 (the Palestinian Authority, the Russian Federation, and Singapore), the increase was due to improved performance in all three science cognitive domains; whereas for Iran, it was due to improved performance in applying and reasoning, for Korea and Norway, in applying, and for the Ukraine in knowing and reasoning. The overall increases in the provinces of Québec and state of Minnesota were due to improved performance in knowing and applying. In all seven of the countries where overall science achievement decreased since 2007, this decrease was the result of lower achievement in all three cognitive domains.

Countries without an overall increase in eighth grade science achievement between 2007 and 2011, but with improved performance in one or more cognitive domains included Georgia (reasoning), Italy, the United States and the state of Massachusetts (knowing), and Slovenia (knowing and applying). Countries with a decrease in one or more cognitive domains but without an overall decrease in science achievement included Lebanon and Tunisia (knowing), and Lithuania (reasoning). Ghana, with no change in overall science achievement between 2007 and 2011, had a decrease in the knowing domain and an increase in reasoning.

Exhibit 3.7: Trends in Achievement for Science Cognitive Domains

Country	Knowing			Applying		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	517 (2.8)	532 (3.6)	-14 (4.5) ▼	513 (3.0)	522 (3.8)	-9 (4.8)
Austria	532 (3.1)	531 (2.5)	1 (3.9)	533 (2.9)	527 (2.7)	7 (3.9)
Chinese Taipei	542 (2.7)	544 (2.8)	-1 (3.9)	552 (3.1)	560 (2.2)	-7 (3.8)
Czech Republic	551 (3.3)	521 (2.9)	30 (4.4) ▲	534 (2.6)	515 (3.4)	19 (4.3) ▲
Denmark	524 (2.6)	517 (3.3)	7 (4.2)	532 (2.5)	513 (3.2)	19 (4.1) ▲
England	529 (3.2)	547 (3.4)	-19 (4.7) ▼	532 (3.1)	537 (3.2)	-4 (4.5)
Georgia	466 (3.9)	429 (4.3)	37 (5.8) ▲	452 (4.4)	415 (4.5)	38 (6.3) ▲
Germany	524 (4.0)	529 (2.4)	-4 (4.6)	533 (2.6)	526 (2.5)	7 (3.6)
Hong Kong SAR	537 (3.6)	553 (3.9)	-16 (5.3) ▼	529 (3.5)	552 (3.4)	-24 (4.8) ▼
Hungary	547 (3.7)	544 (3.5)	2 (5.0)	530 (3.6)	532 (3.8)	-2 (5.2)
Iran, Islamic Rep. of	448 (4.3)	431 (5.0)	17 (6.6) ▲	452 (3.8)	443 (4.9)	9 (6.2)
Italy	532 (3.0)	535 (4.2)	-3 (5.1)	523 (2.7)	541 (3.4)	-18 (4.4) ▼
Japan	538 (1.8)	534 (2.7)	3 (3.3)	562 (1.6)	546 (3.2)	16 (3.6) ▲
Lithuania	508 (2.9)	511 (2.3)	-4 (3.7)	521 (2.5)	513 (3.3)	7 (4.2)
Netherlands	528 (2.3)	521 (2.6)	7 (3.4) ▲	534 (2.0)	525 (2.4)	10 (3.1) ▲
New Zealand	496 (2.7)	511 (3.4)	-15 (4.3) ▼	497 (2.6)	496 (2.7)	1 (3.7)
Norway	502 (2.8)	480 (3.2)	21 (4.3) ▲	487 (2.8)	472 (3.5)	15 (4.5) ▲
Russian Federation	553 (3.8)	546 (5.6)	7 (6.8)	556 (3.6)	550 (5.3)	6 (6.4)
Singapore	570 (3.4)	599 (4.4)	-29 (5.6) ▼	590 (4.0)	587 (4.2)	2 (5.8)
Slovak Republic	547 (3.8)	531 (4.8)	15 (6.1) ▲	528 (4.0)	527 (4.9)	1 (6.3)
Slovenia	518 (2.2)	510 (2.0)	9 (2.9) ▲	518 (2.8)	525 (2.5)	-7 (3.8)
Sweden	536 (2.8)	528 (3.0)	8 (4.1)	531 (3.0)	520 (3.0)	11 (4.2) ▲
Ψ Tunisia	336 (5.3)	301 (6.0)	36 (8.0) ▲	343 (4.7)	315 (7.4)	27 (8.7) ▲
United States	546 (1.9)	546 (2.7)	1 (3.3)	544 (2.1)	534 (3.1)	10 (3.7) ▲
Benchmarking Participants						
Alberta, Canada	543 (3.1)	555 (4.0)	-11 (5.0) ▼	541 (2.8)	536 (4.4)	5 (5.3)
Ontario, Canada	529 (3.1)	542 (3.7)	-14 (4.8) ▼	526 (3.3)	529 (3.9)	-3 (5.1)
Quebec, Canada	519 (2.7)	517 (3.0)	2 (4.0)	514 (2.5)	515 (3.0)	-1 (3.9)
Dubai, UAE	467 (2.5)	461 (2.6)	7 (3.6)	453 (2.0)	458 (3.7)	-5 (4.2)

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.7: Trends in Achievement for Science Cognitive Domains (Continued)

Country	Reasoning		
	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	518 (3.4)	528 (4.1)	-11 (5.3) ▼
Austria	525 (3.1)	514 (2.9)	11 (4.2) ▲
Chinese Taipei	568 (3.2)	574 (3.2)	-6 (4.5)
Czech Republic	516 (4.0)	507 (3.6)	9 (5.4)
Denmark	527 (3.1)	524 (4.5)	3 (5.4)
England	526 (4.4)	540 (2.8)	-14 (5.2) ▼
Georgia	422 (5.0)	379 (6.0)	43 (7.8) ▲
Germany	526 (3.6)	525 (2.6)	1 (4.5)
Hong Kong SAR	541 (4.2)	563 (4.9)	-21 (6.5) ▼
Hungary	525 (4.5)	528 (4.2)	-3 (6.2)
Iran, Islamic Rep. of	459 (3.9)	427 (4.6)	32 (6.0) ▲
Italy	510 (2.9)	523 (3.6)	-14 (4.6) ▼
Japan	591 (2.0)	573 (2.3)	18 (3.0) ▲
Lithuania	515 (2.8)	521 (2.9)	-5 (4.0)
Netherlands	532 (2.9)	526 (2.7)	6 (4.0)
New Zealand	497 (2.9)	503 (4.0)	-6 (5.0)
Norway	493 (3.7)	475 (3.2)	17 (4.9) ▲
Russian Federation	542 (4.2)	542 (5.2)	0 (6.7)
Singapore	597 (3.8)	576 (4.0)	20 (5.5) ▲
Slovak Republic	514 (4.2)	512 (5.3)	2 (6.7)
Slovenia	525 (3.6)	525 (2.0)	0 (4.1)
Sweden	537 (3.0)	528 (4.3)	9 (5.2)
Ψ Tunisia	337 (4.9)	330 (6.2)	7 (7.9)
United States	537 (2.3)	535 (3.0)	2 (3.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Benchmarking Participants

Alberta, Canada	540 (2.9)	536 (4.9)	5 (5.7)
Ontario, Canada	529 (3.7)	540 (3.4)	-11 (5.1) ▼
Quebec, Canada	520 (3.7)	526 (3.7)	-6 (5.2)
Dubai, UAE	455 (3.7)	456 (3.0)	-1 (4.7)

▲ 2011 average significantly higher

▼ 2011 average significantly lower

Exhibit 3.8: Trends in Achievement for Science Cognitive Domains

Country	Knowing			Applying		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	514 (5.4)	505 (3.4)	9 (6.4)	517 (4.8)	511 (3.5)	6 (6.0)
Bahrain	457 (3.6)	468 (2.3)	-10 (4.3) ▼	450 (2.0)	465 (2.2)	-16 (3.0) ▼
Chinese Taipei	569 (2.7)	574 (3.9)	-5 (4.8)	570 (2.7)	564 (3.6)	6 (4.5)
England	533 (5.1)	536 (5.4)	-3 (7.4)	531 (4.7)	540 (4.3)	-8 (6.4)
Georgia	428 (3.9)	438 (5.3)	-10 (6.5)	418 (3.8)	418 (4.8)	0 (6.1)
Ψ Ghana	292 (6.1)	311 (5.8)	-19 (8.4) ▼	295 (6.3)	286 (5.9)	9 (8.6)
Hong Kong SAR	544 (3.3)	537 (4.9)	7 (5.9)	529 (3.5)	522 (5.3)	6 (6.3)
Hungary	511 (3.3)	530 (3.2)	-19 (4.6) ▼	532 (3.5)	551 (3.3)	-19 (4.8) ▼
Indonesia	402 (5.4)	424 (4.0)	-23 (6.7) ▼	398 (4.7)	421 (3.5)	-24 (5.9) ▼
Iran, Islamic Rep. of	479 (4.7)	468 (4.1)	11 (6.2)	470 (3.9)	452 (4.0)	18 (5.6) ▲
Italy	512 (2.7)	496 (3.6)	16 (4.5) ▲	500 (2.4)	497 (3.0)	3 (3.8)
Japan	541 (2.7)	542 (2.5)	-1 (3.7)	561 (2.4)	556 (2.1)	4 (3.2)
Jordan	453 (4.3)	492 (4.9)	-39 (6.5) ▼	451 (4.0)	484 (4.3)	-33 (5.9) ▼
Korea, Rep. of	554 (2.9)	550 (2.3)	4 (3.7)	561 (2.0)	550 (2.3)	11 (3.1) ▲
Lebanon	381 (5.8)	401 (6.3)	-20 (8.5) ▼	408 (5.2)	418 (6.1)	-10 (8.0)
Lithuania	516 (2.3)	517 (2.6)	-1 (3.5)	512 (2.3)	513 (2.4)	-1 (3.3)
Malaysia	403 (7.0)	458 (6.9)	-55 (9.8) ▼	424 (6.2)	470 (6.4)	-46 (8.9) ▼
Norway	490 (2.6)	487 (2.6)	3 (3.7)	496 (3.0)	485 (2.5)	11 (3.9) ▲
Oman	416 (3.4)	425 (3.6)	-8 (5.0)	419 (3.3)	419 (3.6)	0 (4.9)
Palestinian Nat'l Auth.	431 (3.6)	404 (3.8)	27 (5.2) ▲	422 (3.6)	408 (4.4)	13 (5.7) ▲
Romania	457 (3.9)	451 (4.5)	6 (6.0)	468 (3.6)	468 (3.7)	0 (5.2)
Russian Federation	557 (3.9)	541 (4.7)	16 (6.1) ▲	539 (3.5)	527 (4.1)	12 (5.3) ▲
Singapore	588 (4.9)	561 (4.9)	26 (6.9) ▲	589 (4.4)	570 (4.5)	19 (6.3) ▲
Slovenia	551 (2.7)	538 (2.3)	12 (3.5) ▲	542 (2.6)	535 (2.5)	7 (3.6) ▲
Sweden	512 (2.4)	508 (2.6)	4 (3.6)	508 (2.6)	509 (2.8)	-1 (3.9)
Syrian Arab Republic	441 (4.3)	472 (3.1)	-31 (5.3) ▼	426 (4.4)	442 (3.1)	-16 (5.4) ▼
Thailand	443 (4.7)	473 (4.7)	-30 (6.6) ▼	451 (4.1)	471 (4.5)	-19 (6.1) ▼
Tunisia	424 (2.3)	438 (2.2)	-13 (3.2) ▼	437 (2.2)	441 (2.7)	-4 (3.5)
Ukraine	505 (3.9)	478 (4.2)	28 (5.7) ▲	496 (3.8)	486 (4.0)	10 (5.5)
United States	527 (2.8)	516 (3.2)	11 (4.2) ▲	522 (2.3)	517 (2.9)	5 (3.7)
Benchmarking Participants						
Ontario, Canada	513 (2.9)	515 (3.6)	-2 (4.6)	518 (2.4)	524 (3.9)	-6 (4.6)
Quebec, Canada	519 (2.7)	499 (3.3)	20 (4.3) ▲	518 (2.8)	500 (3.4)	17 (4.4) ▲
Dubai, UAE	492 (2.8)	496 (3.3)	-4 (4.4)	486 (2.7)	488 (3.3)	-2 (4.3)
Massachusetts, US	576 (6.5)	551 (4.6)	25 (8.0) ▲	561 (4.8)	553 (4.5)	8 (6.5)
Minnesota, US	552 (5.2)	532 (5.2)	20 (7.4) ▲	553 (4.9)	536 (5.1)	17 (7.0) ▲

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

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

Exhibit 3.8: Trends in Achievement for Science Cognitive Domains (Continued)

Country	Reasoning		
	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	526 (5.2)	530 (4.0)	-4 (6.6)
Bahrain	449 (1.9)	464 (2.5)	-15 (3.1) ▼
Chinese Taipei	551 (2.9)	544 (3.9)	7 (4.9)
England	537 (4.8)	548 (4.5)	-12 (6.5)
Georgia	412 (3.6)	385 (5.3)	27 (6.4) ▲
Ψ Ghana	315 (4.9)	292 (5.1)	22 (7.1) ▲
Hong Kong SAR	538 (4.1)	535 (5.7)	3 (7.0)
Hungary	518 (3.4)	530 (3.3)	-12 (4.7) ▼
Indonesia	413 (5.2)	430 (3.3)	-17 (6.2) ▼
Iran, Islamic Rep. of	475 (3.9)	456 (4.1)	19 (5.7) ▲
Italy	489 (2.7)	489 (3.0)	-1 (4.0)
Japan	568 (2.3)	564 (2.2)	4 (3.2)
Jordan	441 (4.5)	466 (4.4)	-25 (6.3) ▼
Korea, Rep. of	564 (2.2)	561 (2.4)	2 (3.2)
Lebanon	408 (5.6)	410 (6.4)	-2 (8.5)
Lithuania	513 (2.6)	527 (2.7)	-14 (3.8) ▼
Malaysia	439 (5.8)	483 (5.6)	-44 (8.1) ▼
Norway	494 (3.0)	488 (2.9)	6 (4.2)
Oman	417 (3.0)	419 (3.9)	-2 (4.9)
Palestinian Nat'l Auth.	404 (3.6)	385 (4.4)	20 (5.6) ▲
Romania	460 (3.9)	453 (4.0)	7 (5.5)
Russian Federation	533 (3.3)	519 (4.1)	13 (5.3) ▲
Singapore	592 (4.5)	568 (4.5)	24 (6.4) ▲
Slovenia	536 (2.7)	540 (2.5)	-4 (3.6)
Sweden	510 (2.9)	516 (2.8)	-6 (4.0)
Syrian Arab Republic	402 (5.1)	433 (3.0)	-32 (5.9) ▼
Thailand	453 (4.2)	467 (4.4)	-14 (6.1) ▼
Tunisia	446 (2.7)	452 (3.1)	-6 (4.1)
Ukraine	500 (3.9)	485 (4.1)	14 (5.7) ▲
United States	524 (2.5)	529 (3.1)	-5 (3.9)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

Benchmarking Participants

Ontario, Canada	532 (3.1)	542 (4.4)	-10 (5.4)
Quebec, Canada	522 (3.1)	523 (3.4)	-1 (4.6)
Dubai, UAE	479 (2.5)	478 (3.3)	1 (4.2)
Massachusetts, US	567 (5.9)	567 (4.3)	0 (7.3)
Minnesota, US	556 (5.0)	546 (5.8)	10 (7.6)

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

Achievement in the Science Content and Cognitive Domains by Gender

Exhibits 3.9 and 3.10 present the TIMSS 2011 gender differences in average achievement for the content domains at the fourth and eighth grades. At the fourth grade, girls had higher achievement in life science than boys in 18 countries and one benchmarking entity, compared with four countries and no benchmarking participants where boys outperformed girls. Conversely, boys had higher achievement in physical science than girls in 25 countries and five benchmarking participants, compared with seven countries and one benchmarking participant where girls outperformed boys. Also, boys had higher achievement in earth science than girls in 20 countries and five benchmarking entities, compared with eight countries and one benchmarking participant where girls outperformed boys. On average across countries, girls had an 8-point advantage in life science, and boys had a 1-point advantage in physical science and a 4-point advantage in earth science. At the sixth grade, girls in Botswana and Yemen performed better than boys in life science, and boys in Honduras performed better than girls in earth science.

As shown in Exhibit 3.10, on average across the eighth grade countries, girls had a 12-point advantage in biology and a 10-point advantage in chemistry, while boys had a 2-point advantage in earth science. There was no significant difference between the achievement of girls and boys in physics. Girls outperformed boys in biology in 24 countries and two benchmarking entities, and in chemistry in 20 countries and one benchmarking participant. Boys outperformed girls in biology in seven countries and in chemistry in seven countries and four benchmarking entities. Boys outperformed girls in physics in 16 countries and eleven benchmarking participants, and in earth science in 16 countries and twelve benchmarking participants. Girls outperformed boys in physics in nine countries and one benchmarking entity, and in earth science in six countries and one benchmarking entity.

Exhibits 3.11 and 3.12 present gender differences in the cognitive domains for the fourth and eighth grades. On average across the fourth grade countries, girls had higher achievement than boys in the reasoning domain. In eight countries and one benchmarking participant, girls outperformed boys in all three cognitive domains (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Tunisia, the United Arab Emirates, Yemen, and the emirate of Abu Dhabi), while in six countries and one benchmarking participant, boys outperformed girls in all three domains (Austria, Belgium-Flemish, Chile, the Czech Republic, Germany, Italy, and the province of Alberta).

At the eighth grade, on average across countries, girls outperformed boys in all three of the cognitive domains. Specifically, girls outperformed boys in all three domains in twelve countries and one benchmarking participant (Armenia, Bahrain, Georgia, Jordan, Macedonia, Malaysia, Oman, the Palestinian National Authority, Qatar, Thailand, Turkey, the United Arab Emirates, and the emirate of Dubai). Conversely, boys outperformed girls in all three domains in seven countries and one benchmarking participant (Chile, Ghana, Hungary, Italy, New Zealand, Tunisia, Honduras, and the state of Indiana).

Exhibit 3.9: Achievement in Science Content Domains by Gender

Country	Life Science		Physical Science		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	428 (5.0)	421 (3.8)	401 (4.5)	396 (5.2)	401 (5.7)	395 (4.8)
Australia	518 (3.5)	513 (3.8)	512 (3.3)	516 (4.3)	516 (4.8)	523 (3.8)
Austria	525 (2.8)	527 (3.7)	526 (3.2)	544 (4.0) ▲	526 (4.6)	550 (4.6) ▲
² Azerbaijan	444 (6.5)	437 (5.0)	437 (7.2)	435 (5.9)	415 (8.6) ▲	401 (6.8)
Bahrain	459 (6.2) ▲	428 (5.5)	459 (6.5)	447 (5.7)	455 (6.0) ▲	435 (4.9)
Belgium (Flemish)	507 (3.0)	513 (2.7) ▲	503 (2.6)	511 (2.5) ▲	493 (3.5)	516 (3.0) ▲
Chile	486 (2.7)	493 (2.8) ▲	465 (3.6)	477 (3.3) ▲	465 (3.3)	485 (3.2) ▲
Chinese Taipei	535 (3.1)	541 (2.7)	564 (2.6)	572 (2.3) ▲	546 (3.5)	559 (2.6) ▲
² Croatia	527 (2.5)	523 (2.4)	495 (3.6)	509 (3.0) ▲	517 (3.2)	525 (3.5)
Czech Republic	547 (3.7)	552 (3.5)	506 (3.6)	531 (3.7) ▲	530 (3.9)	544 (4.3) ▲
² Denmark	533 (3.4)	527 (3.4)	523 (3.5)	528 (3.1)	522 (4.1)	531 (5.1)
England	534 (3.6)	527 (4.1)	532 (3.5)	538 (4.9)	520 (4.5)	524 (3.9)
Finland	580 (2.8) ▲	569 (3.6)	564 (3.6)	572 (3.2) ▲	562 (3.2)	569 (3.7)
¹ Georgia	467 (3.5) ▲	455 (4.6)	442 (3.9)	438 (5.2)	463 (4.2)	453 (5.8)
Germany	525 (2.8)	525 (3.1)	526 (4.0)	543 (3.2) ▲	507 (4.2)	533 (4.6) ▲
² Hong Kong SAR	525 (3.2)	524 (4.5)	533 (3.5)	545 (5.7) ▲	538 (3.2)	557 (4.1) ▲
Hungary	554 (4.0)	549 (3.8)	514 (4.3)	527 (4.2) ▲	519 (5.1)	529 (4.7) ▲
Iran, Islamic Rep. of	451 (6.0)	447 (6.5)	446 (5.8)	459 (6.6)	455 (5.2)	458 (5.9)
Ireland	514 (4.6)	511 (4.1)	516 (4.5)	518 (3.6)	518 (4.2)	522 (4.7)
Italy	534 (2.9)	537 (3.2)	504 (3.3)	514 (4.2) ▲	518 (4.2)	529 (5.2)
Japan	538 (1.9)	542 (2.6)	588 (2.7)	590 (2.2)	544 (2.6)	559 (2.5) ▲
² Kazakhstan	500 (5.4)	500 (5.3)	479 (5.8)	493 (5.6) ▲	484 (6.5)	497 (5.7) ▲
Korea, Rep. of	570 (2.2)	572 (2.9)	591 (4.1)	602 (2.5) ▲	596 (2.8)	610 (2.6) ▲
¹ Ψ Kuwait	346 (6.1) ▲	295 (8.1)	379 (5.9) ▲	312 (6.7)	371 (5.2) ▲	330 (7.3)
¹ ² Lithuania	524 (3.4) ▲	517 (3.1)	510 (3.7)	518 (3.3) ▲	498 (3.8)	503 (3.7)
Malta	437 (3.0)	440 (3.0)	448 (3.4)	458 (3.2) ▲	442 (2.5)	452 (4.3)
✱ Morocco	253 (4.6) ▲	237 (5.5)	257 (5.6)	256 (6.6)	208 (5.6)	208 (5.8)
† Netherlands	536 (2.1)	538 (2.8)	518 (2.4)	535 (3.0) ▲	517 (4.4)	534 (2.9) ▲
New Zealand	499 (3.2)	496 (3.1)	493 (3.1)	494 (3.2)	494 (4.3)	504 (3.2) ▲
† Northern Ireland	523 (3.5) ▲	514 (3.4)	519 (3.5)	522 (3.8)	503 (3.8)	512 (4.8)
‡ Norway	498 (3.5)	493 (3.6)	476 (4.2)	489 (3.8) ▲	502 (3.8)	511 (4.1)
Oman	388 (4.3) ▲	352 (4.1)	386 (5.3) ▲	354 (5.0)	386 (5.2) ▲	356 (5.4)
Poland	514 (2.8)	513 (3.0)	489 (4.5)	500 (3.6) ▲	491 (3.4)	500 (4.3) ▲
Portugal	520 (5.2)	521 (4.0)	511 (4.7)	523 (4.2) ▲	526 (5.7)	536 (5.0)
² Qatar	396 (6.7) ▲	371 (6.0)	410 (6.5) ▲	385 (5.8)	411 (5.9) ▲	391 (6.6)
Romania	507 (6.8)	501 (6.4)	504 (6.3)	512 (5.7) ▲	499 (7.0)	504 (6.1)
Russian Federation	561 (3.8) ▲	552 (4.0)	546 (4.1)	551 (4.7)	551 (4.9)	554 (4.6)
Saudi Arabia	440 (5.9) ▲	388 (11.1)	462 (5.3) ▲	415 (11.4)	452 (7.0) ▲	410 (10.5)
² Serbia	518 (3.8)	518 (3.2)	519 (4.8)	526 (4.0)	495 (4.6)	500 (4.7)
² Singapore	598 (4.5)	597 (4.7)	596 (3.6)	601 (4.0)	536 (3.9)	546 (3.8) ▲
Slovak Republic	533 (4.3)	535 (4.2)	519 (4.5)	535 (4.1) ▲	530 (4.4)	540 (3.6) ▲
Slovenia	525 (3.4)	523 (3.3)	515 (3.7)	531 (4.2) ▲	503 (3.4)	509 (3.4)
Spain	510 (2.9)	516 (3.4) ▲	490 (3.0)	503 (3.3) ▲	493 (4.7)	505 (3.9) ▲
Sweden	538 (2.8) ▲	530 (3.5)	521 (3.0)	534 (2.9) ▲	533 (4.0)	543 (3.7) ▲
Thailand	486 (6.7) ▲	474 (6.9)	467 (6.3)	458 (6.7)	464 (6.2)	456 (7.2)
Ψ Tunisia	355 (5.8) ▲	330 (5.3)	354 (6.7) ▲	331 (5.7)	333 (7.7) ▲	306 (7.5)
Turkey	463 (5.2)	457 (4.5)	469 (5.1)	464 (5.0)	456 (5.7)	455 (5.9)
United Arab Emirates	433 (3.6) ▲	407 (4.0)	435 (3.6) ▲	422 (4.0)	442 (3.3) ▲	428 (3.7)
² United States	544 (2.4)	550 (2.1) ▲	538 (2.4)	550 (2.4) ▲	531 (2.6)	547 (2.1) ▲
✱ Yemen	192 (7.1) ▲	158 (8.3)	216 (7.7) ▲	186 (8.0)	185 (6.4)	187 (8.1)
International Avg.	489 (0.6) ▲	481 (0.6)	484 (0.6)	485 (0.7) ▲	479 (0.7)	483 (0.7) ▲

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Average significantly higher than other gender

✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
 Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
 See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.
 () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 3.9: Achievement in Science Content Domains by Gender (Continued)

Country	Life Science		Physical Science		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys
Sixth Grade Participants						
Botswana	354 (6.2) ▲	334 (8.2)	384 (6.1)	375 (6.5)	382 (6.9)	369 (6.5)
Honduras	439 (6.1)	444 (6.1)	415 (7.3)	419 (7.2)	419 (6.5)	440 (6.3) ▲
Yemen	325 (9.8) ●	304 (9.0)	374 (8.9)	361 (7.8)	357 (8.8)	345 (9.4)
Benchmarking Participants						
² Alberta, Canada	542 (3.2)	543 (3.2)	537 (3.2)	546 (3.9) ▲	527 (3.6)	549 (3.7) ▲
Ontario, Canada	536 (3.9)	534 (3.6)	522 (4.1)	533 (3.6) ▲	506 (4.9)	521 (4.3) ▲
Quebec, Canada	527 (2.9)	522 (2.8)	498 (3.3)	516 (3.4) ▲	507 (3.7)	525 (4.2) ▲
Abu Dhabi, UAE	422 (6.1) ▲	384 (7.3)	427 (5.8) ▲	403 (7.2)	431 (5.8) ▲	405 (7.1)
Dubai, UAE	460 (4.6)	451 (5.3)	457 (4.5)	462 (5.7)	467 (4.6)	471 (4.8)
^{1 3} Florida, US	548 (4.6)	551 (4.6)	537 (4.6)	548 (4.1) ▲	529 (4.8)	545 (6.0) ▲
^{1 2} North Carolina, US	540 (5.5)	542 (5.9)	535 (5.2)	547 (5.6) ▲	517 (8.1)	540 (6.6) ▲

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.10: Achievement in Science Content Domains by Gender

Country	Biology		Chemistry		Physics		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	433 (3.9) ▲	407 (3.9)	462 (4.1) ▲	443 (4.8)	443 (3.9)	438 (4.2)	432 (3.6) ▲	412 (3.8)
Australia	525 (4.6)	529 (6.6)	496 (4.7)	506 (7.0)	500 (4.9)	522 (6.9) ▲	520 (5.5)	546 (7.2) ▲
Bahrain	484 (2.4) ▲	414 (3.7)	481 (3.3) ▲	415 (4.0)	483 (3.0) ▲	430 (3.5)	475 (2.3) ▲	427 (3.3)
Chile	456 (3.3)	468 (3.4) ▲	444 (4.0)	451 (3.0)	444 (3.6)	463 (3.8) ▲	463 (3.4)	490 (3.3) ▲
Chinese Taipei	560 (2.7)	554 (3.1)	591 (5.0) ▲	580 (4.5)	548 (3.9)	556 (3.9) ▲	563 (3.0)	573 (4.0) ▲
‡ England	538 (5.4)	529 (6.2)	530 (5.9)	527 (6.2)	531 (5.5)	535 (5.6)	531 (5.6)	541 (6.7)
Finland	556 (3.5) ▲	541 (3.3)	555 (3.1)	552 (3.8)	537 (3.2)	543 (3.2)	575 (5.6)	573 (3.8)
¹ Georgia	448 (3.3) ▲	423 (3.9)	397 (4.0)	393 (5.3)	402 (5.2)	400 (4.5)	419 (3.6)	416 (4.2)
^ψ Ghana	273 (6.9)	305 (6.3) ▲	318 (6.2)	342 (6.7) ▲	278 (6.2)	305 (6.8) ▲	243 (6.2)	286 (7.5) ▲
Hong Kong SAR	539 (4.7)	531 (4.0)	529 (5.1)	523 (3.9)	534 (4.8)	543 (3.8)	537 (5.6)	541 (4.7)
Hungary	516 (3.1)	523 (3.6) ▲	527 (4.4)	541 (4.3) ▲	508 (4.2)	541 (4.3) ▲	498 (3.8)	524 (4.1) ▲
Indonesia	416 (5.7) ▲	404 (5.0)	382 (5.0) ▲	374 (5.7)	399 (5.5)	395 (6.4)	412 (7.0)	412 (5.2)
Iran, Islamic Rep. of	471 (5.0)	462 (5.4)	478 (6.0) ▲	461 (5.9)	482 (5.3)	484 (5.8)	475 (5.6)	478 (5.3)
³ Israel	529 (3.8) ▲	517 (5.5)	521 (4.9) ▲	506 (6.5)	514 (3.8)	514 (5.3)	503 (4.4)	506 (5.6)
Italy	500 (3.7)	507 (3.2) ▲	483 (3.3)	499 (4.2) ▲	476 (4.4)	504 (3.4) ▲	503 (5.0)	522 (3.9) ▲
Japan	560 (2.7)	562 (3.3)	557 (3.1)	563 (4.0)	553 (3.5)	563 (3.3) ▲	539 (3.0)	557 (3.5) ▲
Jordan	472 (4.6) ▲	424 (6.6)	487 (4.7) ▲	439 (6.7)	463 (5.1) ▲	430 (6.4)	455 (5.0) ▲	418 (6.5)
Kazakhstan	488 (4.8) ▲	479 (4.7)	511 (5.2)	506 (5.4)	486 (4.4)	492 (4.8)	473 (5.0)	471 (5.9)
Korea, Rep. of	559 (2.8)	563 (2.8)	552 (2.8)	550 (2.8)	574 (3.7)	580 (3.1)	541 (4.4)	555 (2.8) ▲
Lebanon	396 (5.7)	394 (6.7)	440 (5.5)	429 (7.1)	399 (6.1)	412 (6.8)	357 (6.7)	374 (8.3) ▲
¹ Lithuania	523 (3.2) ▲	510 (3.3)	522 (2.7) ▲	513 (3.2)	502 (3.9)	503 (3.7)	518 (4.9)	515 (3.4)
Macedonia, Rep. of	412 (6.3) ▲	388 (7.3)	426 (5.4) ▲	406 (6.7)	407 (6.8) ▲	390 (6.7)	407 (7.0)	398 (7.2)
Malaysia	437 (6.3) ▲	417 (7.2)	436 (6.8) ▲	416 (7.6)	441 (6.4) ▲	428 (7.9)	402 (6.5)	400 (7.4)
Morocco	382 (3.0) ▲	374 (3.8)	380 (3.4) ▲	369 (3.0)	346 (3.4)	351 (3.3)	375 (4.5)	378 (3.6)
New Zealand	509 (5.2)	519 (5.1) ▲	488 (5.9)	513 (5.2) ▲	494 (4.8)	522 (5.1) ▲	507 (5.2)	536 (5.2) ▲
Norway	497 (3.5) ▲	486 (3.5)	487 (3.7)	489 (3.4)	476 (4.1)	487 (4.3) ▲	514 (4.2)	517 (4.4)
Oman	448 (3.4) ▲	365 (4.8)	450 (3.7) ▲	364 (4.5)	464 (3.0) ▲	388 (4.8)	466 (3.2) ▲	396 (4.2)
Palestinian Nat'l Auth.	422 (4.4) ▲	391 (6.6)	449 (4.6) ▲	415 (6.2)	445 (4.2) ▲	420 (6.3)	415 (4.3) ▲	396 (4.8)
Qatar	424 (7.8) ▲	399 (6.8)	434 (7.1) ▲	398 (7.2)	435 (7.5)	418 (5.8)	418 (7.9)	398 (6.3)
Romania	461 (3.8)	456 (4.7)	475 (5.0) ▲	464 (4.9)	454 (4.4)	459 (4.3)	468 (4.1)	472 (4.2)
² Russian Federation	541 (3.8) ▲	533 (3.5)	549 (4.1)	558 (3.8) ▲	539 (3.8)	555 (4.2) ▲	527 (4.4)	543 (4.1) ▲
Saudi Arabia	445 (4.7) ▲	415 (6.5)	447 (3.7) ▲	410 (8.0)	449 (4.5) ▲	426 (7.1)	447 (3.9)	435 (5.8)
² Singapore	596 (4.5)	593 (5.9)	592 (4.7)	589 (5.9)	599 (3.9)	604 (5.3)	562 (4.3)	570 (5.6)
Slovenia	534 (3.1)	530 (3.7)	554 (4.6)	561 (3.4)	526 (3.1)	538 (4.0) ▲	554 (3.6)	566 (4.6) ▲
Sweden	519 (3.0) ▲	506 (3.7)	503 (3.4)	501 (3.1)	495 (3.2)	501 (4.1)	517 (3.4)	522 (3.6)
Syrian Arab Republic	424 (4.9)	425 (5.6)	423 (5.0)	425 (4.6)	420 (4.8)	432 (5.6) ▲	408 (5.4)	420 (6.2)
Thailand	470 (4.0) ▲	448 (5.5)	448 (4.5) ▲	422 (6.3)	434 (4.6)	424 (5.9)	469 (4.0)	462 (5.7)
Tunisia	442 (3.5)	457 (3.5) ▲	429 (3.7)	439 (3.8) ▲	426 (2.9)	447 (3.0) ▲	402 (4.2)	426 (3.8) ▲
Turkey	494 (3.4) ▲	474 (4.6)	489 (3.5) ▲	465 (5.3)	502 (3.4) ▲	486 (4.7)	468 (3.0)	469 (4.6)
Ukraine	495 (3.5)	490 (4.2)	510 (4.5)	514 (4.6)	496 (4.7)	509 (4.6) ▲	487 (4.2)	502 (5.4) ▲
United Arab Emirates	480 (2.8) ▲	447 (3.3)	477 (3.1) ▲	450 (3.3)	471 (2.9) ▲	452 (3.5)	475 (3.0) ▲	458 (3.6)
² United States	528 (3.0)	533 (2.7)	515 (2.9)	525 (3.1) ▲	504 (2.8)	523 (2.7) ▲	525 (3.4)	542 (3.1) ▲
International Avg.	481 (0.7) ▲	469 (0.8)	482 (0.7) ▲	472 (0.8)	473 (0.7)	474 (0.8)	473 (0.7)	475 (0.8) ▲

▲ Average significantly higher than other gender

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

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.10: Achievement in Science Content Domains by Gender (Continued)

Country	Biology		Chemistry		Physics		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Ninth Grade Participants								
Botswana	409 (4.6) ⬆	393 (4.7)	413 (3.8) ⬆	392 (4.4)	416 (3.8)	418 (4.2)	388 (4.5)	381 (4.9)
² Honduras	356 (4.9)	373 (4.7) ⬆	364 (3.8)	373 (5.1)	339 (4.0)	366 (5.1) ⬆	358 (5.5)	394 (6.1) ⬆
^ψ South Africa	324 (4.6) ⬆	312 (4.3)	341 (3.8)	331 (5.7)	351 (3.9)	351 (4.6)	294 (4.4)	294 (5.0)
Benchmarking Participants								
² Alberta, Canada	557 (3.3)	552 (2.5)	516 (3.3)	527 (3.8) ⬆	540 (2.9)	551 (2.8) ⬆	552 (3.9)	567 (2.6) ⬆
² Ontario, Canada	534 (2.9)	529 (3.3)	492 (3.5)	497 (3.4)	519 (3.5)	524 (3.8)	525 (3.4)	532 (4.0) ⬆
Quebec, Canada	528 (3.2)	522 (3.4)	514 (3.9)	517 (3.5)	496 (4.0)	507 (3.4) ⬆	529 (3.4)	542 (4.7) ⬆
Abu Dhabi, UAE	467 (4.4) ⬆	452 (6.3)	465 (4.6)	457 (6.0)	459 (3.9)	459 (6.1)	461 (4.8)	461 (6.6)
Dubai, UAE	504 (4.2) ⬆	468 (5.8)	502 (4.6) ⬆	474 (6.1)	492 (4.4) ⬆	472 (5.8)	498 (4.8) ⬆	477 (6.3)
¹ Alabama, US	492 (6.3)	489 (7.2)	476 (7.4)	483 (8.4)	468 (5.8)	484 (7.1) ⬆	479 (7.9)	496 (9.6) ⬆
^{1 2} California, US	496 (5.7)	503 (5.5)	500 (7.2)	507 (6.3)	478 (5.0)	495 (4.9) ⬆	488 (5.9)	510 (6.3) ⬆
¹ Colorado, US	550 (4.9)	552 (5.5)	524 (6.0)	533 (5.9)	521 (4.9)	540 (6.6) ⬆	545 (5.1)	566 (5.8) ⬆
^{1 2} Connecticut, US	544 (5.3)	534 (6.3)	523 (5.5)	517 (6.7)	510 (6.4)	530 (6.2) ⬆	535 (5.8)	548 (6.8) ⬆
^{1 2} Florida, US	525 (9.0)	532 (8.1)	518 (9.7)	530 (8.3)	517 (9.0)	543 (7.7) ⬆	526 (8.6)	546 (8.5) ⬆
^{1 2} Indiana, US	536 (5.1)	545 (6.1)	521 (5.2)	531 (5.8) ⬆	511 (4.9)	534 (6.3) ⬆	530 (6.4)	552 (6.6) ⬆
^{1 2} Massachusetts, US	576 (6.1)	574 (5.2)	565 (6.0)	571 (6.7)	546 (6.5)	563 (6.1) ⬆	570 (6.7)	585 (7.1) ⬆
¹ Minnesota, US	561 (5.3)	565 (6.6)	532 (4.9)	545 (6.4) ⬆	532 (5.6)	552 (6.7) ⬆	563 (6.6)	585 (7.2) ⬆
^{1 3} North Carolina, US	539 (6.2)	543 (6.9)	525 (7.0)	538 (8.1) ⬆	499 (5.6)	522 (7.2) ⬆	531 (6.2)	549 (7.9) ⬆

⬆ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.11: Achievement in Science Cognitive Domains by Gender

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	416 (4.8)	409 (4.7)	419 (4.3)	417 (4.6)	409 (5.5) ▲	396 (5.6)
Australia	515 (3.1)	520 (3.8)	513 (3.6)	513 (3.8)	520 (3.8)	515 (4.1)
Austria	526 (3.4)	538 (3.8) ▲	527 (2.9)	539 (3.7) ▲	518 (3.8)	533 (3.8) ▲
² Azerbaijan	449 (6.9)	441 (6.8)	444 (5.9)	436 (5.3)	405 (7.3)	399 (7.0)
Bahrain	466 (5.8) ▲	441 (4.7)	454 (5.1) ▲	433 (4.9)	450 (6.0) ▲	435 (5.8)
Belgium (Flemish)	499 (2.6)	515 (2.7) ▲	506 (2.1)	517 (2.3) ▲	505 (3.1)	512 (2.5) ▲
Chile	475 (3.0)	491 (3.3) ▲	474 (2.9)	485 (3.4) ▲	473 (3.9)	482 (2.7) ▲
Chinese Taipei	536 (3.6)	547 (2.9) ▲	548 (3.1)	556 (3.9) ▲	570 (3.9)	566 (3.2)
² Croatia	522 (2.5)	529 (2.4) ▲	508 (2.4)	512 (2.8)	513 (4.0)	512 (3.7)
Czech Republic	541 (3.8)	560 (3.5) ▲	528 (2.8)	540 (3.6) ▲	509 (4.4)	523 (4.9) ▲
² Denmark	523 (2.9)	526 (2.9)	530 (3.9)	533 (3.0)	532 (4.3)	523 (3.6)
England	527 (3.9)	530 (4.0)	533 (3.7)	532 (3.9)	533 (6.3)	521 (4.4)
Finland	580 (2.8)	579 (3.3)	569 (2.8)	568 (2.7)	559 (4.8)	561 (3.8)
¹ Georgia	471 (3.9) ▲	460 (5.3)	455 (3.9)	450 (5.9)	430 (5.4) ▲	415 (6.2)
Germany	517 (4.3)	531 (4.5) ▲	527 (2.8)	539 (3.2) ▲	521 (4.2)	531 (3.8) ▲
² Hong Kong SAR	530 (3.8)	542 (4.2) ▲	525 (3.5)	532 (4.0) ▲	542 (5.0)	541 (4.8)
Hungary	544 (4.6)	549 (3.8)	527 (3.8)	533 (4.2)	525 (5.6)	525 (4.3)
Iran, Islamic Rep. of	445 (6.6)	451 (6.4)	450 (6.0)	453 (6.1)	458 (6.1)	460 (6.1)
Ireland	516 (4.9)	520 (4.6)	516 (4.1)	518 (4.4)	513 (4.8)	505 (3.7)
Italy	528 (3.1)	536 (3.8) ▲	519 (3.2)	527 (3.2) ▲	506 (3.3)	513 (3.4) ▲
Japan	531 (2.6)	544 (2.1) ▲	560 (1.6)	565 (2.7)	593 (2.0)	589 (2.6)
² Kazakhstan	482 (5.8)	490 (5.8) ▲	495 (5.3)	502 (5.3) ▲	491 (6.2)	500 (6.3)
Korea, Rep. of	563 (2.4)	576 (2.6) ▲	590 (2.7)	597 (3.0)	604 (3.1)	606 (4.2)
¹ ^ψ Kuwait	367 (6.6) ▲	312 (8.5)	359 (5.7) ▲	304 (7.7)	360 (6.5) ▲	308 (7.2)
¹ ² Lithuania	507 (3.1)	509 (3.6)	519 (3.0)	522 (3.5)	518 (3.3)	513 (3.4)
Malta	433 (2.7)	440 (4.7)	443 (2.0)	454 (2.5) ▲	459 (5.7)	459 (4.7)
✱ Morocco	243 (7.4) ▲	231 (5.9)	261 (5.2) ▲	251 (5.7)	239 (5.9)	241 (6.1)
† Netherlands	522 (3.3)	535 (2.4) ▲	530 (2.1)	539 (2.7) ▲	530 (3.3)	534 (4.3)
New Zealand	494 (3.1)	498 (3.3)	497 (3.3)	498 (2.8)	501 (3.8)	492 (3.8)
† Northern Ireland	518 (3.6)	517 (3.3)	520 (3.3)	523 (3.0)	505 (3.6)	500 (5.5)
‡ Norway	499 (2.9)	505 (3.9)	484 (2.8)	490 (3.4) ▲	497 (4.9)	488 (3.9)
Oman	393 (5.1) ▲	359 (4.8)	387 (4.9) ▲	357 (4.3)	372 (4.9) ▲	336 (4.8)
Poland	497 (3.7)	503 (3.3)	510 (3.1)	517 (3.3) ▲	488 (3.1)	486 (4.2)
Portugal	525 (5.6)	530 (4.5)	510 (5.3)	520 (4.2) ▲	524 (7.4)	525 (4.4)
² Qatar	401 (6.9) ▲	376 (6.6)	403 (6.9) ▲	377 (6.3)	418 (5.6) ▲	392 (5.1)
Romania	510 (7.0)	512 (6.0)	502 (7.1)	503 (5.6)	499 (7.4)	495 (6.1)
Russian Federation	554 (4.1)	552 (4.0)	554 (3.4)	558 (4.3)	547 (4.8) ▲	537 (4.0)
Saudi Arabia	457 (5.0) ▲	406 (11.3)	450 (5.9) ▲	402 (10.9)	436 (4.7) ▲	394 (11.0)
² Serbia	523 (3.5)	525 (3.9)	503 (3.8)	509 (4.1)	519 (4.1)	520 (4.1)
² Singapore	565 (3.8)	574 (3.8) ▲	586 (4.6)	592 (4.2)	601 (4.8) ▲	592 (3.6)
Slovak Republic	540 (4.4)	553 (3.7) ▲	524 (4.5)	532 (4.0) ▲	512 (4.7)	516 (4.2)
Slovenia	516 (2.7)	521 (2.8)	514 (2.9)	522 (3.7) ▲	523 (3.9)	528 (4.2)
Spain	509 (3.0)	523 (4.0) ▲	494 (3.4)	503 (4.0) ▲	494 (3.9)	498 (3.3)
Sweden	533 (3.4)	538 (3.0)	530 (3.2)	531 (3.5)	535 (3.4)	538 (4.2)
Thailand	476 (6.5)	470 (6.9)	474 (6.0)	468 (6.0)	472 (7.1) ▲	455 (6.9)
^ψ Tunisia	350 (6.3) ▲	324 (5.8)	353 (5.4) ▲	333 (5.2)	353 (6.5) ▲	322 (5.1)
Turkey	459 (5.3)	455 (4.7)	464 (5.4)	462 (5.2)	476 (6.9)	468 (5.0)
United Arab Emirates	444 (3.6) ▲	422 (4.1)	429 (3.5) ▲	413 (3.7)	438 (3.7) ▲	413 (3.7)
² United States	541 (2.4)	551 (2.0) ▲	537 (2.4)	552 (2.2) ▲	537 (2.8)	537 (2.9)
✱ Yemen	200 (7.4) ▲	170 (7.8)	200 (6.7) ▲	171 (7.9)	195 (9.8) ▲	170 (7.7)
International Avg.	486 (0.6)	485 (0.7)	485 (0.6)	484 (0.6)	485 (0.7) ▲	478 (0.7)

▲ Average significantly higher than other gender

✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

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

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.

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

Exhibit 3.11: Achievement in Science Cognitive Domains by Gender (Continued)

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Sixth Grade Participants						
Botswana	353 (6.6) ▲	333 (7.2)	382 (5.6)	376 (6.4)	387 (5.6) ▲	367 (7.5)
Honduras	440 (6.9)	450 (6.5)	423 (5.7)	436 (5.6) ▲	389 (7.9)	396 (8.0)
Yemen	349 (9.2)	331 (9.0)	344 (8.9)	334 (7.8)	351 (9.4) ▲	327 (8.1)
Benchmarking Participants						
² Alberta, Canada	537 (3.5)	549 (3.4) ▲	536 (3.5)	545 (3.5) ▲	536 (3.4)	544 (3.6) ▲
Ontario, Canada	525 (3.8)	532 (3.3) ▲	522 (3.7)	529 (3.7) ▲	530 (3.9)	528 (4.7)
Quebec, Canada	514 (3.5)	523 (2.8) ▲	508 (3.1)	519 (2.7) ▲	519 (3.9)	520 (5.0)
Abu Dhabi, UAE	433 (6.4) ▲	396 (7.7)	419 (6.3) ▲	391 (7.1)	434 (6.0) ▲	398 (6.9)
Dubai, UAE	468 (4.6)	467 (5.1)	452 (4.2)	454 (4.7)	460 (5.4)	451 (5.2)
^{1 3} Florida, US	543 (4.3)	557 (4.4) ▲	539 (3.3)	547 (5.1)	535 (5.2)	536 (4.4)
^{1 2} North Carolina, US	534 (5.0)	545 (5.5) ▲	535 (4.9)	543 (4.6)	526 (5.5)	539 (5.5) ▲

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.12: Achievement in Science Cognitive Domains by Gender

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	474 (3.8) ▲	454 (3.7)	437 (4.2) ▲	421 (4.2)	427 (4.4) ▲	412 (3.6)
Australia	503 (4.7) ▲	525 (7.6) ▲	509 (4.4) ▲	525 (7.0) ▲	521 (4.5)	531 (7.5)
Bahrain	486 (3.9) ▲	429 (4.4)	476 (2.3) ▲	423 (3.1)	483 (3.2) ▲	415 (3.6)
Chile	467 (4.3)	486 (3.6) ▲	446 (2.8)	462 (2.9) ▲	453 (3.2)	466 (3.8) ▲
Chinese Taipei	565 (2.9)	573 (3.4) ▲	571 (2.9)	569 (3.4)	553 (3.6)	549 (3.5)
‡ England	532 (5.3)	535 (6.4)	531 (4.8)	532 (5.9)	540 (5.2)	534 (5.9)
Finland	565 (3.2)	564 (3.7)	553 (2.5) ▲	545 (3.2)	552 (3.5) ▲	543 (4.0)
¹ Georgia	433 (4.9) ▲	422 (4.1)	424 (4.7) ▲	412 (4.4)	420 (4.5) ▲	406 (4.6)
^ψ Ghana	272 (7.1)	309 (6.3) ▲	282 (6.3)	308 (7.4) ▲	300 (5.3)	328 (5.2) ▲
Hong Kong SAR	541 (4.4)	548 (3.9)	529 (4.7)	529 (4.0)	544 (5.2) ▲	532 (4.3)
Hungary	500 (3.6)	520 (3.9) ▲	522 (3.9)	542 (4.0) ▲	511 (4.1)	524 (4.1) ▲
Indonesia	406 (6.7)	398 (5.5)	401 (5.2)	394 (4.9)	415 (5.7)	412 (5.4)
Iran, Islamic Rep. of	484 (6.0)	475 (5.9)	469 (5.2)	470 (5.4)	480 (5.3)	471 (5.3)
³ Israel	521 (4.4)	514 (6.0)	515 (3.9)	508 (5.3)	522 (4.4)	516 (5.9)
Italy	504 (3.4)	520 (2.6) ▲	493 (3.3)	507 (2.4) ▲	480 (3.6)	497 (2.6) ▲
Japan	534 (3.2)	548 (3.1) ▲	557 (3.2)	565 (2.8) ▲	567 (3.2)	569 (3.1)
Jordan	478 (4.9) ▲	429 (6.5)	470 (4.2) ▲	433 (6.3)	465 (4.9) ▲	419 (7.1)
Kazakhstan	481 (5.3)	484 (5.3)	494 (4.5)	488 (5.1)	489 (4.7)	486 (4.7)
Korea, Rep. of	547 (3.2)	561 (3.6) ▲	559 (2.9)	563 (2.4)	564 (3.1)	564 (2.2)
Lebanon	383 (6.2)	379 (8.1)	404 (5.5)	413 (6.6)	409 (6.0)	407 (7.2)
¹ Lithuania	519 (3.0)	512 (3.1)	517 (3.1) ▲	508 (2.8)	517 (4.4)	509 (3.0)
Macedonia, Rep. of	425 (6.6) ▲	408 (6.7)	417 (5.8) ▲	399 (6.1)	402 (6.2) ▲	380 (6.8)
Malaysia	410 (7.1) ▲	395 (8.1)	434 (6.2) ▲	415 (7.1)	445 (6.0) ▲	433 (6.7)
Morocco	363 (2.8)	362 (3.7)	380 (1.9)	381 (2.7)	370 (2.8) ▲	363 (2.9)
New Zealand	498 (5.5)	524 (5.4) ▲	498 (4.5)	519 (4.8) ▲	507 (5.1)	522 (5.1) ▲
Norway	491 (4.8)	489 (3.1)	496 (3.9)	496 (3.3)	495 (4.1)	494 (3.4)
Oman	456 (3.4) ▲	376 (4.4)	458 (3.0) ▲	379 (4.5)	456 (3.4) ▲	377 (4.2)
Palestinian Nat'l Auth.	442 (4.3) ▲	419 (5.9)	434 (4.2) ▲	409 (5.9)	421 (4.5) ▲	387 (5.8)
Qatar	429 (7.5) ▲	407 (5.8)	431 (6.2) ▲	409 (5.4)	421 (8.0) ▲	397 (6.7)
Romania	457 (4.1)	457 (4.7)	467 (4.3)	469 (4.1)	464 (4.3)	456 (4.5)
² Russian Federation	553 (4.7)	561 (4.6)	535 (4.0)	542 (3.7) ▲	531 (3.7)	534 (3.7)
Saudi Arabia	457 (3.8) ▲	439 (7.6)	446 (4.0) ▲	419 (6.6)	439 (4.5) ▲	409 (6.7)
² Singapore	584 (4.7)	591 (6.1)	588 (4.4)	590 (5.4)	596 (4.2)	589 (5.5)
Slovenia	546 (2.7)	555 (3.6) ▲	540 (2.9)	545 (3.4)	535 (3.0)	536 (3.7)
Sweden	509 (3.0)	514 (3.0)	510 (2.9)	506 (3.2)	514 (3.1) ▲	506 (3.4)
Syrian Arab Republic	436 (4.5)	446 (5.2) ▲	424 (4.9)	428 (5.9)	396 (5.5)	407 (6.0) ▲
Thailand	448 (4.6) ▲	436 (6.6)	459 (3.9) ▲	442 (5.4)	462 (4.3) ▲	442 (5.2)
Tunisia	417 (2.8)	433 (2.5) ▲	428 (2.7)	447 (3.0) ▲	439 (3.1)	455 (3.5) ▲
Turkey	499 (3.6) ▲	481 (4.6)	484 (3.3) ▲	472 (4.2)	492 (3.2) ▲	475 (4.1)
Ukraine	505 (4.2)	506 (4.8)	493 (4.4)	499 (4.5)	498 (4.4)	501 (4.9)
United Arab Emirates	485 (3.1) ▲	458 (3.4)	477 (2.9) ▲	452 (3.1)	470 (3.0) ▲	442 (3.8)
² United States	518 (3.0)	537 (3.6) ▲	517 (2.7)	528 (2.5) ▲	521 (3.0)	526 (2.8)
International Avg.	479 (0.7) ▲	476 (0.8)	478 (0.6) ▲	473 (0.7)	478 (0.7) ▲	470 (0.8)

▲ Average significantly higher than other gender

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

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

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

Exhibit 3.12: Achievement in Science Cognitive Domains by Gender (Continued)

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Ninth Grade Participants						
Botswana	406 (4.2) ▲	388 (4.3)	406 (3.6)	401 (3.9)	411 (4.1) ▲	397 (4.4)
² Honduras	360 (4.7)	390 (5.5) ▲	362 (5.2)	377 (4.4) ▲	347 (5.3)	371 (5.5) ▲
^ψ South Africa	286 (4.9)	278 (5.2)	338 (4.2)	333 (4.1)	343 (5.5) ▲	333 (5.6)
Benchmarking Participants						
² Alberta, Canada	534 (3.3)	551 (2.8) ▲	541 (3.3)	545 (2.5)	552 (3.2)	551 (2.7)
² Ontario, Canada	506 (3.2)	520 (4.1) ▲	518 (2.5)	518 (2.9)	535 (3.2) ▲	530 (3.5)
Quebec, Canada	513 (2.9)	527 (3.4) ▲	516 (2.8)	519 (3.9)	524 (3.6)	520 (3.6)
Abu Dhabi, UAE	471 (4.9)	462 (5.9)	465 (4.2)	457 (5.6)	461 (4.7)	450 (6.3)
Dubai, UAE	507 (5.3) ▲	478 (5.9)	500 (4.5) ▲	473 (5.9)	496 (4.9) ▲	464 (6.0)
¹ Alabama, US	479 (8.1)	502 (8.6) ▲	480 (5.9)	489 (7.5)	483 (5.7)	476 (8.7)
^{1 2} California, US	485 (7.5)	504 (6.3) ▲	493 (5.2)	503 (4.9)	495 (5.4)	502 (5.5)
¹ Colorado, US	536 (5.1)	549 (5.8) ▲	532 (4.5)	545 (5.2) ▲	541 (6.0)	550 (4.5)
^{1 2} Connecticut, US	534 (5.4)	540 (6.6)	526 (4.9)	528 (6.1)	531 (4.9)	530 (6.4)
^{1 2} Florida, US	528 (8.8)	553 (7.8) ▲	518 (8.2)	533 (7.4) ▲	522 (8.5)	527 (8.2)
^{1 2} Indiana, US	529 (5.6)	546 (6.2) ▲	524 (4.8)	539 (5.2) ▲	526 (5.2)	535 (5.8) ▲
^{1 2} Massachusetts, US	570 (7.9)	582 (5.8) ▲	560 (5.7)	563 (4.4)	564 (7.0)	569 (5.6)
¹ Minnesota, US	542 (5.3)	563 (6.4) ▲	547 (4.9)	560 (5.9) ▲	554 (5.2)	557 (5.7)
^{1 3} North Carolina, US	527 (6.3)	545 (8.6) ▲	523 (5.5)	534 (7.7) ▲	526 (5.8)	535 (8.6)

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

