

Chapter 3



Average Achievement in the Science Content and Cognitive Domains

As described in the *TIMSS 2007 Assessment Frameworks*,¹ 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.

Chapter 3 presents average student performance in three content domains at the fourth grade: life science, physical science, and earth science, and four domains at the eighth grade: biology, chemistry, physics, and earth science. Average performance also is presented for each of three cognitive domains—knowing, applying, and reasoning—at both grades. The same three cognitive domains were used at both fourth and eighth grades. Knowing refers to the student’s knowledge base of science facts, concepts, tools, and procedures. Applying focuses on the student’s ability to apply knowledge and conceptual understanding in a problem situation. Reasoning goes beyond the solution of routine problems to encompass unfamiliar situations, complex contexts, and multi-step problems. To describe each country’s relative strengths in the content and cognitive domains, relative performance in each content and cognitive domain is depicted graphically.

¹ Mullis, I.V.S., Martin, M.O., Ruddock, G.J., O’Sullivan, C.Y., Arora, A., & Erberber, E. (2005). *TIMSS 2007 assessment frameworks*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Gender differences in the content and cognitive domains also are shown. Trend results are not presented separately for the content and cognitive domains, because there are too few items in common with the previous assessments.

To simplify comparisons of student achievement across domains, the content and cognitive achievement scales at each grade were constructed to have the same average difficulty.² As a point of reference, however, Exhibit A.9 in Appendix A shows the average percentage of students correctly answering the items within each of the content and cognitive domains for each country and benchmarking participant. It can be seen that, across participants, the difficulty of the science items was similar among content domains but varied somewhat across cognitive domains. Most notably, the items in the reasoning domain at both grades were more difficult for students, on average, than those in the applying domain, which were in turn more difficult than the items in the knowing domain. In Yemen, the items were very difficult in all of the domains, making it difficult to obtain accurate domain scale estimates. Therefore, the content and cognitive domain scale results were not reported for Yemen in the exhibits in this chapter. Similarly, students at the eighth grade in Ghana and Qatar had particular difficulty with the science reasoning items, and because of concerns about reliability, results for the reasoning domain scale were not reported in this chapter for these countries.

How Does Achievement Differ Across the TIMSS 2007 Science Content and Cognitive Domains?

Exhibit 3.1 presents average achievement in each of the content and cognitive domains for fourth and eighth grades. Countries and benchmarking participants are displayed in alphabetical order, and to provide a basis for comparison, symbols indicate whether a country's performance is statistically significantly above or below the TIMSS scale average of 500. Please note that this refers to the mid-point of the TIMSS achievement scale, and not the average of the country means presented in the exhibit.

At both grades, the countries scoring highest on the overall science assessment tended also to be the highest-scoring countries in each of the

2 At both fourth and eighth grades, student achievement in each of the content and cognitive domains was placed on the same scale by aligning its achievement distribution with the achievement distribution of the overall science scale.

content and cognitive domains and the lowest-scoring countries overall tended to be those with lowest scores in the content and cognitive domains. In Appendix B, Exhibits B.1 through B.6 for fourth grade and B.7 through B.13 for eighth grade compare average achievement among individual countries and benchmarking participants for each of the content and cognitive domains. The exhibits show whether or not the differences in average achievement between pairs of countries are statistically significant.

It is noteworthy that the high overall science achievement of the high-scoring Asian countries appears to be based on a strong foundation in the physical sciences. At fourth grade, Singapore, Japan, Chinese Taipei, and Hong Kong SAR are the countries with the highest average achievement in physical science, with Singapore and Chinese Taipei maintaining this level in life science and in earth science also. Other high performers in physical science included the Russian Federation, Latvia, England, and the U.S. states of Massachusetts and Minnesota. Italy, Hungary, the benchmarking states of Massachusetts and Minnesota, and the Canadian province of Alberta followed Singapore in having the highest performance in life science. They were followed by Chinese Taipei, the United States, the Russian Federation, the Netherlands, Latvia, and the Canadian provinces of British Columbia and Ontario. In earth science, Hong Kong SAR, Singapore, and Chinese Taipei, along with the two U.S. states had the highest average achievement.

At the fourth grade, Singapore had the highest performance in the knowing and applying cognitive domains, and was joined by Chinese Taipei, Japan, Hong Kong SAR, and the benchmarking state of Massachusetts as top performers in the reasoning domain. Other high achievers in the knowing domain included Hong Kong SAR, England, the Russian Federation, the United States, Hungary, Latvia, Chinese Taipei, Kazakhstan, the two U.S. benchmarking states, and the provinces of Alberta, British Columbia, and Ontario. In the applying domain, Chinese Taipei, Hong Kong SAR, the Russian Federation, and the two U.S. states were among the top performers.

At the eighth grade, in addition to Singapore, the benchmarking states of Massachusetts and Minnesota had the highest average achievement in biology. They were followed by Japan, Chinese Taipei, and Korea, and

Exhibit 3.1 **Average Achievement in the Science Content and Cognitive Domains**TIMSS2007
Science 4th Grade

Country	Average Scale Scores for Science Content Domains			Average Scale Scores for Science Cognitive Domains		
	Life Science	Physical Science	Earth Science	Knowing	Applying	Reasoning
Algeria	351 (6.2) ▼	377 (5.3) ▼	365 (5.7) ▼	350 (5.8) ▼	379 (5.7) ▼	357 (5.8) ▼
Armenia	489 (5.9) ▼	492 (5.1) ▼	479 (5.5) ▼	486 (5.2) ▼	487 (5.6) ▼	484 (5.3) ▼
Australia	528 (3.4) ▲	522 (3.1) ▲	534 (3.2) ▲	529 (3.1) ▲	523 (3.3) ▲	530 (3.4) ▲
Austria	526 (2.0) ▲	514 (2.4) ▲	532 (1.9) ▲	529 (2.0) ▲	526 (2.2) ▲	513 (2.3) ▲
Chinese Taipei	541 (2.1) ▲	559 (2.5) ▲	553 (1.9) ▲	536 (2.5) ▲	556 (2.1) ▲	571 (2.4) ▲
Colombia	408 (5.2) ▼	411 (4.9) ▼	401 (5.6) ▼	409 (5.5) ▼	404 (5.4) ▼	409 (5.1) ▼
Czech Republic	520 (2.9) ▲	511 (2.8) ▲	518 (2.6) ▲	520 (2.7) ▲	516 (3.1) ▲	510 (2.9) ▲
† Denmark	527 (2.4) ▲	502 (2.5) ▼	522 (2.7) ▲	516 (2.9) ▲	515 (2.6) ▲	525 (3.8) ▲
El Salvador	410 (3.6) ▼	392 (3.8) ▼	393 (3.3) ▼	410 (3.9) ▼	393 (3.6) ▼	376 (4.0) ▼
England	532 (2.7) ▲	543 (2.7) ▲	538 (2.9) ▲	543 (2.9) ▲	536 (2.7) ▲	537 (2.7) ▲
¹ Georgia	427 (3.5) ▼	414 (4.0) ▼	432 (5.0) ▼	434 (3.8) ▼	424 (4.1) ▼	388 (4.9) ▼
Germany	529 (2.0) ▲	524 (2.5) ▲	524 (2.4) ▲	527 (2.2) ▲	526 (2.2) ▲	525 (2.3) ▲
Hong Kong SAR	532 (3.5) ▲	558 (3.5) ▲	560 (3.2) ▲	546 (3.2) ▲	549 (3.0) ▲	561 (4.4) ▲
Hungary	548 (2.8) ▲	529 (3.3) ▲	517 (3.5) ▲	540 (3.0) ▲	531 (3.2) ▲	529 (3.7) ▲
Iran, Islamic Rep. of	442 (4.4) ▼	454 (4.2) ▼	433 (4.1) ▼	437 (4.3) ▼	451 (4.3) ▼	436 (4.3) ▼
Italy	549 (3.0) ▲	521 (3.1) ▲	526 (3.0) ▲	530 (3.9) ▲	539 (3.1) ▲	526 (3.8) ▲
Japan	530 (2.0) ▲	564 (2.3) ▲	529 (2.7) ▲	528 (2.2) ▲	542 (2.7) ▲	567 (2.1) ▲
¹ Kazakhstan	528 (5.0) ▲	528 (5.8) ▲	534 (5.2) ▲	534 (5.8) ▲	536 (4.9) ▲	519 (5.3) ▲
✱ Kuwait	353 (4.9) ▼	345 (5.2) ▼	363 (3.8) ▼	360 (3.9) ▼	338 (4.3) ▼	331 (5.4) ▼
¹ Latvia	535 (2.1) ▲	544 (2.4) ▲	536 (2.2) ▲	540 (2.2) ▲	535 (2.4) ▲	551 (2.7) ▲
¹ Lithuania	516 (1.8) ▲	514 (1.4) ▲	511 (2.5) ▲	511 (1.7) ▲	515 (2.8) ▲	524 (2.4) ▲
Morocco	292 (6.8) ▼	324 (5.5) ▼	293 (6.2) ▼	291 (5.8) ▼	311 (6.3) ▼	318 (5.4) ▼
‡ Netherlands	536 (2.2) ▲	503 (2.3) ▼	524 (2.5) ▲	518 (2.5) ▲	525 (2.2) ▲	525 (2.3) ▲
New Zealand	506 (2.5) ▲	498 (2.5) ▼	515 (2.6) ▲	511 (2.5) ▲	500 (2.4) ▼	505 (2.9) ▼
Norway	487 (2.5) ▼	469 (2.7) ▼	497 (2.9) ▼	485 (2.4) ▼	478 (2.8) ▼	480 (3.2) ▼
Qatar	291 (1.4) ▼	303 (2.1) ▼	305 (2.2) ▼	304 (2.3) ▼	283 (2.7) ▼	293 (2.9) ▼
Russian Federation	539 (4.1) ▲	547 (4.6) ▲	536 (4.3) ▲	542 (4.8) ▲	546 (4.7) ▲	542 (4.6) ▲
† Scotland	504 (2.2) ▼	499 (1.9) ▼	508 (2.5) ▲	511 (2.0) ▲	494 (2.4) ▼	501 (2.2) ▼
Singapore	582 (4.1) ▲	585 (3.9) ▲	554 (3.3) ▲	587 (4.1) ▲	579 (3.7) ▲	568 (3.7) ▲
Slovak Republic	532 (4.0) ▲	513 (4.6) ▲	530 (4.8) ▲	527 (4.4) ▲	527 (4.4) ▲	513 (4.9) ▲
Slovenia	511 (2.2) ▲	530 (1.6) ▲	517 (2.5) ▲	511 (1.6) ▲	525 (2.1) ▲	527 (1.8) ▲
Sweden	531 (2.5) ▲	508 (2.7) ▲	535 (2.7) ▲	526 (2.5) ▲	521 (2.9) ▲	527 (3.5) ▲
Tunisia	323 (5.6) ▼	340 (6.4) ▼	325 (5.8) ▼	316 (5.9) ▼	329 (6.3) ▼	349 (5.3) ▼
Ukraine	482 (2.5) ▼	475 (2.7) ▼	474 (3.1) ▼	476 (2.4) ▼	477 (3.2) ▼	478 (3.0) ▼
² † United States	540 (2.5) ▲	534 (2.3) ▲	533 (2.6) ▲	541 (2.3) ▲	533 (2.8) ▲	535 (2.6) ▲
Yemen	++	++	++	++	++	++
TIMSS Scale Avg.	500	500	500	500	500	500
Benchmarking Participants						
² Alberta, Canada	541 (3.7) ▲	535 (3.1) ▲	544 (3.3) ▲	549 (3.5) ▲	535 (3.7) ▲	537 (4.4) ▲
² British Columbia, Canada	538 (2.8) ▲	531 (2.6) ▲	537 (2.7) ▲	539 (2.5) ▲	533 (2.4) ▲	536 (2.7) ▲
✱ ‡ Dubai, UAE	457 (2.8) ▼	467 (2.8) ▼	471 (2.6) ▼	463 (2.6) ▼	463 (2.6) ▼	462 (2.6) ▼
² Massachusetts, US	568 (3.5) ▲	560 (4.4) ▲	558 (4.4) ▲	566 (4.4) ▲	563 (4.4) ▲	569 (6.2) ▲
² † Minnesota, US	545 (6.1) ▲	545 (5.4) ▲	547 (5.8) ▲	550 (5.9) ▲	544 (5.9) ▲	549 (6.4) ▲
² Ontario, Canada	535 (3.7) ▲	535 (2.9) ▲	530 (3.2) ▲	538 (3.4) ▲	528 (3.4) ▲	541 (3.1) ▲
² Quebec, Canada	522 (2.7) ▲	513 (2.6) ▲	523 (2.6) ▲	516 (2.8) ▲	515 (2.7) ▲	528 (3.3) ▲

▲ Country average significantly higher than TIMSS scale average ▼ Country average significantly lower than TIMSS scale average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

¹ National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

² National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

✱ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A plus (+) sign indicates average achievement could not be accurately estimated.

Exhibit 3.1 Average Achievement in the Science Content and Cognitive Domains (Continued)

TIMSS2007
Science 8th Grade

Country	Average Scale Scores for Science Content Domains				Average Scale Scores for Science Cognitive Domains		
	Biology	Chemistry	Physics	Earth Science	Knowing	Applying	Reasoning
Algeria	411 (1.9) ▼	414 (1.7) ▼	397 (2.2) ▼	413 (1.6) ▼	409 (1.9) ▼	410 (2.4) ▼	414 (1.9) ▼
Armenia	490 (5.9)	478 (6.3) ▼	503 (5.6)	475 (5.8) ▼	493 (6.4)	502 (5.4)	459 (6.5) ▼
Australia	518 (3.4) ▲	505 (3.6)	508 (4.2)	519 (3.8) ▲	501 (3.1)	510 (3.2) ▲	530 (3.6) ▲
Bahrain	473 (2.0) ▼	468 (2.4) ▼	466 (1.5) ▼	465 (2.4) ▼	469 (2.1) ▼	468 (2.1) ▼	469 (2.0) ▼
Bosnia and Herzegovina	464 (3.0) ▼	468 (2.9) ▼	463 (3.1) ▼	469 (3.4) ▼	486 (3.7) ▼	463 (2.8) ▼	452 (3.1) ▼
Botswana	359 (2.9) ▼	371 (2.4) ▼	351 (3.2) ▼	361 (4.0) ▼	361 (2.9) ▼	358 (3.2) ▼	362 (2.7) ▼
³ Bulgaria	467 (6.0) ▼	472 (6.1) ▼	466 (5.6) ▼	480 (5.5) ▼	489 (5.8)	471 (6.1) ▼	448 (6.1) ▼
Chinese Taipei	549 (3.4) ▲	573 (4.2) ▲	554 (3.7) ▲	545 (2.9) ▲	565 (3.5) ▲	560 (3.4) ▲	541 (3.5) ▲
Colombia	434 (3.7) ▼	420 (3.1) ▼	407 (3.5) ▼	407 (3.9) ▼	418 (4.0) ▼	417 (3.1) ▼	428 (2.7) ▼
Cyprus	447 (1.9) ▼	452 (2.5) ▼	458 (2.8) ▼	457 (2.3) ▼	438 (2.6) ▼	456 (2.0) ▼	460 (2.3) ▼
Czech Republic	531 (2.1) ▲	535 (2.7) ▲	537 (2.1) ▲	534 (2.0) ▲	533 (2.1) ▲	539 (1.9) ▲	534 (2.3) ▲
Egypt	406 (3.4) ▼	413 (4.0) ▼	413 (3.3) ▼	426 (3.8) ▼	434 (3.9) ▼	404 (3.6) ▼	395 (3.4) ▼
El Salvador	398 (3.0) ▼	377 (3.2) ▼	380 (3.5) ▼	400 (2.9) ▼	394 (3.2) ▼	388 (3.2) ▼	384 (3.4) ▼
[†] England	541 (4.4) ▲	534 (4.0) ▲	545 (4.0) ▲	529 (4.3) ▲	530 (4.9) ▲	538 (4.0) ▲	547 (4.0) ▲
¹ Georgia	423 (3.9) ▼	418 (4.6) ▼	416 (5.8) ▼	425 (4.1) ▼	440 (5.1)	422 (4.5) ▼	394 (4.6) ▼
Ghana	304 (4.9) ▼	342 (4.9) ▼	276 (5.8) ▼	294 (5.8) ▼	316 (5.7) ▼	291 (5.5) ▼	+ +
[†] Hong Kong SAR	527 (4.6) ▲	517 (4.6) ▲	528 (4.8) ▲	532 (4.5) ▲	532 (4.5) ▲	522 (4.9) ▲	533 (5.0) ▲
Hungary	534 (2.7) ▲	536 (3.5) ▲	541 (3.2) ▲	531 (2.9) ▲	524 (3.0) ▲	549 (3.0) ▲	530 (3.0) ▲
Indonesia	428 (3.1) ▼	421 (3.4) ▼	432 (3.1) ▼	442 (3.3) ▼	426 (3.6) ▼	425 (3.1) ▼	438 (3.2) ▼
Iran, Islamic Rep. of	449 (3.6) ▼	463 (3.5) ▼	470 (3.6) ▼	476 (3.7) ▼	468 (3.9) ▼	454 (3.8) ▼	462 (3.8) ▼
³ Israel	472 (4.2) ▼	467 (4.6) ▼	472 (4.6) ▼	462 (4.1) ▼	456 (5.0) ▼	472 (4.2) ▼	481 (4.2) ▼
Italy	502 (3.0) ▼	481 (2.9) ▼	489 (3.1) ▼	503 (3.1)	494 (3.3)	498 (2.9)	493 (2.6) ▼
Japan	553 (1.9) ▲	551 (1.9) ▲	558 (1.9) ▲	533 (2.5) ▲	534 (2.2) ▲	555 (2.0) ▲	560 (2.0) ▲
Jordan	478 (3.8) ▼	491 (4.1) ▼	479 (4.2) ▼	484 (3.6) ▼	491 (4.5) ▼	485 (4.1) ▼	471 (4.1) ▼
Korea, Rep. of	548 (1.9) ▲	536 (2.4) ▲	571 (2.4) ▲	538 (2.2) ▲	543 (2.0) ▲	547 (2.0) ▲	558 (2.0) ▲
[✶] Kuwait	419 (2.6) ▼	418 (3.8) ▼	438 (2.8) ▼	410 (3.0) ▼	430 (2.5) ▼	417 (2.9) ▼	411 (2.9) ▼
Lebanon	405 (6.2) ▼	447 (5.5) ▼	431 (5.1) ▼	389 (6.4) ▼	403 (5.9) ▼	422 (5.8) ▼	420 (5.6) ▼
¹ Lithuania	527 (2.3) ▲	507 (2.3) ▲	505 (2.9)	515 (2.5) ▲	513 (2.4) ▲	512 (2.2) ▲	527 (2.5) ▲
Malaysia	469 (5.8) ▼	479 (5.0) ▼	484 (5.7) ▼	463 (5.4) ▼	458 (6.5) ▼	473 (5.9) ▼	487 (4.9) ▼
Malta	453 (1.7) ▼	461 (2.1) ▼	470 (1.7) ▼	456 (1.5) ▼	436 (1.5) ▼	462 (1.6) ▼	473 (1.4) ▼
Norway	487 (2.3) ▼	483 (2.2) ▼	475 (3.0) ▼	502 (2.5) ▼	486 (2.0) ▼	486 (2.3) ▼	491 (2.8) ▼
Oman	414 (3.1) ▼	416 (3.6) ▼	443 (2.9) ▼	439 (2.5) ▼	428 (3.5) ▼	423 (3.2) ▼	428 (3.5) ▼
Palestinian Nat'l Auth.	402 (4.1) ▼	413 (4.2) ▼	414 (3.7) ▼	408 (3.7) ▼	407 (3.5) ▼	412 (4.0) ▼	396 (3.8) ▼
Qatar	318 (1.7) ▼	322 (1.8) ▼	347 (2.1) ▼	312 (1.9) ▼	325 (1.7) ▼	322 (1.5) ▼	+ +
Romania	459 (3.2) ▼	463 (4.0) ▼	458 (3.4) ▼	471 (3.3) ▼	451 (4.2) ▼	470 (3.5) ▼	460 (3.5) ▼
Russian Federation	525 (3.6) ▲	535 (3.7) ▲	519 (4.0) ▲	525 (3.4) ▲	534 (4.3) ▲	527 (3.8) ▲	520 (3.7) ▲
Saudi Arabia	407 (2.4) ▼	390 (2.5) ▼	408 (2.3) ▼	423 (2.3) ▼	417 (2.1) ▼	403 (2.7) ▼	395 (2.5) ▼
[†] Scotland	495 (3.2) ▼	497 (3.2) ▼	494 (3.7) ▼	498 (3.2) ▼	480 (3.9) ▼	495 (3.1) ▼	511 (3.6) ▲
^{1 2} Serbia	474 (3.2) ▼	467 (3.7) ▼	467 (3.0) ▼	466 (3.8) ▼	485 (2.8) ▼	469 (3.6) ▼	455 (3.5) ▼
Singapore	564 (4.2) ▲	560 (4.1) ▲	575 (3.9) ▲	541 (4.1) ▲	554 (4.5) ▲	567 (4.2) ▲	564 (4.1) ▲
Slovenia	530 (2.3) ▲	539 (2.5) ▲	524 (2.0) ▲	542 (2.2) ▲	533 (2.0) ▲	533 (2.2) ▲	538 (2.2) ▲
Sweden	515 (2.4) ▲	499 (2.4) ▼	506 (2.7) ▼	510 (3.0) ▲	505 (2.3) ▲	509 (2.7) ▲	517 (2.6) ▲
Syrian Arab Republic	459 (2.7) ▼	450 (2.9) ▼	447 (2.7) ▼	448 (3.2) ▼	474 (2.9) ▼	445 (3.0) ▼	440 (2.7) ▼
Thailand	478 (4.5) ▼	462 (4.1) ▼	458 (4.2) ▼	488 (3.8) ▼	473 (4.4) ▼	472 (4.1) ▼	473 (4.0) ▼
Tunisia	452 (2.2) ▼	458 (2.5) ▼	432 (2.5) ▼	447 (1.8) ▼	441 (2.0) ▼	445 (2.3) ▼	458 (2.9) ▼
Turkey	462 (3.4) ▼	435 (5.2) ▼	445 (4.3) ▼	466 (3.3) ▼	462 (3.6) ▼	450 (3.6) ▼	462 (3.4) ▼
Ukraine	477 (3.4) ▼	490 (3.3) ▼	492 (3.9) ▼	482 (4.0) ▼	477 (3.8) ▼	488 (3.7) ▼	488 (3.9) ▼
^{2 †} United States	530 (2.8) ▲	510 (2.7) ▲	503 (2.7) ▼	525 (3.1) ▲	512 (2.9) ▲	516 (2.7) ▲	529 (2.9) ▲
[‡] Morocco	395 (3.5) ▼	416 (3.0) ▼	405 (3.1) ▼	397 (3.8) ▼	396 (3.1) ▼	400 (3.3) ▼	413 (3.0) ▼
TIMSS Scale Avg.	500	500	500	500	500	500	500
Benchmarking Participants							
Basque Country, Spain	498 (2.9) ▼	472 (3.5) ▼	493 (3.4)	514 (2.8) ▲	490 (3.0) ▼	499 (2.9)	499 (3.3)
³ British Columbia, Canada	535 (3.2) ▲	505 (2.7)	517 (2.8) ▲	530 (2.7) ▲	516 (2.9) ▲	521 (2.8) ▲	535 (3.0) ▲
^{✶ †} Dubai, UAE	485 (3.4) ▼	493 (3.5) ▼	489 (3.4) ▼	490 (3.2) ▼	495 (3.3)	489 (3.1) ▼	483 (3.3) ▼
² Massachusetts, US	563 (4.3) ▲	540 (4.6) ▲	535 (5.0) ▲	560 (4.0) ▲	545 (4.2) ▲	550 (4.0) ▲	564 (4.0) ▲
^{2 †} Minnesota, US	555 (5.2) ▲	519 (4.9) ▲	514 (4.8) ▲	545 (5.5) ▲	526 (4.8) ▲	534 (4.8) ▲	545 (5.3) ▲
² Ontario, Canada	537 (3.8) ▲	505 (3.4)	520 (4.1) ▲	530 (4.3) ▲	510 (3.3) ▲	522 (3.6) ▲	542 (4.0) ▲
³ Quebec, Canada	513 (2.9) ▲	497 (3.1) ▼	492 (3.4) ▼	513 (3.5) ▲	495 (2.9)	500 (3.1)	523 (3.1) ▲

▲ Country average significantly higher than TIMSS scale average ▼ Country average significantly lower than TIMSS scale average

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).[‡] Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).[‡] Did not satisfy guidelines for sample participation rates (see Appendix A).¹ National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).² National Defined Population covers 90% to 95% of National Target Population (see Appendix A).³ National Defined Population covers less than 90% of National Target Population (but at least 77%, see Appendix A).[✶] Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.^() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A plus (+) sign indicates average achievement could not be accurately estimated.

then England. In chemistry, top-performing Chinese Taipei was followed by Singapore, then by Japan, and then by a group of countries including Slovenia, Hungary, Korea, the Czech Republic, the Russian Federation, England, and the benchmarking state of Massachusetts. Singapore and Korea were the highest achievers in physics, followed by Japan and Chinese Taipei, and then by England. In earth science, the top performer was the U.S. state of Massachusetts. Other high performers included Chinese Taipei, Slovenia, Singapore, Korea, and the state of Minnesota, followed by the Czech Republic, Japan, Hong Kong SAR, Hungary, England, and the provinces of British Columbia and Ontario.

At the eighth grade, Chinese Taipei had the highest achievement in the knowing domain. It was followed by Singapore and the state of Massachusetts, which in turn were followed by Korea and the Russian Federation, and then by Japan, Slovenia, the Czech Republic, Hong Kong SAR, England, and the state of Minnesota. In the applying domain, the top performers were Singapore and Chinese Taipei. They were followed by Japan, and then by Hungary and the state of Massachusetts. Singapore, Japan, Korea, and the state of Massachusetts were the top performers in the reasoning domain.

In Which Science Content and Cognitive Domains Are Countries Relatively Strong or Weak?

To highlight relative strengths and weaknesses in the science content and cognitive domains within each country, Exhibit 3.2 profiles average achievement in these domains relative to the overall level of performance in the country. For each TIMSS 2007 participant, Exhibit 3.2 displays the difference between average performance in each science content domain and the average across content domains for that participant, and similarly the difference between average performance in each science cognitive domain and the average across cognitive domains. This relative performance is presented in two panels for each country, one for content domains and one for cognitive domains. Average relative performance is represented by a small circle, with a bar extending above and below the circle to denote a 95 percent confidence interval for this average.

The profiles reveal that many countries performed relatively better in one content domain or in one cognitive domain than on average. At fourth grade, Denmark, El Salvador, Hungary, Italy, and the Netherlands performed relatively better in life science than in science overall, while Chinese Taipei, Hong Kong SAR, Japan, Qatar, and Slovenia performed relatively less well. Iran, Japan, Morocco, Qatar, Singapore, and Slovenia performed relatively better in physical science, while Austria, Denmark, Georgia, Italy, the Netherlands, New Zealand, Norway, Sweden, and the province of Quebec relatively less well. In earth science, Austria, Hong Kong SAR, New Zealand, Norway, Sweden, and Dubai performed relatively better and Hungary, Japan, and Singapore less well.

Differences at fourth grade in relative performance in the cognitive domains were mainly in the areas of knowing and reasoning. Austria, El Salvador, Georgia, Kuwait, Qatar, Scotland, and Singapore performed relatively better in knowing while Chinese Taipei, Japan, Morocco, and Slovenia relatively less well. Chinese Taipei, Japan, Latvia, Lithuania, Slovenia, and Tunisia performed relatively better in reasoning while Austria, El Salvador, and Georgia performed relatively less well. Algeria had higher relative performance in applying than in mathematics overall.

At eighth grade, many participants showed a relative strength or weakness in one or other of the content domains. Colombia, El Salvador, Italy, Lithuania, Syria, Turkey, the United States, and, among benchmarking participants, British Columbia, Massachusetts, Minnesota, and Ontario, performed relatively better in biology than in science overall while Cyprus, Iran, Malta, Oman, and Qatar performed relatively less well. In chemistry, countries that performed relatively better included Botswana, Chinese Taipei, Ghana, Lebanon, Tunisia, and Morocco, while participants that performed relatively less well included El Salvador, Italy, Korea, Lithuania, Oman, Saudi Arabia, Sweden, Turkey, the United States, and the benchmarking entities of the Basque Country, British Columbia, Minnesota, Ontario, and Quebec. In physics, Armenia, Japan, Korea, Kuwait, Malta, Oman, Qatar, and Singapore performed relatively better while Algeria, Colombia, Ghana, Lithuania, Norway, Slovenia, Thailand, Tunisia, the United States, the two U.S. states, and the province of Quebec relatively less well. Participants with

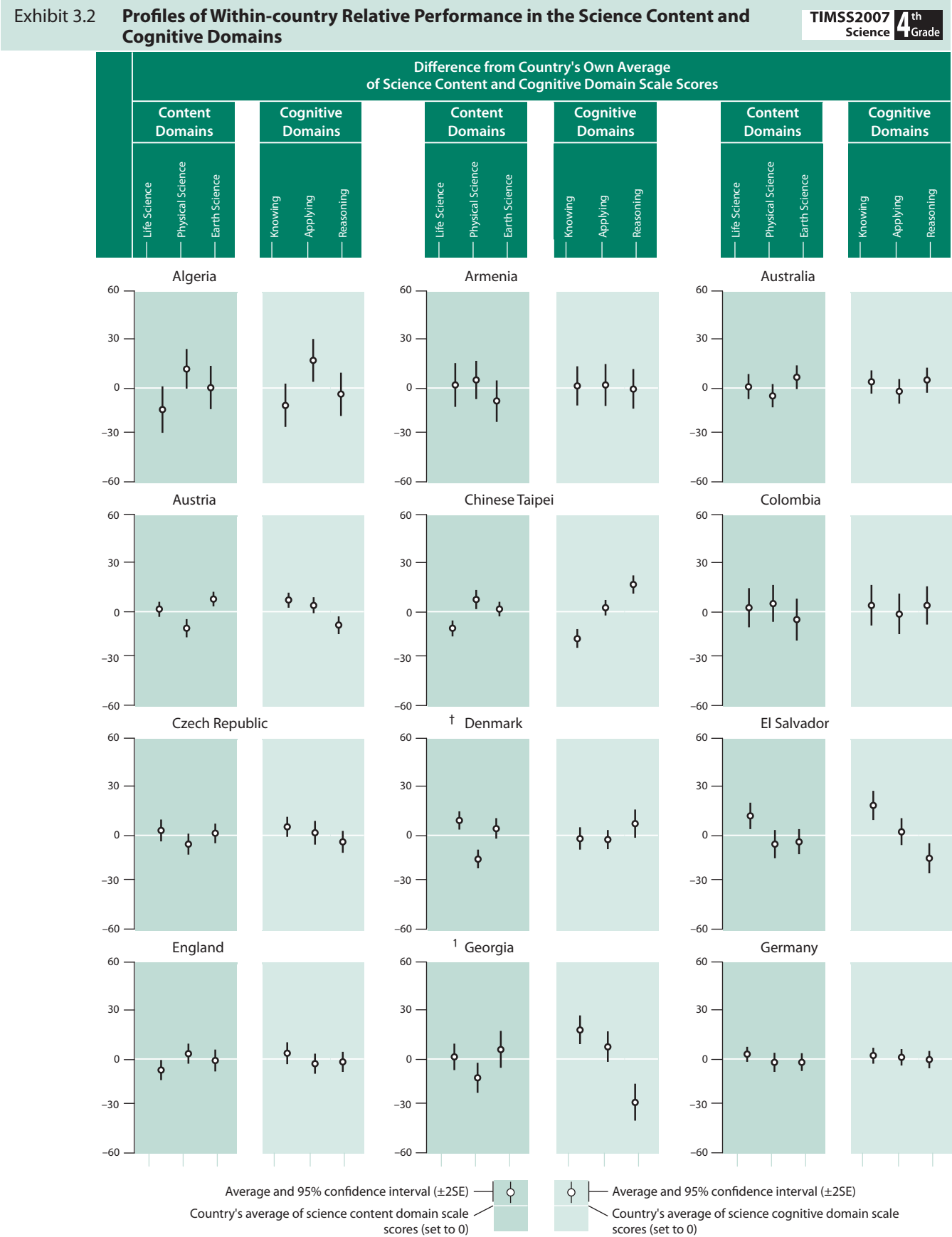
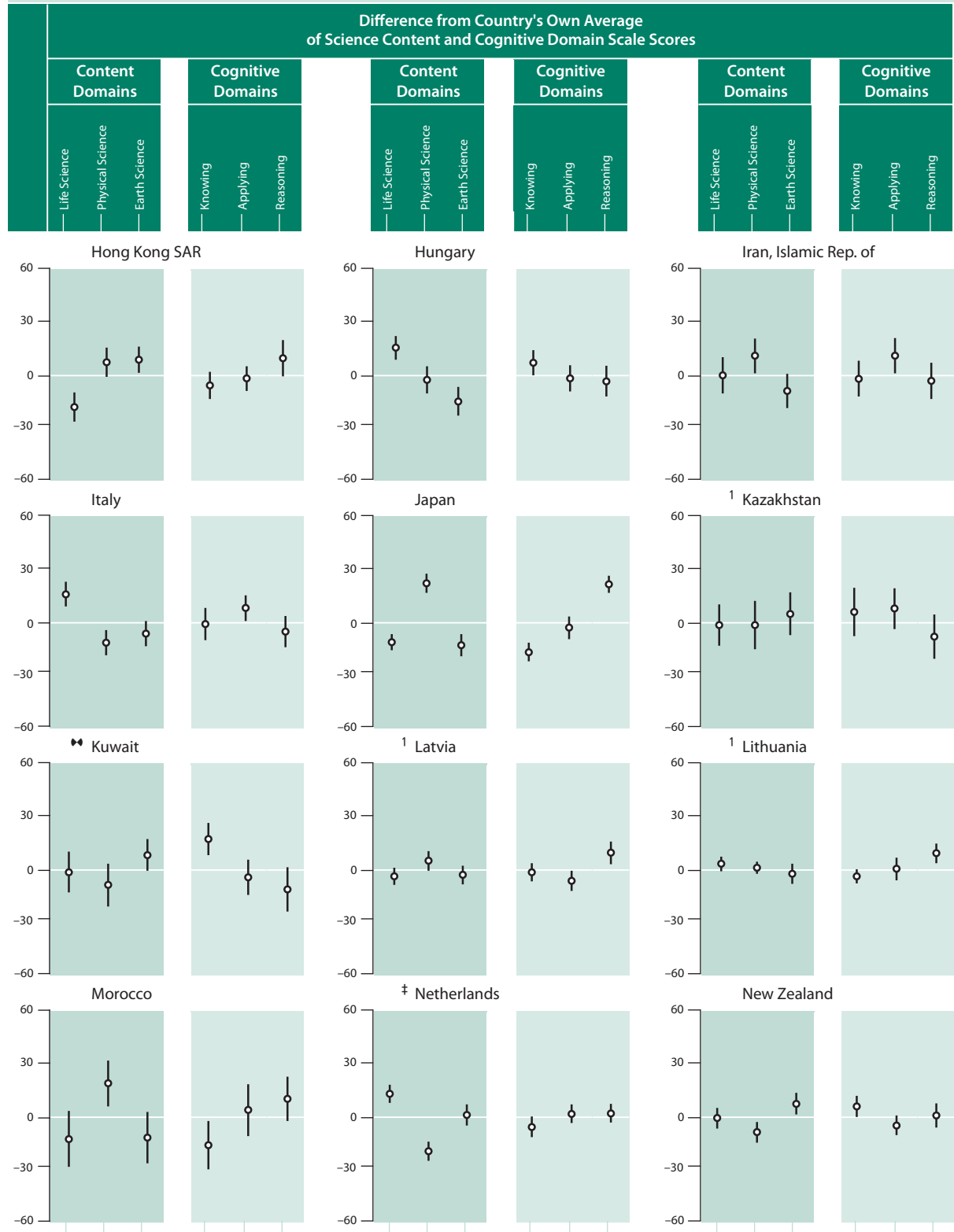


Exhibit 3.2 Profiles of Within-country Relative Performance in the Science Content and Cognitive Domains (Continued)
TIMSS2007
Science **4th**
Grade


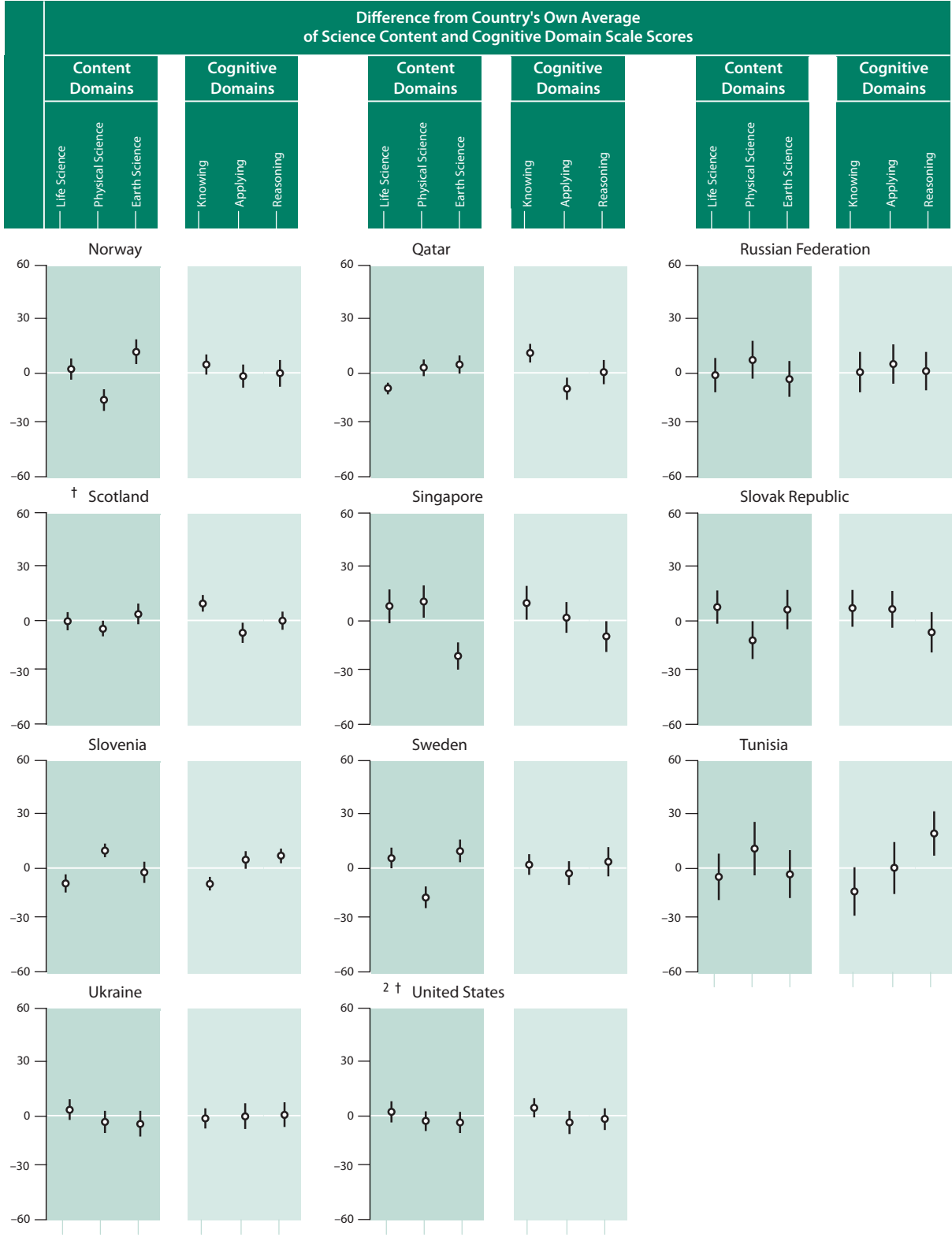
SOURCE: IEA's Trends in International Science and Science Study (TIMSS) 2007

Average and 95% confidence interval ($\pm 2SE$)  Country's average of science content domain scale scores (set to 0)
 Average and 95% confidence interval ($\pm 2SE$)  Country's average of science cognitive domain scale scores (set to 0)

Exhibit 3.2

Profiles of Within-country Relative Performance in the Science Content and Cognitive Domains (Continued)

TIMSS2007
Science4th Grade



SOURCE: IEA's Trends in International Science and Science Study (TIMSS) 2007

Average and 95% confidence interval ($\pm 2SE$)

Country's average of science content domain scale scores (set to 0)

Average and 95% confidence interval ($\pm 2SE$)

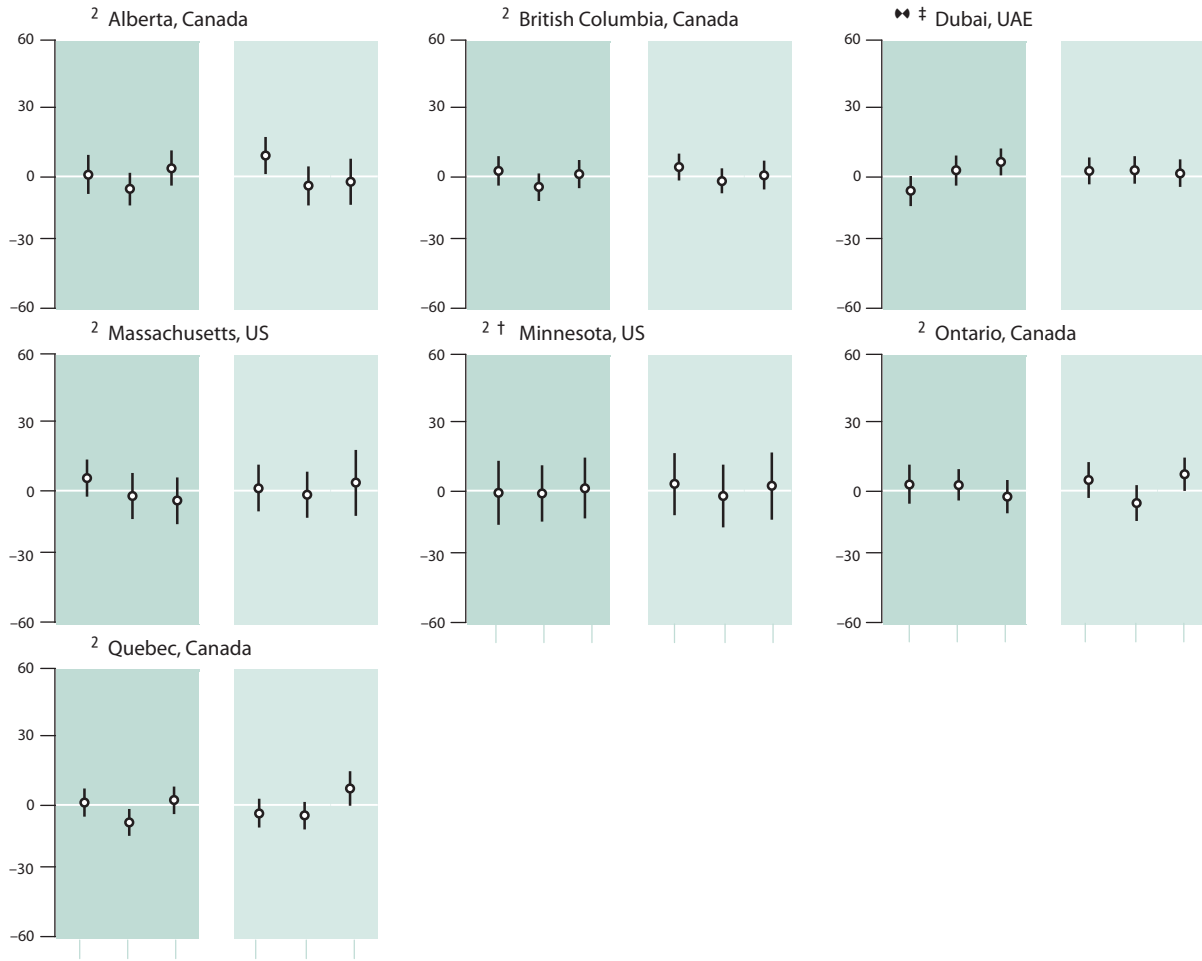
Country's average of science cognitive domain scale scores (set to 0)

Exhibit 3.2 Profiles of Within-country Relative Performance in the Science Content and Cognitive Domains (Continued)

TIMSS2007
Science 4th Grade

Difference from Country's Own Average of Science Content and Cognitive Domain Scale Scores					
Content Domains		Cognitive Domains		Content Domains	
Life Science	Physical Science	Earth Science	Knowing	Applying	Reasoning
Life Science	Physical Science	Earth Science	Knowing	Applying	Reasoning
Life Science	Physical Science	Earth Science	Knowing	Applying	Reasoning

Benchmarking Participants



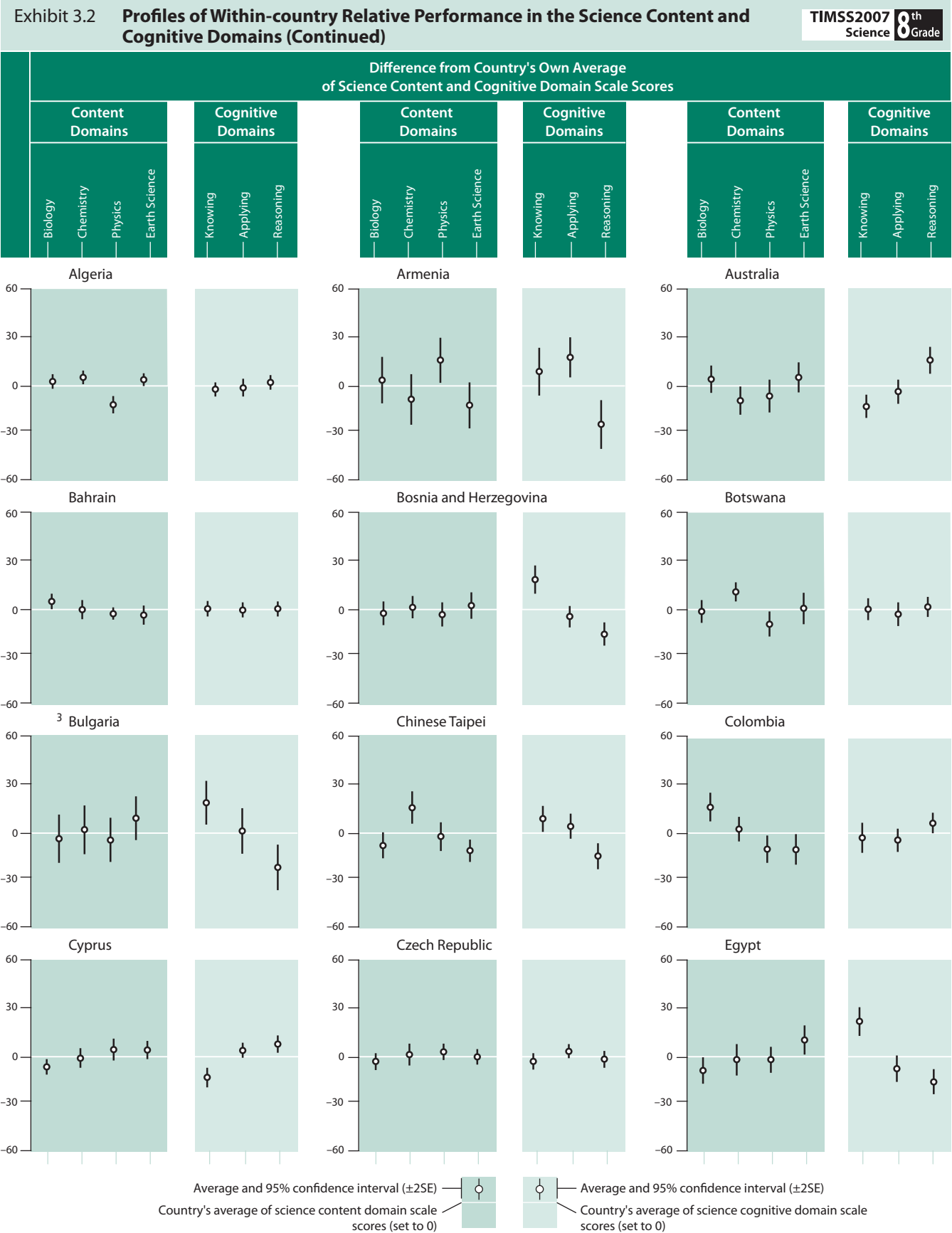
SOURCE: IEA's Trends in International Science and Science Study (TIMSS) 2007

Average and 95% confidence interval ($\pm 2SE$)

Country's average of science content domain scale scores (set to 0)

Average and 95% confidence interval ($\pm 2SE$)

Country's average of science cognitive domain scale scores (set to 0)



† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Did not satisfy guidelines for sample participation rates (see Appendix A).

1 National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

2 National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

3 National Defined Population covers less than 90% of National Target Population (but at least 77%, see Appendix A).

Exhibit 3.2 Profiles of Within-country Relative Performance in the Science Content and Cognitive Domains (Continued)

TIMSS2007
Science **8th Grade**



♦ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

Note: Average achievement could not be accurately estimated on the reasoning scale for Ghana and Qatar.

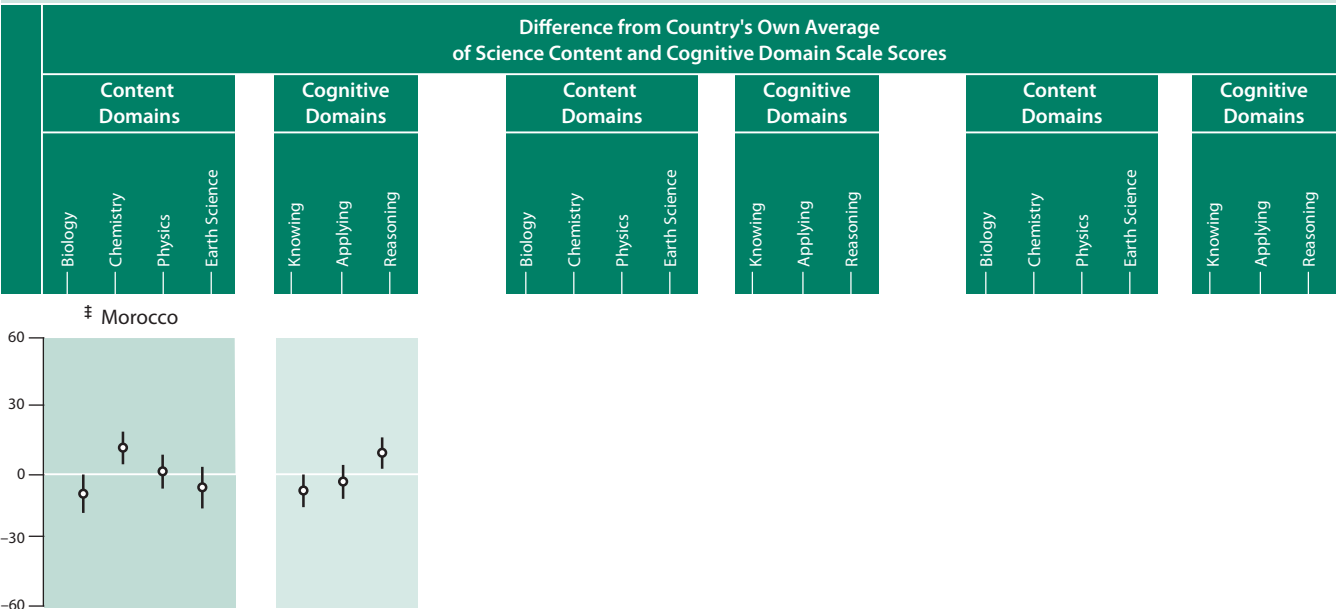


TIMSS2007
Science 8th Grade

Exhibit 3.2

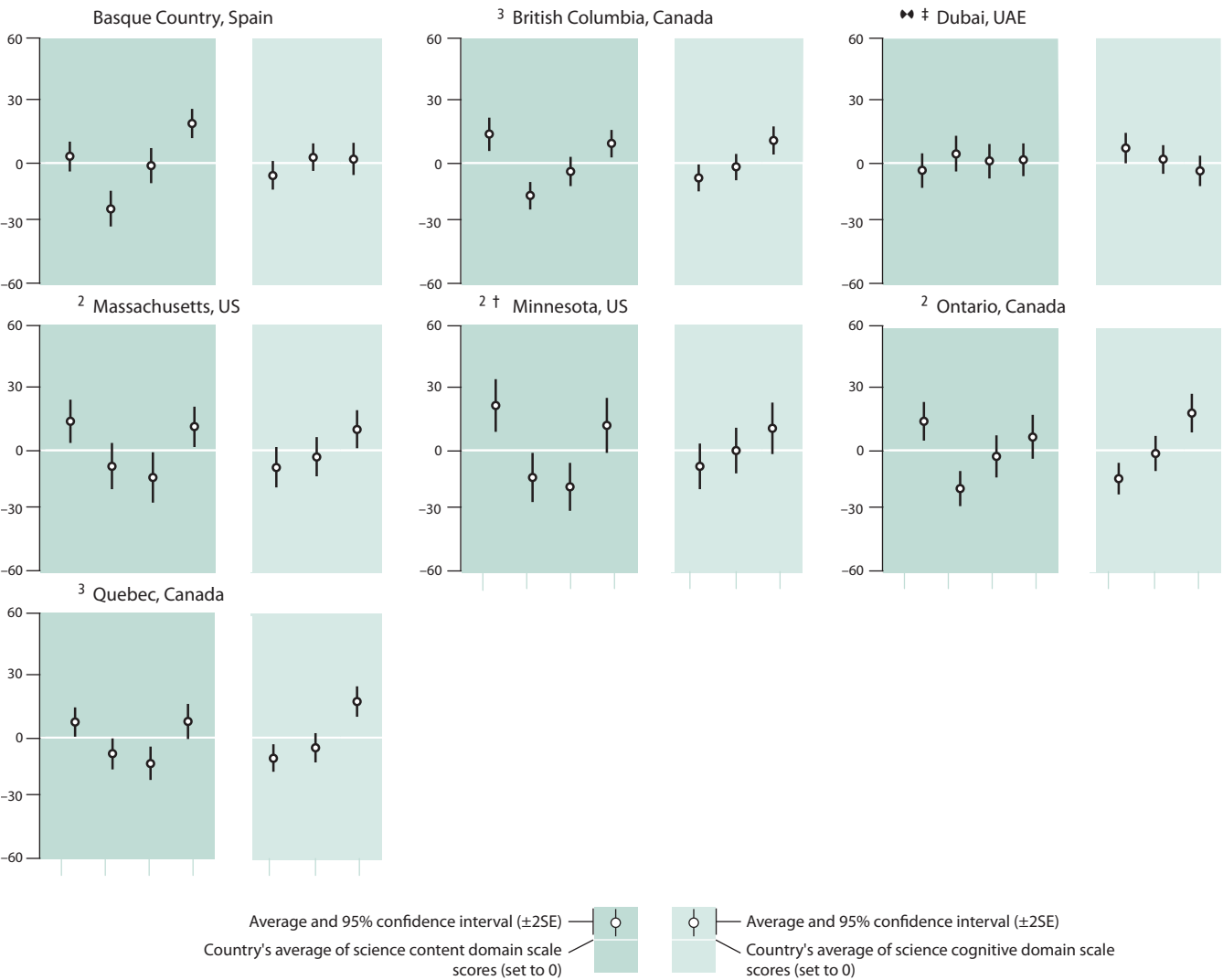
Profiles of Within-country Relative Performance in the Science Content and Cognitive Domains (Continued)

TIMSS2007
Science8th Grade



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

Benchmarking Participants



relatively better performance in earth science included Egypt, El Salvador, Indonesia, Iran, Italy, Norway, Oman, Saudi Arabia, Slovenia, Thailand, Turkey, the Basque Country, the province of British Columbia, and the state of Massachusetts, while those performing relatively less well included Chinese Taipei, Colombia, Japan, Korea, Kuwait, Lebanon, Qatar, and Singapore.

As at fourth grade, differences in relative performance in the cognitive domains at the eighth grade were almost all in the domains of knowing and reasoning. Armenia and Hungary were exceptions, with relatively better performance in the applying domain than in science overall. Participants performing relatively better in knowing included Bosnia and Herzegovina, Bulgaria, Egypt, Georgia, Kuwait, Saudi Arabia, Serbia, and Syria, while those performing relatively less well included Australia, Cyprus, Hungary, Israel, Japan, Korea, Malta, Scotland, Tunisia, and the provinces of Ontario and Quebec. Australia, Israel, Japan, Korea, Lithuania, Malaysia, Malta, Scotland, Sweden, Tunisia, the United States, Morocco, and the benchmarking entities of British Columbia, Massachusetts, Ontario, and Quebec performed relatively better in the reasoning domain than in science overall, while Armenia, Bosnia and Herzegovina, Bulgaria, Chinese Taipei, Egypt, Georgia, the Palestinian National Authority, Saudi Arabia, Serbia, and the Syrian Arab Republic performed relatively less well.

What Are the Gender Differences in Achievement for the Science Content and Cognitive Domains?

To elaborate on the gender differences in overall science achievement presented earlier in Exhibit 1.5, Exhibit 3.3 presents average achievement for boys and girls in each of the content and cognitive domains for fourth and eighth grades. As an additional basis for comparison, the international average for boys and girls (the average across all of the TIMSS 2007 countries) also is shown.

In both life science and physical science at the fourth grade, girls had significantly higher achievement than boys on average across countries. In life science, girls performed better in 10 countries and 2 benchmarking entities, whereas boys performed better in 5 countries. In physical science, girls performed better in 6 countries and 1 benchmarking entity, and boys performed better in 4 countries and 1 benchmarking entity. In earth science, however, the pattern was reversed, with boys performing better than girls in 16 countries and 4 benchmarking entities and girls performing better in 5 countries and 1 benchmarking entity.

Among cognitive domains at the fourth grade, girls performed better in reasoning than boys by an average of 12 points. Girls performed better on the reasoning scale in 19 countries and 4 benchmarking entities, while boys outperformed girls in just 2 countries. Although the average gender differences internationally in knowing and applying were not statistically significant, there were gender differences in many countries, more in favor of boys than girls. In the knowing domain, boys performed better than girls in 13 countries and 3 benchmarking entities and girls performed better in 4 countries and 1 benchmarking entity. In applying, boys performed better in 10 countries and 3 benchmarking entities, and girls performed better in 5 countries and 1 benchmarking entity.

At eighth grade, girls had higher achievement, on average across countries, in biology (11 points) and chemistry (11 points), while boys had higher achievement in physics (4 points). Girls performed better than boys in 26 countries in biology and in 21 countries in chemistry. In contrast, boys performed better than girls in biology in 5 countries and 1 benchmarking entity and in chemistry in 6 countries. In physics, boys performed better than girls in 27 countries and 5 benchmarking entities, whereas girls performed better than boys in 8 countries. Although there was no gender difference in earth science on average across countries, boys performed better than girls in 20 countries and 4 benchmarking entities, while girls performed better than boys in 11 countries.

At the eighth grade, girls performed better than boys, on average internationally, in all three cognitive domains—knowing, applying, and reasoning. As in the fourth grade, the girls' greatest advantage was in reasoning (10 points, on average), with girls outperforming boys in 19 countries and boys outperforming girls in just 5 countries. Although girls outperformed boys on average in both knowing (4 points) and applying (5 points), in each domain there were more participants with a difference favoring boys (in knowing, boys had higher average achievement in 15 countries and 5 benchmarking participants and girls in 13 countries; in applying, boys had higher achievement in 13 countries and 3 benchmarking entities and girls in 13 countries).

Exhibit 3.3 Average Achievement in the Science Content and Cognitive Domains by Gender

TIMSS2007
Science **4th Grade**

Country	Average Scale Scores for Science Content Domains					
	Life Science		Physical Science		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys
Algeria	354 (7.3)	348 (6.5)	385 (5.7) ▲	370 (6.2)	370 (6.4)	360 (6.3)
Armenia	497 (7.3) ▲	482 (5.5)	499 (6.4) ▲	486 (4.4)	490 (6.3) ▲	468 (6.0)
Australia	528 (3.7)	529 (4.0)	520 (3.4)	525 (3.6)	531 (4.3)	538 (3.6)
Austria	522 (2.1)	529 (2.7) ▲	508 (2.8)	519 (2.9) ▲	524 (2.6)	540 (2.8) ▲
Chinese Taipei	541 (2.4)	541 (2.7)	560 (2.8)	559 (3.4)	548 (2.2)	558 (2.6) ▲
Colombia	400 (5.7)	417 (5.8) ▲	407 (5.4)	416 (5.5)	392 (5.9)	410 (6.8) ▲
Czech Republic	520 (3.1)	519 (3.4)	508 (3.4)	513 (3.1)	511 (3.0)	524 (2.7) ▲
† Denmark	527 (2.5)	527 (3.7)	500 (3.2)	505 (3.4)	515 (3.1)	529 (3.3) ▲
El Salvador	404 (4.8)	415 (4.3)	387 (5.0)	396 (4.7)	384 (4.4)	402 (4.7) ▲
England	536 (3.0) ▲	529 (3.4)	544 (2.8)	541 (3.5)	533 (3.2)	543 (3.5) ▲
¹ Georgia	430 (4.1)	424 (3.9)	422 (4.3) ▲	406 (4.9)	438 (6.0) ▲	426 (5.5)
Germany	527 (2.2)	531 (2.3) ▲	517 (2.8)	530 (3.0) ▲	512 (2.8)	535 (3.1) ▲
Hong Kong SAR	531 (3.3)	534 (4.2)	557 (3.3)	559 (4.4)	557 (2.7)	562 (4.1) ▲
Hungary	549 (3.8)	546 (3.3)	527 (4.2)	531 (3.7)	513 (4.4)	521 (4.6)
Iran, Islamic Rep. of	449 (5.9)	436 (6.4)	462 (5.7)	446 (6.1)	439 (5.8)	428 (5.2)
Italy	544 (3.5)	554 (3.6) ▲	516 (3.2)	525 (3.6) ▲	518 (3.4)	533 (3.5) ▲
Japan	532 (2.1)	528 (2.9)	565 (2.6)	564 (2.7)	528 (4.2)	529 (2.9)
¹ Kazakhstan	527 (4.6)	528 (6.0)	529 (5.4)	526 (6.9)	534 (5.0)	534 (6.5)
♦♦ Kuwait	384 (5.3) ▲	319 (8.7)	378 (5.9) ▲	311 (7.5)	391 (4.9) ▲	332 (7.2)
¹ Latvia	542 (2.5) ▲	529 (2.8)	546 (3.2)	542 (2.8)	534 (2.9)	537 (3.1)
¹ Lithuania	519 (2.1)	514 (2.4)	515 (1.9)	513 (2.1)	512 (3.4)	509 (3.2)
Morocco	300 (8.4) ▲	284 (7.0)	330 (6.8)	318 (7.3)	296 (7.5)	289 (7.8)
‡ Netherlands	532 (2.7)	539 (2.8) ▲	499 (2.9)	506 (2.7) ▲	513 (3.8)	533 (3.0) ▲
New Zealand	512 (3.0) ▲	501 (3.8)	500 (3.2)	497 (3.2)	512 (2.9)	518 (3.0) ▲
Norway	487 (3.6)	486 (3.0)	468 (3.5)	469 (3.0)	492 (3.6)	501 (3.4) ▲
Qatar	302 (2.1) ▲	279 (2.2)	319 (3.7) ▲	287 (3.7)	316 (1.9) ▲	293 (3.3)
Russian Federation	541 (5.0)	536 (4.5)	549 (5.1)	545 (4.8)	536 (4.9)	537 (4.5)
† Scotland	505 (2.9)	502 (2.7)	498 (2.4)	501 (2.5)	505 (2.8)	510 (3.6)
Singapore	583 (4.1)	581 (4.7)	587 (4.5)	583 (4.0)	550 (3.7)	557 (3.7) ▲
Slovak Republic	530 (4.3)	533 (4.6)	509 (5.0)	516 (5.1)	525 (5.2)	536 (4.9) ▲
Slovenia	513 (2.5) ▲	508 (2.6)	530 (2.1)	530 (2.2)	514 (2.5)	520 (3.8)
Sweden	535 (2.7) ▲	527 (3.2)	508 (2.5)	509 (4.0)	533 (3.3)	537 (3.5)
Tunisia	338 (5.8) ▲	310 (6.2)	361 (6.8) ▲	321 (7.1)	339 (7.1) ▲	313 (6.8)
Ukraine	483 (3.1)	481 (2.8)	476 (3.9)	474 (3.0)	474 (4.0)	474 (3.5)
² † United States	538 (3.0)	541 (2.9)	532 (2.5)	536 (2.7)	531 (2.9)	536 (2.7) ▲
Yemen	++	++	++	++	++	++
International Avg.	487 (0.7) ▲	483 (0.8)	486 (0.7) ▲	482 (0.7)	483 (0.7)	485 (0.7)
Benchmarking Participants						
² Alberta, Canada	538 (4.0)	544 (4.0)	533 (3.9)	536 (3.4)	537 (3.9)	551 (3.3) ▲
² British Columbia, Canada	543 (3.8) ▲	534 (3.2)	530 (2.9)	531 (2.9)	534 (3.1)	540 (2.9) ▲
♦♦ ‡ Dubai, UAE	471 (4.2) ▲	446 (5.5)	480 (4.6) ▲	455 (5.8)	481 (4.4) ▲	462 (5.3)
² Massachusetts, US	567 (3.8)	570 (4.6)	555 (5.0)	566 (5.4) ▲	549 (4.9)	567 (5.0) ▲
² † Minnesota, US	543 (6.7)	547 (6.4)	545 (5.6)	545 (6.0)	545 (6.0)	549 (6.3)
² † Ontario, Canada	534 (4.1)	536 (4.3)	532 (4.5)	538 (3.4)	528 (3.8)	531 (3.5)
² Quebec, Canada	524 (3.3)	520 (2.9)	512 (2.9)	515 (3.2)	516 (3.4)	530 (3.0) ▲

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

¹ National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

² National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

♦♦ Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A plus (+) sign indicates average achievement could not be accurately estimated.

Exhibit 3.3 Average Achievement in the Science Content and Cognitive Domains by Gender (Continued)**TIMSS2007**
Science **4th** Grade

Country	Average Scale Scores for Science Cognitive Domains					
	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Algeria	354 (6.6)	346 (5.7)	383 (6.4)	375 (6.3)	368 (6.5) ▲	347 (6.2)
Armenia	494 (6.5) ▲	479 (4.8)	496 (7.3) ▲	478 (5.4)	491 (6.7) ▲	478 (5.0)
Australia	527 (3.3)	531 (3.9)	517 (4.2)	529 (4.0) ▲	534 (4.2)	526 (4.0)
Austria	521 (2.3)	537 (2.8) ▲	519 (2.4)	532 (2.7) ▲	514 (2.9)	513 (3.0)
Chinese Taipei	531 (3.1)	542 (2.6) ▲	554 (3.2)	558 (2.1)	578 (3.2) ▲	564 (2.9)
Colombia	399 (5.8)	419 (5.9) ▲	395 (5.5)	412 (6.0) ▲	405 (5.5)	413 (5.5) ▲
Czech Republic	514 (3.2)	525 (2.8) ▲	509 (3.8)	522 (3.4) ▲	517 (3.5) ▲	504 (3.9)
† Denmark	511 (3.3)	521 (3.7) ▲	512 (3.1)	519 (3.0) ▲	528 (5.4)	523 (3.9)
El Salvador	401 (5.0)	419 (4.6) ▲	384 (4.8)	402 (4.8) ▲	377 (5.7)	376 (5.9)
England	542 (3.5)	544 (3.3)	537 (3.0)	536 (3.1)	541 (3.0) ▲	534 (3.2)
¹ Georgia	435 (3.8)	434 (4.6)	432 (4.5) ▲	416 (5.4)	400 (6.4) ▲	378 (5.4)
Germany	519 (2.8)	536 (2.6) ▲	518 (2.6)	534 (2.5) ▲	524 (2.5)	526 (2.6)
Hong Kong SAR	542 (3.3)	549 (3.8) ▲	547 (3.4)	552 (3.5)	564 (4.3)	558 (5.2)
Hungary	536 (3.8)	544 (3.6)	528 (4.1)	534 (3.5)	534 (5.0)	524 (4.3)
Iran, Islamic Rep. of	442 (5.4)	433 (6.5)	455 (5.7)	446 (5.8)	450 (5.4) ▲	423 (6.6)
Italy	523 (4.0)	537 (4.3) ▲	533 (3.1)	545 (3.6) ▲	523 (3.7)	528 (4.1) ▲
Japan	527 (2.7)	530 (2.8)	544 (3.6)	541 (2.6)	571 (3.1)	564 (2.9)
¹ Kazakhstan	535 (5.5)	532 (6.9)	537 (5.1)	534 (5.8)	519 (5.7)	520 (6.3)
♦♦ Kuwait	388 (4.4) ▲	330 (6.4)	370 (5.2) ▲	304 (6.8)	367 (6.9) ▲	293 (8.2)
¹ Latvia	541 (2.6)	538 (2.8)	537 (2.9)	533 (2.8)	560 (3.3) ▲	542 (4.4)
¹ Lithuania	511 (2.2)	510 (2.3)	515 (2.8)	515 (3.7)	531 (2.5) ▲	518 (3.3)
Morocco	295 (6.6)	286 (7.1)	316 (7.6)	306 (6.9)	323 (6.3)	312 (8.0)
‡ Netherlands	511 (3.0)	524 (3.0) ▲	520 (2.5)	530 (2.8) ▲	526 (3.0)	525 (3.4)
New Zealand	513 (3.1)	508 (3.1)	498 (2.7)	501 (3.2)	514 (3.1) ▲	497 (4.0)
Norway	481 (3.1)	489 (2.9) ▲	476 (3.3)	481 (3.3)	485 (3.8) ▲	475 (3.8)
Qatar	314 (2.9) ▲	293 (2.7)	296 (3.1) ▲	269 (3.4)	308 (3.9) ▲	276 (2.8)
Russian Federation	543 (5.7)	540 (4.7)	547 (5.6)	546 (4.8)	548 (5.4)	537 (4.9)
† Scotland	510 (2.8)	512 (2.5)	491 (2.7)	496 (3.2)	505 (2.6) ▲	496 (3.3)
Singapore	583 (4.6)	591 (4.5) ▲	577 (3.7)	580 (4.2)	575 (4.3) ▲	561 (4.4)
Slovak Republic	522 (4.4)	532 (4.7) ▲	520 (4.8)	533 (4.5) ▲	516 (5.3)	511 (4.9)
Slovenia	512 (2.2)	511 (2.1)	524 (2.7)	526 (2.7)	530 (2.9)	525 (2.4)
Sweden	526 (2.6)	525 (3.6)	521 (3.0)	521 (3.5)	532 (4.0) ▲	523 (3.9)
Tunisia	331 (7.0) ▲	302 (6.2)	344 (6.4) ▲	316 (7.0)	366 (5.9) ▲	334 (5.6)
Ukraine	476 (3.0)	476 (2.8)	475 (3.8)	479 (4.0)	483 (3.7) ▲	474 (3.5)
² † United States	539 (2.6)	544 (2.8)	531 (3.1)	536 (3.2)	536 (3.0)	533 (2.8)
Yemen	++	++	++	++	++	++
International Avg.	484 (0.7)	485 (0.7)	485 (0.7)	484 (0.7)	490 (0.7) ▲	478 (0.7)
Benchmarking Participants						
² Alberta, Canada	543 (3.8)	554 (3.9) ▲	529 (3.8)	540 (4.4) ▲	542 (4.5) ▲	532 (5.0)
² British Columbia, Canada	539 (3.4)	540 (3.0)	532 (3.1)	534 (3.0)	541 (3.9) ▲	531 (3.6)
♦♦ ‡ Dubai, UAE	475 (5.0) ▲	452 (5.3)	473 (5.2) ▲	454 (4.8)	481 (5.4) ▲	445 (5.5)
² Massachusetts, US	560 (4.4)	573 (6.1) ▲	554 (4.8)	573 (5.6) ▲	570 (7.0)	567 (7.9)
² † Minnesota, US	548 (6.8)	552 (6.2)	540 (6.7)	549 (6.0)	551 (6.3)	547 (7.3)
² Ontario, Canada	533 (4.2)	543 (4.1) ▲	527 (4.1)	529 (3.9)	543 (3.9)	539 (3.8)
² Quebec, Canada	514 (3.4)	518 (3.3)	511 (3.1)	520 (3.3) ▲	533 (3.7) ▲	522 (3.7)

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

Exhibit 3.3 Average Achievement in the Science Content and Cognitive Domains by Gender (Continued)

TIMSS2007
Science **8th** Grade

Country	Average Scale Scores for Science Content Domains							
	Biology		Chemistry		Physics		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Algeria	414 (2.3)	409 (2.7)	415 (2.9)	413 (2.1)	392 (2.6)	402 (2.9)	413 (2.4)	413 (2.0)
Armenia	494 (7.4)	487 (5.2)	484 (7.9)	473 (5.7)	504 (7.1)	502 (5.2)	477 (7.3)	472 (5.4)
Australia	515 (5.0)	522 (5.1)	497 (4.3)	512 (5.6)	492 (5.5)	522 (5.6)	505 (5.6)	532 (5.2)
Bahrain	507 (2.0)	441 (2.8)	502 (3.5)	436 (2.6)	488 (2.8)	444 (3.5)	488 (2.8)	443 (3.0)
Bosnia and Herzegovina	466 (3.3)	463 (3.6)	470 (2.9)	466 (3.7)	458 (3.7)	468 (3.7)	466 (3.7)	472 (3.8)
Botswana	374 (3.2)	342 (4.0)	379 (4.2)	363 (4.0)	352 (4.3)	350 (5.2)	371 (4.9)	349 (4.4)
³ Bulgaria	475 (6.1)	459 (7.1)	482 (6.5)	464 (7.1)	467 (6.0)	465 (6.9)	483 (6.0)	476 (6.1)
Chinese Taipei	549 (3.3)	548 (4.1)	575 (4.4)	572 (5.1)	548 (3.6)	561 (4.5)	541 (4.2)	549 (3.4)
Colombia	420 (4.6)	449 (4.0)	408 (3.7)	432 (3.5)	388 (4.6)	427 (3.8)	388 (5.0)	427 (4.5)
Cyprus	455 (3.5)	438 (2.7)	463 (3.1)	442 (3.3)	462 (3.9)	453 (3.5)	463 (2.5)	452 (3.4)
Czech Republic	530 (2.2)	532 (3.4)	534 (3.4)	536 (2.8)	528 (2.8)	546 (2.4)	525 (2.4)	542 (2.7)
Egypt	417 (4.9)	397 (4.4)	426 (5.3)	401 (5.4)	415 (4.9)	412 (4.2)	432 (5.6)	421 (4.8)
El Salvador	392 (4.1)	405 (4.2)	370 (4.7)	384 (4.2)	363 (5.3)	399 (3.4)	384 (4.5)	418 (3.7)
[†] England	539 (4.6)	543 (5.4)	534 (4.3)	534 (5.2)	538 (4.2)	553 (5.4)	523 (5.0)	536 (5.0)
¹ Georgia	434 (3.6)	412 (5.2)	428 (4.8)	407 (5.9)	425 (5.9)	407 (6.4)	437 (4.5)	413 (5.0)
Ghana	291 (6.0)	315 (5.0)	327 (5.6)	355 (5.1)	259 (7.6)	290 (6.2)	279 (7.0)	307 (5.9)
[†] Hong Kong SAR	531 (4.1)	523 (6.2)	522 (4.4)	513 (6.6)	525 (4.7)	532 (6.7)	532 (4.0)	532 (6.2)
Hungary	533 (3.2)	535 (3.0)	534 (3.9)	538 (4.1)	529 (4.2)	553 (3.6)	523 (3.6)	540 (3.3)
Indonesia	432 (3.6)	424 (3.8)	423 (4.3)	418 (3.9)	425 (3.5)	440 (4.2)	439 (4.3)	444 (3.3)
Iran, Islamic Rep. of	456 (4.9)	443 (5.3)	474 (4.9)	453 (5.7)	472 (4.8)	469 (5.3)	479 (6.0)	473 (5.1)
³ Israel	479 (4.7)	465 (5.2)	475 (5.8)	459 (5.3)	472 (5.3)	471 (5.7)	461 (5.0)	464 (4.8)
Italy	501 (3.3)	504 (3.3)	477 (3.0)	484 (3.5)	481 (3.6)	497 (3.6)	496 (3.6)	509 (3.8)
Japan	554 (2.6)	551 (2.5)	554 (2.7)	549 (2.9)	552 (3.2)	565 (2.6)	527 (4.3)	538 (2.6)
Jordan	493 (5.4)	464 (5.2)	514 (5.6)	470 (5.8)	492 (5.9)	467 (5.9)	496 (5.4)	473 (4.9)
Korea, Rep. of	546 (2.8)	549 (2.2)	536 (2.9)	536 (2.7)	564 (2.9)	578 (2.9)	530 (2.6)	546 (2.8)
[‡] Kuwait	442 (3.3)	393 (4.2)	445 (4.5)	386 (5.2)	455 (3.7)	418 (4.3)	427 (3.9)	390 (4.3)
Lebanon	404 (6.1)	407 (7.4)	449 (5.7)	444 (7.0)	424 (5.2)	439 (6.0)	384 (6.0)	395 (8.3)
¹ Lithuania	532 (2.9)	522 (2.8)	512 (3.8)	501 (2.6)	497 (3.6)	514 (3.4)	508 (3.4)	522 (2.8)
Malaysia	476 (6.2)	462 (6.4)	485 (5.6)	472 (5.7)	484 (6.4)	483 (6.3)	463 (5.7)	462 (6.1)
Malta	457 (1.9)	448 (2.7)	462 (2.9)	460 (2.8)	461 (2.3)	479 (2.2)	450 (2.2)	462 (2.3)
Norway	492 (3.0)	482 (2.6)	484 (2.2)	482 (3.7)	468 (2.7)	482 (4.4)	499 (2.8)	505 (3.1)
Oman	442 (4.1)	383 (5.2)	450 (5.2)	380 (4.8)	469 (4.5)	416 (3.8)	461 (3.5)	415 (4.0)
Palestinian Nat'l Auth.	419 (4.9)	384 (6.1)	435 (5.0)	391 (6.4)	428 (5.1)	400 (5.7)	422 (4.5)	395 (5.4)
Qatar	352 (2.1)	284 (2.1)	355 (2.5)	289 (3.0)	379 (1.7)	314 (3.6)	342 (2.2)	282 (2.3)
Romania	468 (3.9)	451 (3.7)	470 (4.6)	457 (4.4)	455 (4.3)	461 (4.6)	469 (3.8)	472 (4.1)
Russian Federation	526 (3.9)	524 (4.5)	533 (3.7)	536 (4.5)	509 (5.0)	530 (4.0)	520 (3.5)	530 (4.0)
Saudi Arabia	433 (3.6)	384 (3.9)	411 (4.3)	371 (3.8)	424 (2.8)	393 (3.7)	442 (3.2)	406 (3.4)
[†] Scotland	495 (3.4)	496 (4.1)	498 (4.0)	496 (4.0)	487 (4.4)	501 (4.7)	491 (4.1)	505 (4.2)
^{1 2} Serbia	479 (3.5)	469 (4.1)	471 (4.3)	463 (4.0)	465 (3.8)	470 (3.8)	463 (4.9)	469 (4.0)
Singapore	570 (4.4)	558 (5.1)	567 (4.2)	554 (5.0)	574 (4.4)	577 (4.6)	543 (4.2)	538 (5.2)
Slovenia	534 (2.9)	526 (3.1)	539 (3.0)	539 (2.8)	520 (2.7)	529 (2.6)	537 (2.5)	547 (3.1)
Sweden	521 (2.8)	509 (2.7)	502 (2.8)	497 (3.0)	501 (3.0)	511 (2.9)	510 (3.5)	510 (3.6)
Syrian Arab Republic	456 (3.8)	463 (3.9)	447 (3.9)	452 (4.1)	441 (3.3)	453 (4.1)	445 (3.6)	452 (5.2)
Thailand	489 (5.1)	468 (4.8)	473 (4.6)	451 (4.5)	460 (4.8)	455 (4.9)	493 (4.2)	484 (4.4)
Tunisia	446 (3.1)	458 (2.8)	450 (2.8)	467 (2.6)	418 (3.2)	447 (3.4)	440 (2.9)	456 (3.2)
Turkey	467 (3.9)	458 (3.7)	443 (5.2)	428 (6.5)	446 (4.5)	445 (4.7)	463 (3.7)	470 (4.5)
Ukraine	481 (3.8)	472 (4.0)	493 (4.1)	487 (3.3)	485 (4.4)	500 (5.1)	476 (5.4)	489 (3.6)
^{2 †} United States	527 (3.2)	533 (2.9)	508 (3.2)	512 (2.9)	491 (3.2)	514 (3.1)	516 (3.5)	534 (3.7)
[‡] Morocco	400 (4.0)	388 (4.3)	418 (4.4)	413 (4.1)	398 (4.2)	412 (3.8)	392 (4.8)	404 (4.8)
International Avg.	471 (0.6)	460 (0.6)	471 (0.6)	460 (0.6)	464 (0.6)	468 (0.6)	466 (0.5)	466 (0.6)

Benchmarking Participants

Basque Country, Spain	493 (3.5)	503 (3.8)	470 (3.8)	475 (5.4)	484 (4.7)	502 (4.5)	501 (4.5)	526 (4.4)
³ British Columbia, Canada	536 (3.7)	533 (3.5)	501 (3.5)	508 (3.4)	509 (2.8)	525 (3.8)	527 (3.1)	533 (3.8)
[‡] Dubai, UAE	493 (5.3)	477 (6.7)	501 (5.3)	485 (6.0)	491 (4.5)	488 (6.0)	495 (5.4)	485 (6.2)
² Massachusetts, US	562 (5.6)	563 (4.3)	539 (4.7)	542 (6.7)	525 (5.6)	544 (5.8)	551 (4.4)	568 (4.5)
^{2 †} Minnesota, US	558 (4.8)	551 (6.9)	516 (5.5)	522 (5.9)	504 (5.2)	525 (5.7)	542 (6.2)	547 (6.2)
² Ontario, Canada	535 (4.1)	540 (4.5)	504 (3.7)	505 (4.0)	511 (5.1)	530 (4.6)	523 (5.4)	536 (4.4)
³ Quebec, Canada	512 (2.9)	513 (4.1)	494 (4.1)	499 (4.5)	486 (4.5)	497 (4.5)	506 (3.3)	520 (4.6)

● Average significantly higher than other gender

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

[‡] Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

[‡] Did not satisfy guidelines for sample participation rates (see Appendix A).

¹ National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

² National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

Exhibit 3.3 Average Achievement in the Science Content and Cognitive Domains by Gender (Continued)**TIMSS2007**
Science **8th** Grade

Country	Average Scale Scores for Science Cognitive Domains					
	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Algeria	409 (2.7)	410 (2.8)	410 (2.7)	411 (3.0)	416 (3.2)	411 (2.9)
Armenia	498 (8.3)	489 (5.6)	505 (6.7)	499 (5.2)	463 (8.5)	456 (5.4)
Australia	488 (4.6)	512 (4.9)	501 (4.3)	519 (4.9)	525 (5.2)	535 (5.2)
Bahrain	499 (2.6)	440 (3.2)	498 (2.4)	440 (2.7)	500 (1.9)	438 (3.3)
Bosnia and Herzegovina	484 (3.9)	488 (4.2)	461 (3.4)	464 (3.1)	449 (3.8)	454 (3.4)
Botswana	376 (3.5)	344 (3.7)	364 (4.0)	351 (3.4)	377 (3.3)	346 (4.0)
³ Bulgaria	493 (6.2)	487 (6.7)	480 (6.6)	463 (7.1)	455 (6.9)	441 (7.0)
Chinese Taipei	560 (3.4)	570 (4.4)	559 (3.8)	562 (3.9)	540 (3.6)	542 (4.0)
Colombia	401 (4.8)	437 (4.2)	400 (3.5)	434 (3.5)	416 (3.8)	440 (3.8)
Cyprus	443 (3.6)	434 (3.1)	465 (2.4)	446 (3.1)	469 (2.9)	450 (2.9)
Czech Republic	526 (2.4)	539 (2.8)	534 (2.5)	544 (2.3)	533 (3.0)	535 (2.8)
Egypt	443 (4.5)	425 (5.3)	411 (4.6)	397 (5.0)	403 (4.0)	388 (4.7)
El Salvador	382 (4.2)	408 (4.3)	377 (4.2)	401 (3.5)	378 (3.9)	390 (5.4)
[†] England	525 (5.1)	537 (6.2)	532 (4.0)	544 (5.3)	547 (4.3)	547 (5.1)
¹ Georgia	453 (4.8)	427 (6.3)	433 (4.9)	410 (5.1)	404 (4.9)	385 (5.7)
Ghana	300 (7.1)	330 (5.9)	271 (6.2)	307 (5.5)	++	++
[†] Hong Kong SAR	528 (3.8)	536 (6.2)	524 (4.6)	520 (6.6)	541 (4.7)	525 (7.0)
Hungary	516 (3.4)	532 (3.6)	543 (3.4)	555 (3.4)	526 (3.7)	534 (3.2)
Indonesia	426 (4.3)	425 (4.2)	423 (3.3)	426 (3.9)	437 (3.7)	440 (3.7)
Iran, Islamic Rep. of	474 (5.0)	464 (5.8)	459 (5.4)	450 (5.4)	471 (4.6)	454 (5.6)
³ Israel	458 (5.4)	455 (6.0)	476 (4.5)	467 (5.5)	487 (5.0)	475 (5.0)
Italy	489 (4.1)	499 (3.6)	493 (3.2)	503 (3.3)	488 (3.4)	497 (2.9)
Japan	530 (3.5)	539 (3.2)	553 (2.8)	557 (2.5)	562 (2.8)	557 (2.7)
Jordan	506 (6.7)	477 (6.2)	501 (5.8)	470 (5.7)	489 (5.3)	454 (5.7)
Korea, Rep. of	535 (2.3)	550 (2.7)	544 (2.8)	550 (2.3)	557 (2.5)	560 (2.6)
[✶] Kuwait	447 (3.1)	409 (4.0)	440 (3.5)	389 (4.6)	437 (3.9)	380 (5.2)
Lebanon	402 (6.0)	404 (7.2)	419 (6.1)	427 (6.8)	418 (5.5)	423 (7.2)
¹ Lithuania	510 (3.0)	516 (2.8)	514 (2.9)	510 (2.4)	527 (3.4)	527 (2.5)
Malaysia	461 (7.0)	454 (7.5)	477 (6.4)	469 (6.6)	492 (5.4)	482 (5.8)
Malta	434 (2.3)	439 (2.1)	461 (2.3)	464 (2.7)	475 (2.4)	472 (2.1)
Norway	486 (3.1)	485 (2.6)	486 (2.5)	486 (2.9)	492 (2.7)	490 (3.6)
Oman	455 (4.3)	399 (5.4)	452 (3.8)	392 (4.2)	457 (4.3)	397 (4.5)
Palestinian Nat'l Auth.	422 (4.6)	391 (5.2)	430 (5.1)	394 (5.4)	415 (5.1)	375 (5.3)
Qatar	361 (3.7)	289 (2.6)	358 (1.9)	285 (2.5)	++	++
Romania	455 (4.7)	447 (4.6)	473 (3.8)	468 (4.1)	466 (4.1)	453 (4.2)
Russian Federation	530 (4.7)	539 (4.4)	523 (4.1)	531 (4.1)	520 (3.7)	521 (4.1)
Saudi Arabia	432 (2.9)	404 (3.7)	426 (3.6)	383 (4.3)	422 (3.5)	371 (3.7)
[†] Scotland	474 (4.4)	487 (4.7)	492 (3.3)	498 (3.8)	511 (3.6)	510 (4.5)
^{1 2} Serbia	487 (3.3)	483 (3.7)	471 (3.6)	468 (4.7)	458 (4.4)	451 (4.3)
Singapore	556 (4.8)	552 (5.2)	570 (4.4)	565 (4.9)	572 (4.2)	556 (4.7)
Slovenia	529 (2.4)	537 (2.8)	532 (3.2)	535 (2.7)	540 (2.7)	536 (3.2)
Sweden	504 (2.8)	505 (3.1)	510 (3.3)	507 (2.9)	521 (3.1)	513 (3.1)
Syrian Arab Republic	471 (3.4)	478 (4.5)	439 (3.6)	451 (4.0)	439 (3.3)	441 (4.0)
Thailand	479 (4.8)	466 (4.9)	480 (4.3)	465 (4.7)	484 (4.1)	462 (4.6)
Tunisia	432 (2.2)	450 (2.8)	435 (2.7)	456 (2.5)	452 (3.5)	465 (2.9)
Turkey	463 (4.0)	461 (3.9)	450 (4.2)	449 (4.1)	469 (3.9)	457 (4.0)
Ukraine	475 (4.5)	479 (4.0)	485 (4.3)	490 (4.3)	488 (4.5)	487 (4.2)
^{2 †} United States	503 (3.4)	521 (3.1)	510 (3.0)	522 (2.9)	528 (3.1)	530 (3.0)
[‡] Morocco	397 (5.2)	394 (4.7)	400 (4.7)	400 (3.9)	415 (3.8)	410 (4.1)
International Avg.	468 (0.6)	464 (0.6)	468 (0.6)	463 (0.6)	477 (0.6)	467 (0.7)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

Benchmarking Participants

Basque Country, Spain	481 (4.0)	499 (3.9)	490 (3.4)	508 (3.8)	495 (4.1)	502 (4.5)
³ British Columbia, Canada	509 (3.1)	523 (3.5)	518 (3.0)	524 (3.2)	536 (3.5)	533 (3.4)
^{✶ †} Dubai, UAE	500 (5.7)	489 (5.8)	493 (5.4)	484 (5.5)	491 (5.1)	475 (6.6)
² Massachusetts, US	538 (4.8)	551 (5.4)	545 (4.2)	555 (5.1)	562 (4.7)	566 (4.3)
^{2 †} Minnesota, US	522 (4.5)	531 (6.5)	531 (5.0)	538 (5.8)	548 (5.2)	542 (6.2)
² Ontario, Canada	500 (3.6)	520 (3.8)	519 (4.2)	526 (4.3)	541 (4.9)	544 (5.2)
³ Quebec, Canada	489 (2.8)	502 (4.2)	497 (3.3)	504 (4.1)	523 (3.1)	523 (4.8)

▲ Average significantly higher than other gender

³ National Defined Population covers less than 90% of National Target Population (but at least 77%, see Appendix A).^{✶ †} Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A plus (+) sign indicates average achievement could not be accurately estimated.



