

Erratum for the TIMSS 2007 Australian report - TIMSS 07: Taking a closer look at mathematics and science in Australia

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Due to an error in the international datasets for all countries, the results for the *Knowing* and *Applying* cognitive domains were inadvertently mislabelled, so that all data labelled *Knowing* actually pertain to *Applying* and all data labelled *Applying* actually pertain to *Knowing* data. This error has been rectified in the on-line version of this report – any written copies should have this erratum attached.

The following pages should be replaced by the accompanying documents:

- Page iv
- Pages 78-90
- Pages 119-131

- *Year 4 science* – Singapore outscored all other participating countries. Australia’s mean score of 527 was similar to eight countries (including Germany and the Netherlands), significantly lower than that of eight countries (including the Asian countries, England and the United States), and significantly higher than that of 19 countries and the TIMSS scale average.
- *Year 8 science* – Singapore and Chinese Taipei outscored all other participating countries. Australia’s mean score of 515 was similar to three countries (including the United States), significantly lower than that of 10 countries (including five Asian countries and England) and significantly higher than that of 35 countries and the TIMSS scale average.

Performance at the international benchmarks:

- *Year 4 mathematics* – While the proportion of Australian Year 4 students at each of the international benchmarks was higher than the international median, the nine per cent reaching the advanced benchmark was considerably less than that of the highest scoring countries. The proportion reaching the low benchmark (91%) was, however, fairly similar to the highest performing countries.
- *Year 8 mathematics* – Six per cent of Australia’s Year 8 students reached the advanced benchmark, which was higher than the international median, and 11 per cent of Australian Year 8 students failed to achieve the low benchmark.
- *Year 4 science* – While the proportion of Australian Year 4 students at each of the international benchmarks was higher than the international median, the 10 per cent reaching the advanced benchmark was less than that of the highest scoring countries. The proportion reaching the low benchmark (93%) was, however, fairly similar to the highest performing countries.
- *Year 8 science* – Eight per cent of Australia’s Year 8 students reaching the advanced benchmark, which was higher than the international median, but much less than that of the highest scoring countries. The proportion reaching the low benchmark (92%) was, however, similar to the proportions of students performing at this level in the highest scoring countries.

Performance in the content and cognitive domains:

- *Year 4 mathematics* – In terms of the mathematics content domains, Australian Year 4 students were strongest in *geometric shapes and measures* and *data display*, rather than in *number*. This pattern of strengths and weaknesses was apparent for all states in the content domains, and in the cognitive domains Year 4 students were strongest in *applying* and *reasoning* rather than *knowing*. The only significant gender differences were in favour of males in the *number* content domain and the *applying* cognitive domain.
- *Year 8 mathematics* – At Year 8, Australian students’ performance in both *algebra* and *geometry* was significantly lower than the TIMSS scale average, while performance in *number* was equivalent, and *data and chance*, as in previous cycles, was found to be a strength. In terms of the cognitive domains, Australian Year 8 students performed at a similar level to the TIMSS scale average in *applying* and *reasoning*, and lower in *knowing*. This pattern of strengths and weaknesses was also apparent for all states. In addition, the gender bias in favour of males was found to be significant for *data and chance*, *number* and *applying*.
- *Year 4 science* – In terms of the content domains, Australian Year 4 students were stronger in *Earth science* and *life science* than in *physical science*. In the cognitive domains, performance in the areas of *reasoning* and *knowing* was relatively strong, while *applying* was the weakest area. This pattern of strengths and weaknesses was apparent for all states. There were no significant gender differences in performance in each of the three content domains.
- *Year 8 science* – In terms of the content domains, Australian Year 8 students were stronger in *Earth science* and *biology* than in *physics* and *chemistry*. In the cognitive domains, *reasoning* was a strength, while *knowing* was an area of relative weakness. This pattern of strengths and weaknesses was apparent for all of the states. The gender difference in overall science achievement in favour of males was also found to be significant in most of the content and cognitive domains, except for *biology* and *reasoning*. The gender difference was largest (around 30 score points) for *Earth science* and *physics*.

Achievement in the TIMSS content and cognitive domains

As outlined in Chapter 2, the TIMSS mathematics assessment can be described in terms of content and cognitive domains. The content domain outlines the subject matter to be assessed: at Year 4, *number, geometric shapes and measures, and data display*; and at Year 8, *number, algebra, geometry, and data and chance*. The cognitive dimension details the thinking processes that students will need to use. At both year levels the cognitive domains are *knowing, applying* and *reasoning*. Each item is associated with a single content domain and a single cognitive domain. This allows student performance to be described in terms of achievement in each of the domains.

To simplify comparisons of student achievement across the domains, the content and cognitive achievement scales at each year level were constructed to have the same average difficulty (see the Reader's Guide). Tables 3.6A and 3.6B present the average achievement in each of the content and cognitive domains for Year 4 and 8 students in each of the participating countries. Countries are displayed in alphabetical order, and to provide a basis for comparison, symbols indicate whether a country's performance is statistically above or below the TIMSS scale average of 500².

Table 3.6A shows Year 4 mathematics content and cognitive domain means for Australia and internationally. At Year 4 level Singapore was the highest achieving country in *number* (611) and *data display* (583), while Hong Kong was the highest achieving country in *geometric shapes and measures* (599). Tunisia was the lowest achieving country in *data display* with an average domain score of 307, while Qatar achieved the lowest in both *geometric shapes and measures* (296) and *number* (292). The performance for both of these countries was significantly lower than the TIMSS scale average for these content domains.

² Note that this refers to the mid-point of the TIMSS achievement scale, and not the average of the country means (or the international average).

Table 3.6A Average achievement in the mathematics content and cognitive domains by country, Year 4

Country	Average Scale Scores for Mathematics Content Domains						Average Scale Scores for Mathematics Cognitive Domains					
	Data Display		Geometric Shapes and Measures		Number		Knowing		Applying		Reasoning	
Algeria	361	(5.2) ▼	383	(4.5) ▼	391	(5.0) ▼	384	(5.4) ▼	376	(5.2) ▼	387	(4.7) ▼
Armenia	458	(4.3) ▼	483	(4.7) ▼	522	(4.0) ▲	518	(4.8) ▲	493	(4.1)	489	(4.7) ▼
Australia	534	(3.1) ▲	536	(3.1) ▲	496	(3.7) ▼	509	(4.2) ▲	523	(3.5) ▲	516	(3.4) ▲
Austria	508	(2.6) ▲	509	(2.4) ▲	502	(2.2)	505	(2.0) ▲	507	(1.8) ▲	506	(2.1) ▲
Chinese Taipei	567	(2.0) ▲	556	(2.2) ▲	581	(1.9) ▲	584	(1.7) ▲	569	(1.7) ▲	566	(1.9) ▲
Colombia	363	(5.9) ▼	361	(4.8) ▼	360	(4.3) ▼	360	(5.2) ▼	357	(5.1) ▼	372	(4.9) ▼
Czech Republic	493	(3.3) ▼	494	(2.8) ▼	482	(2.8) ▼	473	(2.4) ▼	496	(2.7)	493	(3.4) ▼
† Denmark	529	(3.4) ▲	544	(2.6) ▲	509	(2.9) ▲	513	(2.7) ▲	528	(2.5) ▲	524	(2.1) ▲
El Salvador	367	(3.5) ▼	333	(4.3) ▼	317	(3.9) ▼	312	(4.1) ▼	339	(3.7) ▼	356	(4.0) ▼
England	547	(2.5) ▲	548	(2.7) ▲	531	(3.2) ▲	544	(3.6) ▲	540	(3.1) ▲	537	(3.1) ▲
1 Georgia	414	(4.6) ▼	415	(4.8) ▼	464	(3.8) ▼	450	(4.0) ▼	433	(4.5) ▼	437	(4.2) ▼
Germany	534	(3.1) ▲	528	(2.0) ▲	521	(2.2) ▲	514	(2.0) ▲	531	(2.2) ▲	528	(2.5) ▲
Hong Kong SAR	585	(2.7) ▲	599	(3.1) ▲	606	(3.8) ▲	617	(3.5) ▲	599	(3.4) ▲	589	(3.5) ▲
Hungary	504	(3.5)	510	(3.3) ▲	510	(3.7) ▲	511	(3.4) ▲	507	(3.5) ▲	509	(3.8) ▲
Iran, Islamic Rep. of	400	(4.0) ▼	429	(3.3) ▼	398	(3.6) ▼	410	(3.6) ▼	405	(3.7) ▼	410	(3.8) ▼
Italy	506	(3.4)	509	(3.0) ▲	505	(3.2)	514	(3.2) ▲	501	(2.9)	509	(3.1) ▲
Japan	578	(2.8) ▲	566	(2.2) ▲	561	(2.2) ▲	565	(2.1) ▲	566	(2.0) ▲	563	(2.1) ▲
1 Kazakhstan	522	(5.8) ▲	542	(7.4) ▲	556	(6.6) ▲	559	(7.3) ▲	547	(7.2) ▲	539	(6.1) ▲
¿ Kuwait	318	(4.7) ▼	316	(3.6) ▼	321	(3.5) ▼	326	(4.6) ▼	305	(4.1) ▼	+	+
1 Latvia	536	(3.0) ▲	532	(2.6) ▲	536	(2.1) ▲	530	(2.2) ▲	540	(2.5) ▲	537	(2.5) ▲
1 Lithuania	530	(2.9) ▲	518	(2.4) ▲	533	(2.3) ▲	520	(2.8) ▲	539	(2.4) ▲	526	(2.5) ▲
Morocco	316	(6.1) ▼	365	(4.3) ▼	353	(4.7) ▼	354	(4.8) ▼	346	(4.7) ▼	+	+
‡ Netherlands	543	(2.3) ▲	522	(2.3) ▲	535	(2.2) ▲	525	(2.2) ▲	540	(2.0) ▲	534	(2.4) ▲
New Zealand	513	(2.6) ▲	502	(2.3)	478	(2.7) ▼	482	(2.5) ▼	495	(2.3) ▼	503	(2.8)
Norway	487	(2.6) ▼	490	(3.0) ▼	461	(2.8) ▼	461	(2.9) ▼	479	(2.8) ▼	489	(2.7) ▼
Qatar	326	(1.6) ▼	296	(1.4) ▼	292	(1.2) ▼	293	(1.3) ▼	296	(1.2) ▼	+	+
Russian Federation	530	(4.9) ▲	538	(5.1) ▲	546	(4.4) ▲	538	(4.5) ▲	547	(4.8) ▲	540	(4.8) ▲
† Scotland	516	(2.2) ▲	503	(2.6)	481	(2.6) ▼	489	(2.6) ▼	500	(2.4)	497	(2.2)
Singapore	583	(3.2) ▲	570	(3.6) ▲	611	(4.3) ▲	620	(4.0) ▲	590	(3.7) ▲	578	(3.8) ▲
Slovak Republic	492	(4.2)	499	(4.3)	495	(3.9)	492	(3.9) ▲	498	(4.0)	499	(4.0)
Slovenia	518	(2.5) ▲	522	(1.8) ▲	485	(1.9) ▼	497	(1.8)	504	(1.9) ▲	505	(2.1) ▲
Sweden	529	(2.7) ▲	508	(2.3) ▲	490	(2.5) ▼	482	(2.5) ▼	508	(2.2) ▲	519	(2.5) ▲
Tunisia	307	(4.8) ▼	334	(4.5) ▼	352	(4.5) ▼	343	(4.9) ▼	329	(4.8) ▼	+	+
Ukraine	462	(3.2) ▼	457	(2.8) ▼	480	(2.9) ▼	472	(3.0) ▼	466	(3.1) ▼	474	(3.2) ▼
2† United States	543	(2.4) ▲	522	(2.5) ▲	524	(2.7) ▲	541	(2.6) ▲	524	(2.6) ▲	523	(2.2) ▲
Yemen	+	+	+	+	+	+	+	+	+	+	+	+
TIMSS Scale Avg.	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)

▲ 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.

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.

1 National Target Population does not include all of the International Target Population defined by TIMSS.

2 National Defined Population covers 90% to 95% of National Target Population.

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

¿ Kuwait 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.

Australian Year 4 students' achievement in *geometric shapes and measures* and *data display* was significantly higher than the TIMSS scale average. At Year 4, the weakest area for Australian students was *number*.

Table 3.6A also illustrates the broad range of achievement across the countries in the cognitive domains. At Year 4 level, Hong Kong achieved the highest average scale score for mathematics in the *applying* and *reasoning* cognitive domains and Singapore achieved the highest scale score in the *knowing* cognitive domain. Of all the countries participating in TIMSS 2007, 14 achieved their highest average scale score in the *knowing* cognitive domain, while 12 (including Australia) achieved their highest average scale score in the *applying* cognitive domain, and 10 countries achieved their highest average scale score in the *reasoning* cognitive domain. Of the countries achieving their highest scale score in the reasoning cognitive domain, only two countries achieved significantly higher than the TIMSS scale average score. In the *knowing* and *applying* cognitive domains nine countries achieved significantly higher than the TIMSS scale average.

At the lower end of the scale Qatar was the lowest achieving country in the cognitive domains of *knowing* and *applying*, with scores of 293 and 296 respectively, while El Salvador was the lowest achieving country in *reasoning* (356). The cognitive domain scores for both of these countries were significantly lower than the TIMSS scale average.

In terms of the cognitive domains, Australian Year 4 students performed at a level that was statistically significantly higher than the TIMSS scale average in all three cognitive domains.

Table 3.6B shows that, for Year 8 (as at Year 4), the countries scoring highest on the overall mathematics assessment tended also to be the highest-scoring countries in each of the content and cognitive domains, and the lowest-scoring countries overall tended to be those with the lowest scores in the content and cognitive domains.

In the *number* content area, Singapore had the highest average achievement. In *algebra*, Chinese Taipei had the highest achievement, and Chinese Taipei and Korea shared the highest average achievement in *geometry*. In *data and chance*, the highest performing countries were Korea and Singapore. Australian students' performance varied over the different content domains, with the average score in both *algebra* and *geometry* significantly lower than the TIMSS scale averages while the performance in *data and chance* was, as in previous cycles, significantly higher than the TIMSS scale average. There was no statistical difference between the Australian Year 8 students' performance in *number* and the TIMSS scale average for this content domain.

Chinese Taipei was a top-performer across the cognitive domains. Achievement in the *knowing* domain was led by Korea and Chinese Taipei. In the *applying* domain, the three highest achieving countries were Korea, Singapore, and Chinese Taipei.

In terms of the cognitive domains, Australian Year 8 students performed at a similar level to the TIMSS scale average in *applying* and *reasoning*, and lower than the TIMSS scale average in *knowing*.

Table 3.6B Average achievement in the mathematics content and cognitive domains by country, Year 8
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Country	Average Scale Scores for Mathematics Content Domains				Average Scale Scores for Mathematics Cognitive Domains					
	Algebra	Data and Chance	Number	Geometry	Knowing	Applying	Reasoning			
Algeria	349 (2.4) ▼	371 (1.7) ▼	403 (1.7) ▼	432 (2.1) ▼	371 (1.9) ▼	412 (2.0) ▼	+	+		
Armenia	532 (2.5) ▲	427 (3.9) ▲	492 (3.1) ▼	493 (4.1)	507 (3.1) ▲	493 (3.8)		489 (3.8) ▼		
Australia	471 (3.7) ▼	525 (3.2) ▲	503 (3.7)	487 (3.6) ▼	487 (3.3) ▼	500 (3.4)		502 (3.3)		
Bahrain	403 (1.8) ▼	418 (2.1) ▼	388 (2.0) ▼	412 (2.1) ▼	395 (1.7) ▼	403 (1.9) ▼		413 (2.1) ▼		
Bosnia and Herzegovina	475 (3.2) ▼	437 (2.3) ▼	451 (3.0) ▼	451 (3.5) ▼	478 (2.9) ▼	440 (2.6) ▼		452 (2.9) ▼		
Botswana	394 (2.2) ▼	384 (2.6) ▼	366 (2.9) ▼	325 (3.2) ▼	376 (2.1) ▼	351 (2.6) ▼	+	+		
Bulgaria	476 (5.1) ▼	440 (4.7) ▼	458 (4.7) ▼	468 (5.0) ▼	477 (4.7) ▼	458 (4.8) ▼		455 (4.7) ▼		
Chinese Taipei	617 (5.4) ▲	566 (3.6) ▲	577 (4.2) ▲	592 (4.6) ▲	594 (4.5) ▲	592 (4.2) ▲	▲	591 (4.1) ▲		
Colombia	390 (3.1) ▼	405 (3.8) ▼	369 (3.5) ▼	371 (3.3) ▼	364 (3.4) ▼	384 (3.7) ▼		416 (3.3) ▼		
Cyprus	468 (2.0) ▼	464 (1.6) ▼	464 (1.6) ▼	458 (2.7) ▼	468 (1.6) ▼	465 (1.8) ▼		461 (2.1) ▼		
Czech Republic	484 (2.4) ▼	512 (2.8) ▲	511 (2.5) ▲	498 (2.7)	502 (2.5)	504 (2.7)		500 (2.6)		
Egypt	409 (3.3) ▼	384 (3.1) ▼	393 (3.1) ▼	406 (3.4) ▼	392 (3.6) ▼	393 (3.6) ▼		396 (3.4) ▼		
El Salvador	331 (3.7) ▼	362 (3.0) ▼	355 (3.0) ▼	318 (3.7) ▼	336 (3.1) ▼	347 (3.3) ▼	+	+		
† England	492 (4.6)	547 (5.0) ▲	510 (5.0)	510 (4.4) ▲	503 (4.0)	514 (4.9) ▲	▲	518 (4.3) ▲		
1 Georgia	421 (6.6) ▼	373 (4.3) ▼	421 (5.6) ▼	409 (6.7) ▼	427 (5.8) ▼	401 (5.5) ▼		389 (5.8) ▼		
Ghana	358 (3.6) ▼	321 (3.6) ▼	310 (3.9) ▼	275 (4.9) ▼	313 (4.6) ▼	297 (4.2) ▼	+	+		
† Hong Kong SAR	565 (5.6) ▲	549 (4.7) ▲	567 (5.6) ▲	570 (5.5) ▲	574 (5.4) ▲	569 (5.9) ▲	▲	557 (5.6) ▲		
Hungary	503 (3.6)	524 (3.3) ▲	517 (3.6) ▲	508 (3.6) ▲	518 (3.3) ▲	513 (3.1) ▲	▲	513 (3.2) ▲		
Indonesia	405 (3.5) ▼	402 (3.6) ▼	399 (3.7) ▼	395 (4.5) ▼	397 (4.0) ▼	398 (3.7) ▼		405 (3.3) ▼		
Iran, Islamic Rep. of	408 (3.9) ▼	415 (3.5) ▼	395 (3.9) ▼	423 (4.4) ▼	403 (4.1) ▼	402 (4.2) ▼		427 (3.5) ▼		
3 Israel	470 (3.9) ▼	465 (4.4) ▼	469 (3.2) ▼	436 (4.3) ▼	473 (3.7) ▼	456 (4.1) ▼		462 (4.1) ▼		
Italy	460 (3.2) ▼	491 (3.1) ▼	478 (2.8) ▼	490 (3.1) ▼	476 (3.0) ▼	483 (2.9) ▼		483 (2.8) ▼		
Japan	559 (2.5) ▲	573 (2.2) ▲	551 (2.3) ▲	573 (2.2) ▲	560 (2.2) ▲	565 (2.2) ▲	▲	568 (2.4) ▲		
Jordan	448 (4.1) ▼	425 (3.8) ▼	416 (4.3) ▼	436 (3.9) ▼	432 (4.2) ▼	422 (4.1) ▼		440 (3.6) ▼		
Korea, Rep. of	596 (3.0) ▲	580 (2.0) ▲	583 (2.4) ▲	587 (2.3) ▲	596 (2.5) ▲	595 (2.8) ▲	▲	579 (2.3) ▲		
ı Kuwait	354 (3.0) ▼	366 (3.5) ▼	347 (3.1) ▼	385 (2.8) ▼	347 (3.1) ▼	361 (2.7) ▼	+	+		
Lebanon	465 (3.2) ▼	407 (4.4) ▼	454 (3.4) ▼	462 (4.0) ▼	464 (3.9) ▼	448 (4.6) ▼		429 (4.0) ▼		
1 Lithuania	483 (2.7) ▼	523 (2.3) ▲	506 (2.7) ▲	507 (2.6) ▲	508 (2.5) ▲	511 (2.4) ▲	▲	486 (2.5) ▼		
Malaysia	454 (4.3) ▼	469 (4.1) ▼	491 (5.1)	477 (5.6) ▼	477 (4.8) ▼	478 (4.9) ▼		468 (3.8) ▼		
Malta	473 (1.4) ▼	487 (1.4) ▼	496 (1.3) ▼	495 (1.1) ▼	490 (1.6) ▼	492 (1.0) ▼		475 (1.3) ▼		
¶ Morocco	362 (4.0) ▼	371 (3.4) ▼	389 (3.4) ▼	396 (3.6) ▼	365 (4.4) ▼	389 (3.3) ▼		383 (3.5) ▼		
Norway	425 (2.8) ▼	505 (2.5) ▼	488 (2.0) ▼	459 (2.3) ▼	458 (1.8) ▼	477 (2.2) ▼		475 (2.3) ▼		
Oman	391 (3.2) ▼	389 (3.0) ▼	363 (2.7) ▼	387 (3.0) ▼	372 (3.5) ▼	368 (3.0) ▼		397 (3.3) ▼		
Palestinian Nat'l Auth.	382 (3.4) ▼	371 (2.9) ▼	366 (3.2) ▼	388 (3.8) ▼	365 (3.8) ▼	371 (3.4) ▼		381 (3.5) ▼		
Qatar	312 (1.5) ▼	305 (1.6) ▼	334 (1.6) ▼	301 (1.8) ▼	307 (1.4) ▼	305 (1.4) ▼	+	+		
Romania	478 (4.6) ▼	429 (3.7) ▼	457 (3.5) ▼	466 (4.0) ▼	470 (4.2) ▼	462 (4.0) ▼		449 (4.6) ▼		
Russian Federation	518 (4.5) ▲	487 (3.8) ▼	507 (3.8)	510 (4.1) ▲	521 (3.9) ▲	510 (3.7) ▲	▲	497 (3.6)		
Saudi Arabia	344 (2.8) ▼	348 (2.2) ▼	309 (3.3) ▼	359 (2.6) ▼	308 (2.6) ▼	335 (2.3) ▼	+	+		
† Scotland	467 (3.7) ▼	517 (3.5) ▲	489 (3.7) ▼	485 (3.9) ▼	481 (3.3) ▼	489 (3.7) ▼		495 (3.3)		
12 Serbia	500 (3.2)	458 (3.0) ▼	478 (2.9) ▼	486 (3.6) ▼	500 (3.2)	478 (3.3) ▼		474 (3.3) ▼		
Singapore	579 (3.7) ▲	574 (3.9) ▲	597 (3.5) ▲	578 (3.4) ▲	581 (3.4) ▲	593 (3.6) ▲	▲	579 (4.1) ▲		
Slovenia	488 (2.4) ▼	511 (2.3) ▲	502 (2.3)	499 (2.4)	500 (2.2)	503 (2.0)		496 (2.5)		
Sweden	456 (2.4) ▼	526 (3.0) ▲	507 (1.8) ▲	472 (2.5) ▼	478 (2.0) ▼	497 (2.0)		490 (2.6) ▼		
Syrian Arab Republic	406 (3.7) ▼	387 (2.7) ▼	393 (3.4) ▼	417 (3.4) ▼	393 (4.2) ▼	401 (3.4) ▼		396 (3.4) ▼		
Thailand	433 (5.0) ▼	453 (4.1) ▼	444 (4.8) ▼	442 (5.3) ▼	436 (4.8) ▼	446 (4.7) ▼		456 (4.4) ▼		
Tunisia	423 (2.6) ▼	411 (2.3) ▼	425 (2.6) ▼	437 (2.6) ▼	421 (2.6) ▼	423 (2.4) ▼		425 (2.3) ▼		
Turkey	440 (5.1) ▼	445 (4.4) ▼	429 (4.0) ▼	411 (5.1) ▼	439 (4.8) ▼	425 (4.5) ▼		441 (4.2) ▼		
Ukraine	464 (3.9) ▼	458 (3.5) ▼	460 (3.7) ▼	467 (3.6) ▼	471 (3.5) ▼	464 (3.5) ▼		445 (3.8) ▼		
2† United States	501 (2.7)	531 (2.8) ▲	510 (2.7) ▲	480 (2.5) ▼	514 (2.6) ▲	503 (2.9)		505 (2.4) ▲		
TIMSS Scale Avg.	500 (0.0)	500 (0.0)	500 (0.0)	500 (0.0)	500 (0.0)	500 (0.0)		500 (0.0)		

- ▲ 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.

¶ Did not satisfy guidelines for sample participation rates.

1 National Target Population does not include all of the International Target Population defined by TIMSS.

2 National Defined Population covers 90% to 95% of National Target Population.

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

ı Kuwait 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.

Achievement in the content and cognitive domains by state

Tables 3.7A and 3.7B present the means by state for the content and cognitive domains.

Table 3.7A shows the average achievement for each of the states in each of the Year 4 mathematics content and cognitive domains. Students in New South Wales scored significantly higher than students in all states other than Victoria and the Australian Capital Territory in *data display* and *number*, while students in New South Wales and Victoria scored significantly higher than students in all states other than the Australian Capital Territory in *geometric shapes and measures*. Overall, the order of the states in their performance in each of the content and cognitive domains was almost the same, with only very minor shifts depending on the domain.

Table 3.7A Average achievement in the mathematics content and cognitive domains by state, Year 4

	Average Scale Scores for Mathematics Content Domains						Average Scale Scores for Mathematics Cognitive Domains					
	Data Display		Geometric Shapes and Measures		Number		Knowing		Applying		Reasoning	
NSW	551	(5.4)	551	(5.9)	516	(6.8)	531	(7.2)	540	(6.3)	531	(5.9)
VIC	544	(7.1)	551	(6.9)	514	(8.3)	526	(9.2)	537	(8.0)	529	(8.0)
QLD	507	(4.4)	507	(5.3)	462	(6.7)	471	(7.6)	494	(6.5)	489	(5.8)
SA	517	(8.2)	518	(8.3)	468	(9.6)	485	(9.5)	502	(7.9)	499	(7.3)
WA	514	(5.6)	516	(5.3)	473	(7.1)	484	(6.4)	502	(6.4)	500	(5.8)
TAS	526	(6.6)	531	(5.2)	489	(6.5)	500	(6.5)	515	(5.3)	513	(4.5)
NT	510	(11.2)	508	(9.4)	460	(12.3)	473	(9.9)	491	(8.4)	490	(8.3)
ACT	532	(10.4)	532	(9.1)	494	(8.9)	505	(11.4)	519	(8.9)	515	(8.8)

Table 3.7B shows the average achievement for each of the states in each of the Year 8 mathematics content and cognitive domains. For each domain, the Australian Capital Territory had the highest mean score and the Northern Territory the lowest, with the order of the states in-between shifting slightly depending on the domain. However, as for the overall mathematics achievement score, none of the differences between the states were statistically significant.

Table 3.7B Average achievement in the mathematics content and cognitive domains by state, Year 8

	Average Scale Scores for Mathematics Content Domains								Average Scale Scores for Mathematics Cognitive Domains					
	Algebra		Data and Chance		Number		Geometry		Knowing		Applying		Reasoning	
NSW	474	(9.7)	527	(8.4)	504	(9.4)	490	(9.2)	492	(8.7)	502	(9.0)	504	(8.3)
VIC	480	(8.8)	530	(8.3)	511	(8.5)	493	(7.2)	494	(7.3)	508	(7.3)	506	(7.6)
QLD	465	(4.8)	523	(4.6)	499	(4.9)	483	(5.0)	483	(4.2)	495	(5.0)	498	(4.3)
SA	462	(7.0)	522	(6.7)	500	(5.9)	481	(6.6)	481	(5.5)	495	(5.1)	495	(6.0)
WA	459	(7.5)	518	(8.1)	493	(8.3)	479	(7.7)	475	(7.5)	488	(8.1)	495	(7.3)
TAS	459	(6.1)	520	(6.4)	494	(6.5)	480	(6.4)	476	(6.1)	491	(6.3)	497	(6.3)
NT	457	(13.8)	514	(14.1)	491	(14.8)	476	(10.3)	473	(13.7)	485	(13.3)	490	(10.8)
ACT	491	(21.3)	542	(21.1)	526	(22.1)	509	(21.4)	506	(18.9)	521	(20.2)	521	(20.2)

Figures 3.17A and 3.17B highlight relative strengths and weaknesses in the mathematics content and cognitive domains for each of the states, and for Australia as a whole, by profiling average achievement in these domains relative to the overall mathematics achievement for that state. Relative performance is calculated as the difference between average performance in each mathematics content (or cognitive) domain and the average across the content (or cognitive domains). This relative performance is presented in Figures 3.17A and 3.17B as the difference from zero (the average across content or cognitive domains) and is represented by a small circle, with a bar extending above and below the circle to denote the 95% confidence interval.

Figure 3.17A shows the average and confidence intervals for each of the Year 4 mathematics content areas (*data display, geometric shapes and measures* and *number*) and cognitive domains (*knowing, applying* and *reasoning*) for each of the Australian states. For Australia as a whole, Year 4 students performed less well in *number* while they performed considerably better in *geometric shapes and measures*.

In terms of the cognitive domains, Australian Year 4 students performed less well in the *knowing* domain while showing relative strength in the *applying* domain.

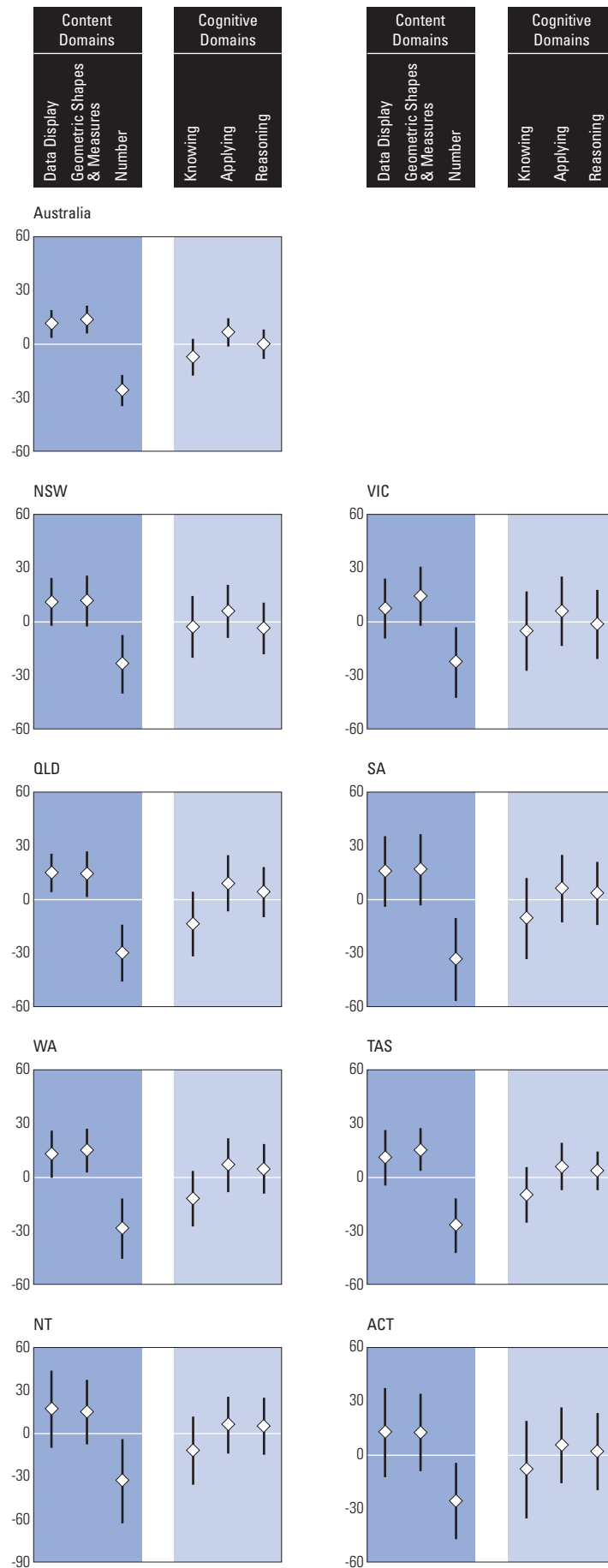


Figure 3.17A Profiles of relative performance in the mathematics content and cognitive domains within Australia and the states, Year 4

When viewed together, Figure 3.17A and 3.17B indicate that the same pattern of strengths and weaknesses in the mathematics content and cognitive domains at both Year 4 and Year 8 can be found in each of the states, and for Australia as a whole. For example, Year 8 students in each of the states performed less well in *algebra* while they performed relatively better in *data and chance*, and this performance pattern was also evident for Australia as a whole.

In terms of the cognitive domains, Year 8 students in Australia and across the states performed relatively equally across all domains. While *knowing* appears to be the relatively weaker domain, this difference was not significant.

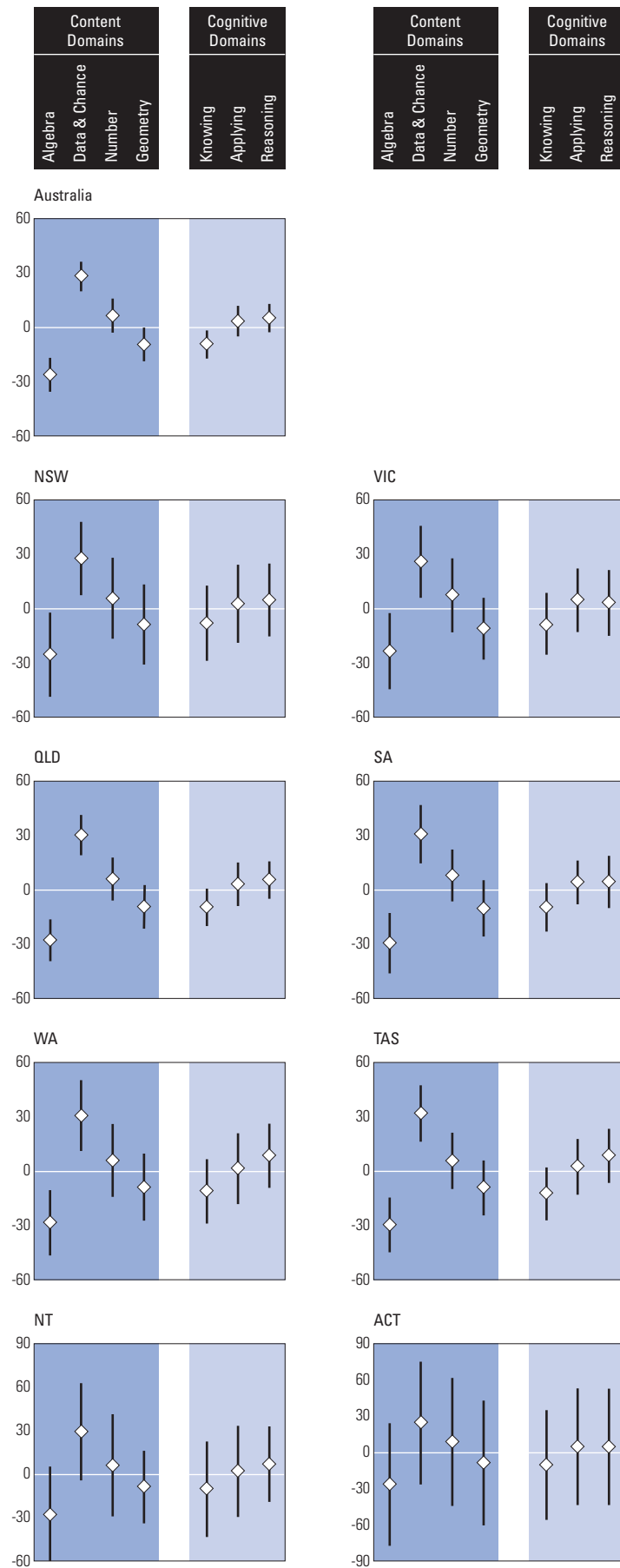


Figure 3.17B Profiles of relative performance in the mathematics content and cognitive domains within Australia and the states, Year 8

Achievement in the content and cognitive domains by gender

Males and females have different strengths and weaknesses across the content and cognitive domains. Tables 3.8A and 3.8B provide the average performance in each of the content and cognitive domains for males and females, across the states.

At the Year 4 level, nationally, males scored significantly higher than females in *number*, while females significantly outperformed males in *data display*. However, there were no statistically significant gender differences within states in the mathematics content domains.

In terms of cognitive domains, nationally, males performed at a significantly higher level than females in the *applying* cognitive domain; however, within states there were no significant differences.

Table 3.8A Average achievement in the mathematics content and cognitive domains by gender within states, Year 4

	Average Scale Scores for Mathematics Content Domains											
	Data Display				Geometric Shapes and Measures				Number			
	Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	554	(6.1)	547	(6.3)	551	(6.5)	552	(6.7)	512	(7.4)	521	(7.9)
VIC	545	(7.8)	543	(8.3)	548	(8.1)	554	(8.1)	506	(8.2)	523	(10.5)
QLD	509	(5.9)	505	(5.0)	507	(6.1)	506	(7.0)	454	(8.5)	471	(8.2)
SA	522	(7.5)	512	(10.7)	522	(8.4)	514	(9.6)	465	(8.9)	470	(13.7)
WA	517	(6.1)	512	(6.3)	515	(5.4)	517	(7.2)	462	(8.3)	483	(7.2)
TAS	528	(8.3)	525	(7.6)	532	(6.2)	529	(6.8)	482	(8.5)	495	(8.3)
NT	512	(11.6)	508	(14.1)	507	(8.0)	509	(12.2)	454	(10.7)	466	(17.6)
ACT	535	(12.7)	529	(10.0)	533	(12.2)	531	(6.9)	487	(13.8)	502	(7.1)
Australia	536	(3.7)	531	(3.1)	535	(3.8)	536	(3.3)	491	(3.9)	503	(4.3)
International Average	483	(0.6)	478	(0.7)	483	(0.6)	479	(0.7)	477	(0.6)	482	(0.7)

	Average Scale Scores for Mathematics Cognitive Domains											
	Knowing				Applying				Reasoning			
	Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	530	(8.0)	533	(7.6)	536	(7.1)	545	(6.7)	530	(6.9)	532	(5.9)
VIC	521	(10.0)	530	(10.1)	530	(7.7)	544	(9.8)	527	(8.6)	532	(9.1)
QLD	467	(9.2)	476	(8.3)	488	(7.9)	500	(7.2)	489	(7.4)	490	(6.3)
SA	485	(9.0)	486	(13.4)	499	(7.0)	504	(11.3)	500	(7.2)	498	(10.3)
WA	476	(7.4)	491	(8.3)	496	(7.6)	509	(6.6)	497	(7.6)	502	(5.6)
TAS	498	(8.8)	502	(8.0)	512	(7.0)	519	(7.5)	516	(6.0)	511	(6.7)
NT	471	(10.3)	475	(15.5)	489	(8.1)	493	(12.7)	490	(7.7)	490	(11.2)
ACT	503	(15.5)	509	(8.9)	516	(12.8)	522	(6.8)	514	(12.2)	517	(6.6)
Australia	506	(5.0)	512	(4.1)	518	(4.0)	528	(3.7)	515	(3.8)	517	(3.4)
International Average	480	(0.7)	480	(0.7)	480	(0.7)	481	(0.7)	501	(0.7)	502	(0.7)

The results presented in Table 3.8B suggest a pattern of apparent higher performance for male students in most states across the content and cognitive domains. Conversely in three states, female students appeared to be performing better than their male counterparts. Further exploration revealed that the only state in which gender differences in performance were statistically significant was Queensland, in which males performed better than females in all content domains apart from *algebra*.

For Australia as a whole, the gender difference in favour of males was statistically significant for the content domains *data and chance* and *number*, and for *applying* in the cognitive domains. This is in contrast to the situation internationally, in which females performed better than males on average in all domains except for *number*, where there was no significant difference between the genders.

Table 3.8B Average achievement in the mathematics content and cognitive domains by gender within states, Year 8

	Average Scale Scores for Mathematics Content Domains															
	Algebra				Data and Chance				Number				Geometry			
	Girls		Boys		Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	461	(15.7)	486	(11.6)	510	(15.1)	542	(10.5)	485	(15.5)	523	(12.7)	478	(14.2)	501	(11.8)
VIC	484	(12.3)	477	(9.7)	527	(11.3)	532	(8.4)	507	(12.1)	515	(8.9)	493	(9.8)	493	(7.6)
QLD	457	(7.9)	472	(4.7)	509	(6.9)	535	(4.7)	483	(6.8)	513	(4.8)	474	(6.9)	492	(5.7)
SA	470	(7.6)	456	(7.5)	523	(8.6)	522	(8.0)	499	(7.2)	500	(7.3)	485	(7.8)	478	(6.7)
WA	457	(10.6)	462	(8.7)	512	(9.5)	524	(10.3)	486	(10.2)	501	(10.4)	474	(8.4)	484	(10.2)
TAS	457	(6.9)	460	(8.8)	516	(7.9)	523	(8.0)	483	(7.0)	503	(9.0)	475	(7.1)	483	(9.1)
NT	461	(13.1)	453	(15.7)	517	(11.7)	511	(18.6)	491	(14.9)	490	(17.3)	482	(7.9)	471	(13.3)
ACT	480	(24.7)	503	(27.3)	532	(24.6)	552	(24.6)	511	(25.5)	542	(27.2)	494	(25.5)	524	(26.5)
Australia	466	(5.6)	475	(5.2)	516	(4.8)	534	(4.8)	492	(5.3)	514	(5.6)	481	(4.8)	493	(5.3)
International Average	457	(0.6)	444	(0.6)	453	(0.5)	449	(0.6)	448	(0.6)	453	(0.6)	454	(0.6)	448	(0.6)

	Average Scale Scores for Mathematics Cognitive Domains											
	Knowing				Applying				Reasoning			
	Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	478	(15.2)	504	(11.0)	486	(15.6)	517	(11.9)	489	(14.7)	519	(10.4)
VIC	495	(9.8)	493	(7.9)	507	(10.1)	508	(7.7)	509	(10.0)	504	(8.3)
QLD	474	(6.0)	491	(4.5)	484	(7.2)	505	(5.3)	487	(6.6)	507	(5.3)
SA	485	(6.9)	478	(6.0)	497	(6.3)	494	(6.6)	498	(8.1)	493	(6.0)
WA	473	(9.1)	478	(9.1)	481	(9.4)	495	(10.6)	490	(8.6)	500	(9.3)
TAS	472	(6.7)	479	(7.7)	483	(7.0)	497	(8.2)	494	(6.7)	499	(8.6)
NT	478	(11.9)	469	(15.9)	487	(11.2)	484	(16.2)	493	(10.6)	488	(12.7)
ACT	494	(22.1)	519	(24.2)	506	(23.6)	537	(25.4)	510	(21.1)	533	(24.3)
Australia	481	(4.9)	493	(4.9)	491	(4.9)	508	(5.2)	495	(4.8)	508	(4.9)
International Average	454	(0.6)	447	(0.6)	452	(0.6)	450	(0.6)	471	(0.6)	465	(0.7)

Summary

This chapter has examined Australian Year 4 and Year 8 students' achievements in mathematics overall, in the content and cognitive domains at both Year 4 and Year 8, and according to background characteristics of interest. In mathematics overall, Year 4 students performed significantly above the TIMSS scale average but Year 8 students performed at a similar level to the TIMSS scale average.

At Year 4, Hong Kong and Singapore outscored all other participating countries. Australia's mean score of 516 was similar to three countries, significantly lower than that of 12 countries, and significantly higher than that of 20 countries and the TIMSS scale average. Australia's average Year 4 mathematics score in TIMSS 2007 was significantly higher than its equivalent score in 2003.

While the proportion of Australian Year 4 students at each of the international benchmarks was higher than the international median, the nine per cent reaching the advanced benchmark was considerably less than that of the highest scoring countries. The proportion reaching the low benchmark was, however, fairly similar to the highest performing countries.

Across the states there were some significant differences in Year 4 mathematics performance. Students in New South Wales performed significantly better than students in all other states. Students in Victoria performed slightly below students in New South Wales, but significantly better than the remaining states, with the exception of the Australian Capital Territory, with which there was no statistically significant difference. Students from the Australian Capital Territory and Tasmania performed significantly better than students in Western Australia, Queensland and the Northern Territory.

In terms of performance at each of the international benchmarks, there was relatively little difference across the states, although a larger proportion of students from New South Wales and Victoria than the other states performed at the advanced benchmark.

There was no significant gender difference in the Year 4 mathematics performance of Australian students. This was similar to the results internationally, in which males and females performed equally well at this level. In Australia, a slightly higher proportion of males achieved at the advanced benchmark, while a similar proportion of males and females achieved at the low benchmark. There were no gender differences across the states.

Students who identified themselves as Indigenous performed at a significantly lower level than both non-Indigenous students and the TIMSS scale average. The proportion of Australian Indigenous students performing at each of the international benchmarks was also less than the international median.

The geographic location of schools had a significant impact on mathematics achievement at Year 4 such that metropolitan students performed better than provincial students, who in turn performed better than students in remote schools. Lower proportions of students from remote schools achieved at each of the higher benchmarks, compared to metropolitan and provincial students.

Students in Year 4 who spoke a language other than English at home achieved significantly lower on average in mathematics than students who predominantly spoke English. In addition, a smaller proportion of students who did not speak English as their main language at home reached the high benchmark and a greater proportion of these students, compared to predominantly English-speaking students, failed to reach the low benchmark.

In terms of the mathematics content domains, Australian Year 4 students were strongest in *geometric shapes and measures* and *data display*, rather than in *number*. This pattern of strengths and weaknesses was apparent for all states in the content domains, and in the cognitive domains Year 4 students were strongest in *applying* and *reasoning* rather than *knowing*. The only significant gender differences were in favour of males in the *number* content domain and the *applying* cognitive domain.

At Year 8, Australia's mean score in mathematics was 496, not significantly different from the TIMSS scale average of 500. Nine countries achieved scores higher than Australia, including the highest scoring countries, Chinese Taipei, Korea and Singapore. Eight countries scored similarly to Australia, while Australia scored significantly higher than 31 countries. Australia's average Year 8 mathematics score in 2007 was significantly lower than in 1995, but not statistically different from the 2003 average score.

Six per cent of Australia's Year 8 students reached the advanced benchmark, which was higher than the international median, and 11 per cent of Australian Year 8 students failed to achieve the low benchmark.

At Year 8 nationally, there was a substantial and significant gender difference in favour of males. More males than females achieved the higher benchmark levels, yet similar proportions of females and males failed to achieve at the low benchmark level. The gender difference in favour of males was only significant in Queensland.

There was little variation and no significant differences between the states in terms of average Year 8 scores. As for performance at each of the benchmarks, there was little variation across the states except for the substantially larger proportion of students achieving the advanced benchmark in the Australian Capital Territory and New South Wales than in the other states.

Year 8 students who identified as Indigenous performed at a significantly lower level than both non-Indigenous students and the TIMSS scale average. The performance of Australian Indigenous students at each of the international benchmarks was also similar to or less than the international median.

The geographic location of schools had limited impact on mathematics achievement at Year 8. There was no significant difference in the average performance of students from metropolitan, provincial or remote areas. However, smaller proportions of remote students compared to metropolitan and provincial students achieved each of the benchmarks.

At Year 8, there was no significant difference in mean mathematics scores according to language background. However, there was a much larger spread of scores for those that spoke a language other than English at home. The proportions of these students who were performing at the advanced benchmark or who were failing to attain the low benchmark was greater than the proportions of English-speaking students at each of these levels.

Parental education was also significantly related to mathematics achievement, with mean mathematics achievement increasing as parental education increased. The proportion of students achieving the advanced and high benchmarks was considerably higher for students with at least one parent completing a university degree than for any other group.

At Year 8, Australian students' performance in both algebra and geometry was significantly lower than the TIMSS scale average, while performance in *number* was equivalent, and *data and chance* was, as in previous cycles, found to be a strength. In terms of the cognitive domains, Australian Year 8 students performed at a similar level to the TIMSS scale average in *applying* and *reasoning*, and lower in *knowing*. This pattern of strengths and weaknesses was also apparent for all states. In addition, the gender bias in favour of males was found to be significant for *data and chance*, *number* and *applying*.

The next chapter will examine Australian Year 4 and Year 8 students' achievements in science overall, and in the specific content and cognitive domains.

Achievement in the TIMSS content and cognitive domains

As outlined in Chapter 2, the TIMSS science assessment can be described in terms of content and cognitive domains. The content domains outline the subject matter to be assessed. At Year 4 the content domains are *life science*, *physical science* and *Earth science*. At Year 8 the content domains are *biology*, *chemistry*, *physics* and *Earth science*. The cognitive domain details the thinking processes that students will need to employ in responding to the questions. At both year levels, the cognitive domains are *knowing*, *applying* and *reasoning*. Each item is associated with a single content domain and a single cognitive domain.

To simplify comparisons of student achievement across the domains, the content and cognitive achievement scales at each year level were constructed to have the same average difficulty (see the Reader's Guide). Tables 4.6A and 4.6B present the average achievement in each of the content and cognitive domains for Years 4 and 8, in each of the participating countries. Countries are displayed in alphabetical order, and to provide a basis for comparison, symbols indicate whether a country's performance is statistically above or below the TIMSS scale average of 500².

Table 4.6A shows science content and cognitive domain means for Australia and the other TIMSS 2007 countries. At Year 4 level, Singapore was the highest achieving country in *life science* (582) and *physical science* (585), while Hong Kong was the highest achieving country in *Earth science* (560). Qatar was the lowest achieving country in *life science* (291) and *physical science* (305), while Morocco was the lowest achieving country in *Earth science* (293). Both of these results were significantly lower than the TIMSS scale average.

Australian Year 4 students' achievement in all three content areas was significantly higher than the TIMSS scale average. At Year 4, the weakest area for Australia was *physical science*, although this result was still significantly higher than the international average. In contrast, Australian students in Year 4 performed the best in *Earth science*. Overall, 13 countries achieved their highest average scale scores in the *physical science* content domain, with a similar number of countries (11) achieving their best in *life science* or *Earth science*.

Table 4.6A also highlights the broad range of achievement across countries in the cognitive domains. At Year 4 level, Singapore achieved the highest average scale score for science in the *knowing* and *applying* cognitive domains, and Chinese Taipei achieved the highest scale score in the *reasoning* cognitive domain. Twenty-one countries achieved significantly higher than the TIMSS scale average in the *reasoning* domain, while in the *applying* domain 21 countries achieved significantly higher than the TIMSS scale average, and 23 countries achieved significantly higher than the scale average in the *knowing* cognitive domain. Australian Year 4 students performed at a level statistically significantly higher than the TIMSS scale average for all three of the cognitive domains.

² Note that this refers to the mid-point of the TIMSS achievement scale and not the average of the country means.

Table 4.6A Average achievement in the science content and cognitive domains by country, Year 4

Country	Average Scale Scores for Science Content Domains						Average Scale Scores for Science Cognitive Domains					
	Earth Science		Life Science		Physical Science		Knowing		Applying		Reasoning	
Algeria	365	(5.7) ▼	351	(6.2) ▼	377	(5.3) ▼	350	(5.8) ▼	379	(5.7) ▼	357	(5.8) ▼
Armenia	479	(5.5) ▼	489	(5.9)	492	(5.1)	486	(5.2) ▼	487	(5.6) ▼	484	(5.3) ▼
Australia	534	(3.2) ▲	528	(3.4) ▲	522	(3.1) ▲	529	(3.1) ▲	523	(3.3) ▲	530	(3.4) ▲
Austria	532	(1.9) ▲	526	(2.0) ▲	514	(2.4) ▲	529	(2.0) ▲	526	(2.2) ▲	513	(2.3) ▲
Chinese Taipei	553	(1.9) ▲	541	(2.1) ▲	559	(2.5) ▲	536	(2.5) ▲	556	(2.1) ▲	571	(2.4) ▲
Colombia	401	(5.6) ▼	408	(5.2) ▼	411	(4.9) ▼	409	(5.5) ▼	404	(5.4) ▼	409	(5.1) ▼
Czech Republic	518	(2.6) ▲	520	(2.9) ▲	511	(2.8) ▲	520	(2.7) ▲	516	(3.1) ▲	510	(2.9) ▲
† Denmark	522	(2.7) ▲	527	(2.4) ▲	502	(2.5)	516	(2.9) ▲	515	(2.6) ▲	525	(3.8) ▲
El Salvador	393	(3.3) ▼	410	(3.6) ▼	392	(3.8) ▼	410	(3.9) ▼	393	(3.6) ▼	376	(4.0) ▼
England	538	(2.9) ▲	532	(2.7) ▲	543	(2.7) ▲	543	(2.9) ▲	536	(2.7) ▲	537	(2.7) ▲
1 Georgia	432	(5.0) ▼	427	(3.5) ▼	414	(4.0) ▼	434	(3.8) ▼	424	(4.1) ▼	388	(4.9) ▼
Germany	524	(2.4) ▲	529	(2.0) ▲	524	(2.5) ▲	527	(2.2) ▲	526	(2.2) ▲	525	(2.3) ▲
Hong Kong SAR	560	(3.2) ▲	532	(3.5) ▲	558	(3.5) ▲	546	(3.2) ▲	549	(3.0) ▲	561	(4.4) ▲
Hungary	517	(3.5) ▲	548	(2.8) ▲	529	(3.3) ▲	540	(3.0) ▲	531	(3.2) ▲	529	(3.7) ▲
Iran, Islamic Rep. of	433	(4.1) ▼	442	(4.4) ▼	454	(4.2) ▼	437	(4.3) ▼	451	(4.3) ▼	436	(4.3) ▼
Italy	526	(3.0) ▲	549	(3.0) ▲	521	(3.1) ▲	530	(3.9) ▲	539	(3.1) ▲	526	(3.8) ▲
Japan	529	(2.7) ▲	530	(2.0) ▲	564	(2.3) ▲	528	(2.2) ▲	542	(2.7) ▲	567	(2.1) ▲
1 Kazakhstan	534	(5.2) ▲	528	(5.0) ▲	528	(5.8) ▲	534	(5.8) ▲	536	(4.9) ▲	519	(5.3) ▲
¿ Kuwait	363	(3.8) ▼	353	(4.9) ▼	345	(5.2) ▼	360	(3.9) ▼	338	(4.3) ▼	331	(5.4) ▼
1 Latvia	536	(2.2) ▲	535	(2.1) ▲	544	(2.4) ▲	540	(2.2) ▲	535	(2.4) ▲	551	(2.7) ▲
1 Lithuania	511	(2.5) ▲	516	(1.8) ▲	514	(1.4) ▲	511	(1.7) ▲	515	(2.8) ▲	524	(2.4) ▲
Morocco	293	(6.2) ▼	292	(6.8) ▼	324	(5.5) ▼	291	(5.8) ▼	311	(6.3) ▼	318	(5.4) ▼
‡ Netherlands	524	(2.5) ▲	536	(2.2) ▲	503	(2.3)	518	(2.5) ▲	525	(2.4) ▲	525	(2.3) ▲
New Zealand	515	(2.6) ▲	506	(2.5) ▲	498	(2.5)	511	(2.5) ▲	500	(2.2)	505	(2.9)
Norway	497	(2.9)	487	(2.5) ▼	469	(2.7) ▼	485	(2.4) ▼	478	(2.8) ▼	480	(3.2) ▼
Qatar	305	(2.2) ▼	291	(1.4) ▼	303	(2.1) ▼	304	(2.3) ▼	283	(2.7) ▼	293	(2.9) ▼
Russian Federation	536	(4.3) ▲	539	(4.1) ▲	547	(4.6) ▲	542	(4.8) ▲	546	(4.7) ▲	542	(4.6) ▲
† Scotland	508	(2.5) ▲	504	(2.2)	499	(1.9)	511	(2.0) ▲	494	(2.4) ▼	501	(2.2)
Singapore	554	(3.3) ▲	582	(4.1) ▲	585	(3.9) ▲	587	(4.1) ▲	579	(3.7) ▲	568	(3.7) ▲
Slovak Republic	530	(4.8) ▲	532	(4.0) ▲	513	(4.6) ▲	527	(4.4) ▲	527	(4.4) ▲	513	(4.9) ▲
Slovenia	517	(2.5) ▲	511	(2.2) ▲	530	(1.6) ▲	511	(1.6) ▲	525	(2.1) ▲	527	(1.8) ▲
Sweden	535	(2.7) ▲	531	(2.5) ▲	508	(2.7) ▲	526	(2.5) ▲	521	(2.9) ▲	527	(3.5) ▲
Tunisia	325	(5.8) ▼	323	(5.6) ▼	340	(6.4) ▼	316	(5.9) ▼	329	(6.3) ▼	349	(5.3) ▼
Ukraine	474	(3.1) ▼	482	(2.5) ▼	475	(2.7) ▼	476	(2.4) ▼	477	(3.2) ▼	478	(3.0) ▼
2† United States	533	(2.6) ▲	540	(2.5) ▲	534	(2.3) ▲	541	(2.3) ▲	533	(2.8) ▲	535	(2.6) ▲
Yemen	+	+	+	+	+	+	+	+	+	+	+	+
TIMSS Scale Avg.	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)

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.

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.

1 National Target Population does not include all of the International Target Population defined by TIMSS.

2 National Defined Population covers 90% to 95% of National Target Population.

¿ Kuwait 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.

Table 4.6B shows that, for Year 8 (as at Year 4), the countries scoring highest on the overall science assessment tended also to be the highest-scoring countries in each of the content and cognitive domains, and the lowest-scoring countries overall tended to be those with the lowest scores in the content and cognitive domains.

In the content area of *biology*, Singapore had the highest average achievement. In *chemistry*, Chinese Taipei had the highest achievement, and Singapore and Korea had the highest average achievement in *physics*. In *Earth science*, the highest performing countries were Chinese Taipei, Slovenia, Singapore and Korea. Australian students' performance in both *Earth science* and *biology* was significantly higher than the TIMSS scale average, while Year 8 students' performance in *chemistry* and *physics* was not statistically different from the TIMSS scale average.

In the *knowing* domain, the top performer was Chinese Taipei, followed by Singapore. Singapore and Chinese Taipei had the highest achievement in the *applying* domain. Singapore, Japan and Korea were the top performers in the *reasoning* domain.

Australian Year 8 students performed higher than the TIMSS scale average in *applying* and *reasoning*, while their average performance in the *knowing* domain was at a similar level to the TIMSS scale average.

Table 4.6B Average achievement in the science content and cognitive domains by country, Year 8
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Country	Average Scale Scores for Science Content Domains								Average Scale Scores for Science Cognitive Domains					
	Chemistry		Earth Science		Biology		Physics		Knowing		Applying		Reasoning	
Algeria	414	(1.7) ▼	413	(1.6) ▼	411	(1.9) ▼	397	(2.2) ▼	409	(1.9) ▼	410	(2.4) ▼	414	(1.9) ▼
Armenia	478	(6.3) ▼	475	(5.8) ▼	490	(5.9) ▼	503	(5.6) ▼	493	(6.4) ▼	502	(5.4) ▼	459	(6.5) ▼
Australia	505	(3.6)	519	(3.8) ▲	518	(3.4) ▲	508	(4.2)	501	(3.1)	510	(3.2) ▲	530	(3.6) ▲
Bahrain	468	(2.4) ▼	465	(2.4) ▼	473	(2.0) ▼	466	(1.5) ▼	469	(2.1) ▼	468	(2.1) ▼	469	(2.0) ▼
Bosnia and Herzegovina	468	(2.9) ▼	469	(3.4) ▼	464	(3.0) ▼	463	(3.1) ▼	486	(3.7) ▼	463	(2.8) ▼	452	(3.1) ▼
Botswana	371	(2.4) ▼	361	(4.0) ▼	359	(2.9) ▼	351	(3.2) ▼	361	(2.9) ▼	358	(3.2) ▼	362	(2.7) ▼
3 Bulgaria	472	(6.1) ▼	480	(5.5) ▼	467	(6.0) ▼	466	(5.6) ▼	489	(5.8) ▼	471	(6.1) ▼	448	(6.1) ▼
Chinese Taipei	573	(4.2) ▲	545	(2.9) ▲	549	(3.4) ▲	554	(3.7) ▲	565	(3.5) ▲	560	(3.4) ▲	541	(3.5) ▲
Colombia	420	(3.1) ▼	407	(3.9) ▼	434	(3.7) ▼	407	(3.5) ▼	418	(4.0) ▼	417	(3.1) ▼	428	(2.7) ▼
Cyprus	452	(2.5) ▼	457	(2.3) ▼	447	(1.9) ▼	458	(2.8) ▼	438	(2.6) ▼	456	(2.0) ▼	460	(2.3) ▼
Czech Republic	535	(2.7) ▲	534	(2.0) ▲	531	(2.1) ▲	537	(2.1) ▲	533	(2.1) ▲	539	(1.9) ▲	534	(2.3) ▲
Egypt	413	(4.0) ▼	426	(3.8) ▼	406	(3.4) ▼	413	(3.3) ▼	434	(3.9) ▼	404	(3.6) ▼	395	(3.4) ▼
El Salvador	377	(3.2) ▼	400	(2.9) ▼	398	(3.0) ▼	380	(3.5) ▼	394	(3.2) ▼	388	(3.2) ▼	384	(3.4) ▼
† England	534	(4.0) ▲	529	(4.3) ▲	541	(4.4) ▲	545	(4.0) ▲	530	(4.9) ▲	538	(4.0) ▲	547	(4.0) ▲
1 Georgia	418	(4.6) ▼	425	(4.1) ▼	423	(3.9) ▼	416	(5.8) ▼	440	(5.1) ▼	422	(4.5) ▼	394	(4.6) ▼
Ghana	342	(4.9) ▼	294	(5.8) ▼	304	(4.9) ▼	276	(5.8) ▼	316	(5.7) ▼	291	(5.5) ▼	+	+
† Hong Kong SAR	517	(4.6) ▲	532	(4.5) ▲	527	(4.6) ▲	528	(4.8) ▲	532	(4.5) ▲	522	(4.9) ▲	533	(5.0) ▲
Hungary	536	(3.5) ▲	531	(2.9) ▲	534	(2.7) ▲	541	(3.2) ▲	524	(3.0) ▲	549	(3.0) ▲	530	(3.0) ▲
Indonesia	421	(3.4) ▼	442	(3.3) ▼	428	(3.1) ▼	432	(3.1) ▼	426	(3.6) ▼	425	(3.1) ▼	438	(3.2) ▼
Iran, Islamic Rep. of	463	(3.5) ▼	476	(3.7) ▼	449	(3.6) ▼	470	(3.6) ▼	468	(3.9) ▼	454	(3.8) ▼	462	(3.8) ▼
3 Israel	467	(4.6) ▼	462	(4.1) ▼	472	(4.2) ▼	472	(4.6) ▼	456	(5.0) ▼	472	(4.2) ▼	481	(4.2) ▼
Italy	481	(2.9) ▼	503	(3.1) ▼	502	(3.0) ▼	489	(3.1) ▼	494	(3.3) ▼	498	(2.9) ▼	493	(2.6) ▼
Japan	551	(1.9) ▲	533	(2.5) ▲	553	(1.9) ▲	558	(1.9) ▲	534	(2.2) ▲	555	(2.0) ▲	560	(2.0) ▲
Jordan	491	(4.1) ▼	484	(3.6) ▼	478	(3.8) ▼	479	(4.2) ▼	491	(4.5) ▼	485	(4.1) ▼	471	(4.1) ▼
Korea, Rep. of	536	(2.4) ▲	538	(2.2) ▲	548	(1.9) ▲	571	(2.4) ▲	543	(2.0) ▲	547	(2.0) ▲	558	(2.0) ▲
¿ Kuwait	418	(3.8) ▼	410	(3.0) ▼	419	(2.6) ▼	438	(2.8) ▼	430	(2.5) ▼	417	(2.9) ▼	411	(2.9) ▼
Lebanon	447	(5.5) ▼	389	(6.4) ▼	405	(6.2) ▼	431	(5.1) ▼	403	(5.9) ▼	422	(5.8) ▼	420	(5.6) ▼
1 Lithuania	507	(2.3) ▲	515	(2.5) ▲	527	(2.3) ▲	505	(2.9) ▼	513	(2.4) ▲	512	(2.2) ▲	527	(2.5) ▲
Malaysia	479	(5.0) ▼	463	(5.4) ▼	469	(5.8) ▼	484	(5.7) ▼	458	(6.5) ▼	473	(5.9) ▼	487	(4.9) ▼
Malta	461	(2.1) ▼	456	(1.5) ▼	453	(1.7) ▼	470	(1.7) ▼	436	(1.5) ▼	462	(1.6) ▼	473	(1.4) ▼
¶ Morocco	416	(3.0) ▼	397	(3.8) ▼	395	(3.5) ▼	405	(3.1) ▼	396	(3.1) ▼	400	(3.3) ▼	413	(3.0) ▼
Norway	483	(2.2) ▼	502	(2.5) ▼	487	(2.3) ▼	475	(3.0) ▼	486	(2.0) ▼	486	(2.3) ▼	491	(2.8) ▼
Oman	416	(3.6) ▼	439	(2.5) ▼	414	(3.1) ▼	443	(2.9) ▼	428	(3.5) ▼	423	(3.2) ▼	428	(3.5) ▼
Palestinian Nat'l Auth.	413	(4.2) ▼	408	(3.7) ▼	402	(4.1) ▼	414	(3.7) ▼	407	(3.5) ▼	412	(4.0) ▼	396	(3.8) ▼
Qatar	322	(1.8) ▼	312	(1.9) ▼	318	(1.7) ▼	347	(2.1) ▼	325	(1.7) ▼	322	(1.5) ▼	+	+
Romania	463	(4.0) ▼	471	(3.3) ▼	459	(3.2) ▼	458	(3.4) ▼	451	(4.2) ▼	470	(3.5) ▼	460	(3.5) ▼
Russian Federation	535	(3.7) ▲	525	(3.4) ▲	525	(3.6) ▲	519	(4.0) ▲	534	(4.3) ▲	527	(3.8) ▲	520	(3.7) ▲
Saudi Arabia	390	(2.5) ▼	423	(2.3) ▼	407	(2.4) ▼	408	(2.3) ▼	417	(2.1) ▼	403	(2.7) ▼	395	(2.5) ▼
† Scotland	497	(3.2) ▼	498	(3.2) ▼	495	(3.2) ▼	494	(3.7) ▼	480	(3.9) ▼	495	(3.1) ▼	511	(3.6) ▲
12 Serbia	467	(3.7) ▼	466	(3.8) ▼	474	(3.2) ▼	467	(3.0) ▼	485	(2.8) ▼	469	(3.6) ▼	455	(3.5) ▼
Singapore	560	(4.1) ▲	541	(4.1) ▲	564	(4.2) ▲	575	(3.9) ▲	554	(4.5) ▲	567	(4.2) ▲	564	(4.1) ▲
Slovenia	539	(2.5) ▲	542	(2.2) ▲	530	(2.3) ▲	524	(2.0) ▲	533	(2.0) ▲	533	(2.2) ▲	538	(2.2) ▲
Sweden	499	(2.4) ▼	510	(3.0) ▲	515	(2.4) ▲	506	(2.7) ▲	505	(2.3) ▲	509	(2.7) ▲	517	(2.6) ▲
Syrian Arab Republic	450	(2.9) ▼	448	(3.2) ▼	459	(2.7) ▼	447	(2.7) ▼	474	(2.9) ▼	445	(3.0) ▼	440	(2.7) ▼
Thailand	462	(4.1) ▼	488	(3.8) ▼	478	(4.5) ▼	458	(4.2) ▼	473	(4.4) ▼	472	(4.1) ▼	473	(4.0) ▼
Tunisia	458	(2.5) ▼	447	(1.8) ▼	452	(2.2) ▼	432	(2.5) ▼	441	(2.0) ▼	445	(2.3) ▼	458	(2.9) ▼
Turkey	435	(5.2) ▼	466	(3.3) ▼	462	(3.4) ▼	445	(4.3) ▼	462	(3.6) ▼	450	(3.6) ▼	462	(3.4) ▼
Ukraine	490	(3.3) ▼	482	(4.0) ▼	477	(3.4) ▼	492	(3.9) ▼	477	(3.8) ▼	488	(3.7) ▼	488	(3.9) ▼
2† United States	510	(2.7) ▲	525	(3.1) ▲	530	(2.8) ▲	503	(2.7) ▼	512	(2.9) ▲	516	(2.7) ▲	529	(2.9) ▲
TIMSS Scale Avg.	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)	500	(0.0)

- ▲ 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.

¶ Did not satisfy guidelines for sample participation rates.

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.

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

¿ Kuwait 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.

Achievement in the content and cognitive domains by state

Tables 4.7A and 4.7B present the average content and cognitive domain scores for the states.

Table 4.7A shows the average achievement for each of the states in each of the Year 4 science content and cognitive domains. For each domain, Victoria had the highest mean score. In contrast, the Northern Territory achieved the lowest mean scores, with the exception being in the content domain of *life science* and the cognitive domains of *applying* and *reasoning*, in which Queensland achieved slightly lower than the Northern Territory. Overall, the order of the states in their performance in each domain was fairly similar, with only minor shifts depending on the domain.

Table 4.7A Average achievement in the science content and cognitive domains by state, Year 4

	Average Scale Scores for Science Content Domains						Average Scale Scores for Science Cognitive Domains					
	Earth Science		Life Science		Physical Science		Knowing		Applying		Reasoning	
NSW	541	(6.0)	536	(5.4)	532	(5.2)	537	(6.0)	533	(5.5)	539	(6.0)
VIC	549	(6.7)	544	(7.6)	534	(6.7)	544	(7.7)	537	(8.7)	545	(8.5)
QLD	514	(6.7)	505	(6.7)	502	(5.9)	507	(6.0)	498	(6.5)	507	(6.6)
SA	523	(8.1)	516	(8.8)	511	(8.2)	519	(9.5)	513	(9.6)	515	(8.2)
WA	523	(6.2)	517	(4.4)	506	(4.2)	516	(5.2)	508	(6.0)	518	(5.5)
TAS	537	(5.8)	536	(5.0)	527	(5.8)	535	(6.5)	529	(6.0)	537	(6.8)
NT	509	(9.3)	508	(9.0)	498	(11.3)	506	(9.9)	500	(10.8)	510	(9.3)
ACT	533	(8.7)	525	(8.3)	520	(8.3)	527	(9.1)	522	(8.9)	533	(9.6)

Table 4.7B shows the average achievement for each of the states on each of the Year 8 science content and cognitive domains. For each domain, the Australian Capital Territory had the highest mean score. The Northern Territory had the lowest mean score in most domains, except for *chemistry* where Western Australia had the equal lowest score, and *Earth science* where Western Australia was lowest. However, as for the overall science achievement score, none of the between-state comparisons were statistically significant.

Table 4.7B Average achievement in the science content and cognitive domains by state, Year 8

	Average Scale Scores for Science Content Domains								Average Scale Scores for Science Cognitive Domains					
	Chemistry		Earth Science		Biology		Physics		Knowing		Applying		Reasoning	
NSW	512	(9.0)	526	(9.5)	524	(9.0)	512	(9.4)	508	(8.4)	515	(8.0)	537	(8.7)
VIC	502	(6.4)	515	(8.2)	517	(7.3)	504	(8.0)	498	(6.3)	507	(6.9)	528	(7.3)
QLD	501	(4.6)	517	(5.2)	516	(4.6)	506	(4.3)	496	(3.9)	508	(4.2)	525	(5.3)
SA	504	(6.3)	519	(7.1)	517	(6.4)	507	(6.6)	497	(6.2)	510	(6.0)	531	(7.6)
WA	496	(6.6)	511	(8.0)	512	(7.7)	503	(7.8)	494	(8.4)	505	(7.3)	523	(8.7)
TAS	498	(6.6)	515	(6.2)	510	(6.2)	503	(7.2)	494	(5.8)	503	(6.3)	527	(7.3)
NT	496	(10.5)	513	(11.1)	505	(11.1)	498	(9.5)	488	(10.0)	501	(8.8)	516	(9.8)
ACT	529	(17.4)	547	(18.8)	538	(19.0)	530	(19.7)	523	(17.9)	532	(18.5)	554	(20.3)

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Figures 4.17A and 4.17B highlight relative strengths and weaknesses in the science content and cognitive domains for each of the states, and for Australia as a whole, by profiling average achievement in these domains relative to the overall science achievement for that state. Relative performance is calculated as the difference between the average performance in each science content (or cognitive) domain and the average across the content (or cognitive domains). This relative performance is presented in Figures 4.17A and 4.17B as the difference from zero (the average across content or cognitive domains) and is represented by a small circle, with a bar extending above and below the circle to denote the 95% confidence interval around this value.

Figure 4.17A shows the average and confidence intervals for each of the Year 4 science content areas (*life science*, *physical science* and *Earth science*) and cognitive domains (*knowing*, *applying* and *reasoning*) for each of the Australian states. For Australia as a whole, Year 4 students performed less well in *physical science* and *life science*, while they performed considerably better in *Earth science*.

In terms of the cognitive domains, Australian Year 4 students performed less well in the *applying* domain while they performed better in the *reasoning* and *knowing* domains.

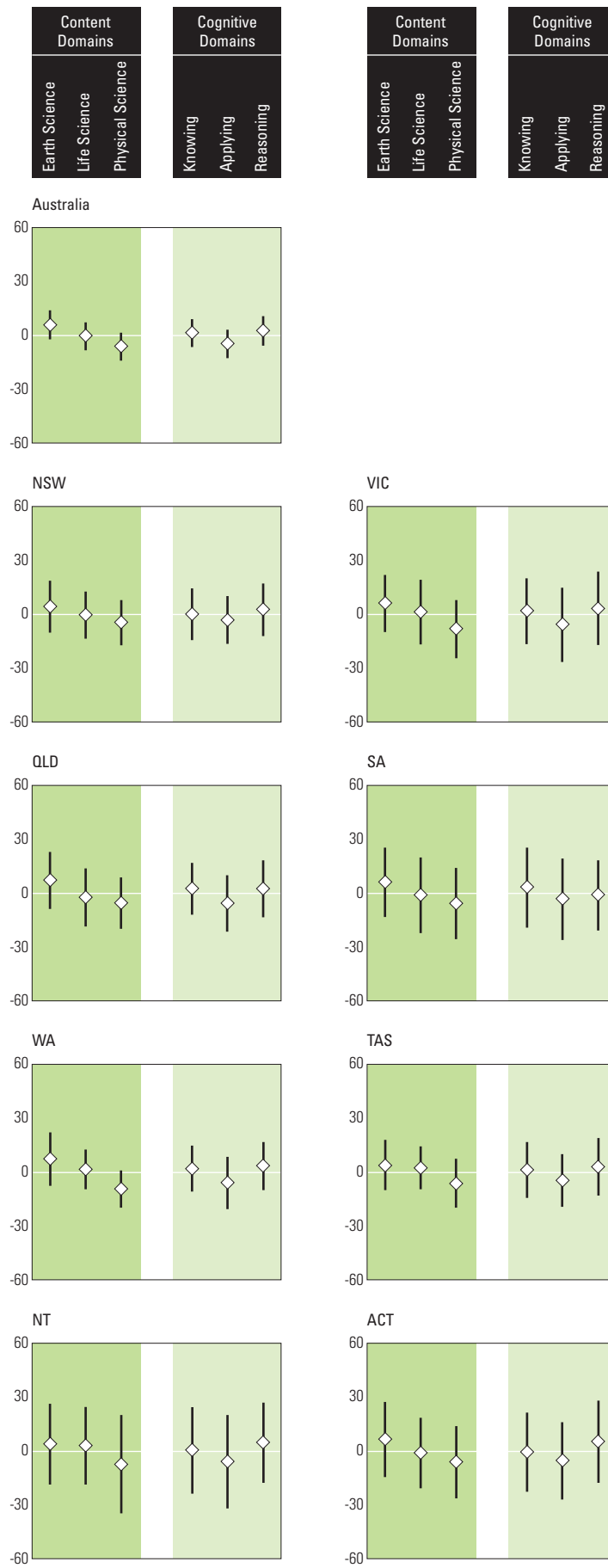


Figure 4.17A Profiles of relative performance in the science content and cognitive domains within Australia and the states, Year 4

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Figure 4.17A and 4.17B show that, at both Year 4 and Year 8, the same pattern of strengths and weaknesses in the science content and cognitive domains can be found in each of the states, mirroring the strengths and weaknesses identified for Australia as a whole. Thus, across the states, as well as for Australia as a whole, Year 8 students performed less well in *chemistry* and *physics* while they performed relatively better in *biology* and *Earth science*.

In terms of the cognitive domains, Australian Year 8 students' achievement in the *knowing* domain was an area of relative weakness, while the *reasoning* domain was an area of relatively stronger performance.

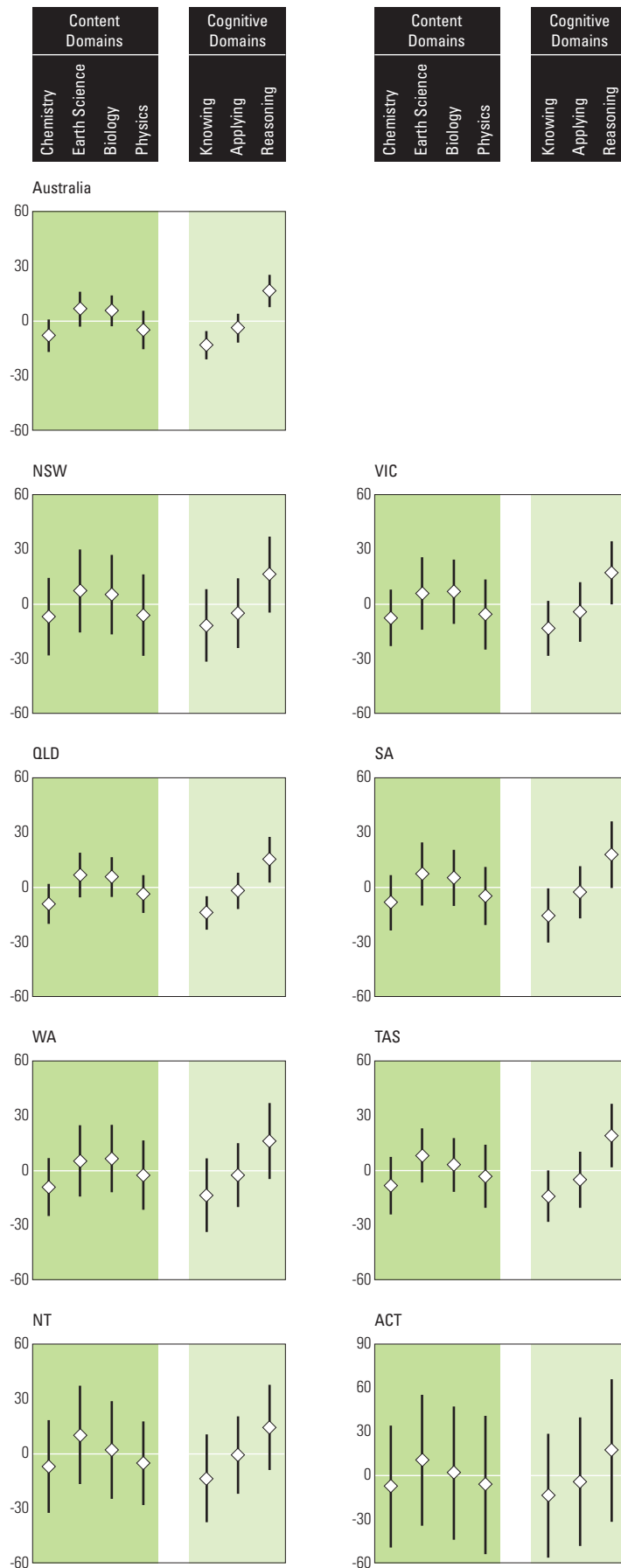


Figure 4.17B Profiles of relative performance in the science content and cognitive domains within Australia and the states, Year 8

Achievement in the content and cognitive domains by gender

Males and females have different strengths and weaknesses across the content and cognitive domains. Tables 4.8A and 4.8B provide the average performance in each of the content and cognitive domains for males and females across the states.

At the Year 4 level there were some apparent variations in performance across the states in the different content areas; however, there were no statistically significant gender differences in the content domains.

Similarly in terms of cognitive domains, while there was some variation in scores, the only significant difference was in *applying* for Australia as a whole.

Table 4.8A Average achievement in the science content and cognitive domains by gender within state, Year 4

	Average Scale Scores for Science Content Domains											
	Earth Science				Life Science				Physical Science			
	Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	535	(7.1)	546	(7.4)	534	(5.3)	538	(7.1)	527	(5.5)	537	(6.9)
VIC	546	(6.7)	552	(9.0)	541	(7.4)	546	(9.6)	532	(6.6)	537	(9.5)
QLD	510	(9.0)	519	(6.4)	505	(8.8)	504	(6.8)	499	(8.7)	504	(5.4)
SA	522	(7.8)	524	(12.3)	519	(7.6)	513	(12.5)	511	(7.9)	511	(11.5)
WA	524	(7.5)	522	(7.8)	519	(6.4)	515	(6.0)	507	(5.4)	505	(5.8)
TAS	534	(5.6)	539	(9.0)	538	(6.4)	534	(7.9)	527	(8.1)	527	(7.8)
NT	505	(12.9)	513	(14.0)	509	(12.8)	507	(16.3)	499	(12.8)	496	(16.7)
ACT	535	(10.4)	531	(9.5)	528	(9.0)	522	(8.1)	523	(9.0)	517	(9.1)
Australia	531	(4.3)	538	(3.6)	528	(3.7)	529	(4.0)	520	(3.4)	525	(3.6)
International Average	483	(0.7)	485	(0.7)	487	(0.7)	483	(0.8)	486	(0.7)	482	(0.7)

	Average Scale Scores for Science Cognitive Domains											
	Knowing				Applying				Reasoning			
	Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	534	(6.1)	540	(8.1)	526	(7.0)	541	(7.7)	539	(6.7)	539	(8.2)
VIC	541	(7.1)	547	(10.5)	530	(9.0)	543	(10.7)	549	(9.2)	541	(10.1)
QLD	503	(8.5)	510	(5.8)	491	(8.8)	506	(6.3)	510	(8.2)	503	(7.0)
SA	521	(6.9)	517	(13.9)	511	(8.1)	514	(13.6)	525	(6.9)	506	(12.0)
WA	516	(7.6)	516	(6.9)	507	(8.3)	510	(6.4)	528	(7.3)	508	(8.2)
TAS	535	(7.9)	535	(9.8)	524	(9.5)	534	(8.2)	545	(10.4)	529	(8.3)
NT	505	(11.6)	507	(13.7)	498	(15.7)	501	(13.4)	520	(11.8)	501	(13.3)
ACT	529	(10.4)	524	(9.6)	522	(11.9)	522	(8.1)	540	(12.0)	523	(11.6)
Australia	527	(3.3)	531	(3.9)	517	(4.2)	529	(4.0)	534	(4.2)	526	(4.0)
International Average	484	(0.7)	485	(0.7)	485	(0.7)	484	(0.7)	490	(0.7)	478	(0.7)

Table 4.8B shows that, for Australia as a whole, the gender differences in favour of males are statistically significant for *chemistry*, *Earth science* and *physics* in the content domains, and for *knowing* and *applying* in the cognitive domains. This is in contrast to the situation internationally, in which females performed better on average than males in *chemistry* and *biology*, while males performed significantly better than females in *physics*. There was no gender difference in achievement internationally in the *Earth science* content domain.

At the state level, all of the significant differences were in favour of males. The gender difference in favour of males was significant in all domains in Queensland. In addition, the gender difference in favour of males for the domains of *Earth science*, *physics* and *knowing* were also significant in New South Wales and Tasmania.

Table 4.8B Average achievement in the science content and cognitive domains by gender within state, Year 8

	Average Scale Scores for Science Content Domains															
	Chemistry				Earth Science				Biology				Physics			
	Girls		Boys		Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	496	(13.3)	526	(12.4)	505	(15.5)	546	(11.5)	513	(14.7)	534	(12.0)	489	(14.8)	534	(11.7)
VIC	503	(8.8)	501	(7.9)	510	(11.5)	521	(7.7)	523	(10.1)	511	(7.8)	496	(10.1)	512	(8.6)
QLD	488	(5.4)	512	(5.8)	498	(8.0)	533	(5.7)	507	(6.8)	523	(5.6)	488	(5.2)	522	(5.7)
SA	505	(7.9)	503	(5.4)	515	(10.1)	523	(5.9)	523	(8.0)	512	(5.6)	499	(8.5)	514	(6.1)
WA	492	(7.7)	501	(7.7)	499	(9.0)	522	(10.9)	509	(9.1)	515	(9.7)	491	(8.2)	515	(9.7)
TAS	491	(7.6)	504	(8.2)	502	(7.7)	525	(8.0)	506	(6.8)	513	(8.7)	489	(9.3)	515	(8.5)
NT	497	(11.4)	495	(12.0)	508	(9.9)	517	(14.0)	510	(10.4)	500	(13.2)	494	(11.6)	501	(11.0)
ACT	520	(24.0)	537	(21.7)	533	(21.6)	560	(23.2)	533	(26.3)	543	(21.5)	514	(23.1)	546	(24.0)
Australia	497	(4.3)	512	(5.6)	505	(5.6)	532	(5.2)	515	(5.0)	522	(5.1)	492	(5.5)	522	(5.6)
International Average	471	(0.6)	460	(0.6)	466	(0.5)	466	(0.6)	471	(0.6)	460	(0.6)	464	(0.6)	468	(0.6)

	Average Scale Scores for Science Cognitive Domains											
	Knowing				Applying				Reasoning			
	Girls		Boys		Girls		Boys		Girls		Boys	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
NSW	489	(14.3)	527	(11.1)	500	(12.1)	530	(10.8)	524	(14.3)	548	(11.5)
VIC	494	(9.0)	502	(6.9)	506	(9.5)	508	(7.6)	533	(9.8)	524	(8.2)
QLD	481	(5.4)	510	(5.2)	496	(5.8)	519	(5.0)	515	(7.4)	534	(5.3)
SA	492	(8.1)	502	(6.4)	508	(8.0)	512	(5.8)	536	(10.6)	527	(6.6)
WA	483	(8.2)	505	(10.5)	498	(7.4)	512	(9.3)	520	(9.0)	527	(11.3)
TAS	481	(7.9)	505	(7.7)	494	(8.3)	511	(8.2)	522	(7.8)	531	(9.8)
NT	483	(10.8)	493	(13.7)	502	(8.0)	501	(12.6)	521	(8.7)	512	(12.9)
ACT	510	(23.0)	535	(19.8)	522	(23.2)	542	(22.2)	548	(26.2)	559	(23.2)
Australia	488	(4.6)	512	(4.9)	501	(4.3)	519	(4.9)	525	(5.2)	535	(5.2)
International Average	468	(0.6)	464	(0.6)	468	(0.6)	463	(0.6)	477	(0.6)	467	(0.7)

Summary

This chapter has described Australian Year 4 and Year 8 students' achievements in science overall, in the content and cognitive domains, and according to background characteristics of interest. Australian students acquitted themselves well in science, with the performance of Australian students at both year levels above the TIMSS scale average, although significantly below that of the highest scoring countries.

At Year 4, Singapore outscored all other participating countries. Australia's mean score of 527 was similar to eight countries, significantly lower than that of eight countries, and significantly higher than that of 19 countries and the TIMSS scale average. Australia's mean score in this cycle of TIMSS has slightly increased since 2003.

While the proportion of Australian Year 4 students at each of the international benchmarks was higher than the international median, the 10 per cent reaching the advanced benchmark was less than that of the highest scoring countries. The proportion reaching the low benchmark was, however, fairly similar to the highest performing countries.

Across the states there were some significant differences in Year 4 performance. Students in Victoria, New South Wales, Tasmania, and the Australian Capital Territory had similar scores, with the first two of these states outperforming students in South Australia, Western Australia, Queensland and the Northern Territory.

In terms of performance at each of the international benchmarks, there was relatively little difference across the states, except for a larger proportion of students achieving the advanced benchmark in Tasmania, Victoria and New South Wales than in the other states.

At Year 4, there was no significant difference between the average performance of males and females in across the states in Australia. This is different to the results internationally where females outperformed males on average. In Australia, a higher proportion of males achieved at the advanced benchmark, while a similar proportion of males and females achieved at the low benchmark. There was no difference across the states in terms of the performance of male and female students.

Students who identified themselves as Indigenous performed at a significantly lower level than both non-Indigenous students and the TIMSS scale average. The performance of Australian Indigenous students at each of the international benchmarks was also less than the international median.

The geographic location of schools had a significant impact on science achievement at Year 4, such that metropolitan students performed better than provincial students, who similarly performed better than students in remote schools. Students from remote schools were much less likely to achieve at each of the benchmarks.

Students in Year 4 who spoke a language other than English at home achieved significantly lower on average in science than students who spoke English only. This was related to a lower proportion of students who spoke a language other than English reaching the advanced benchmark, and far more students who spoke a language other than English not reaching the low benchmark.

In terms of the content domains, Australian Year 4 students were strongest in *Earth science* and *life science* rather than in *physical science*. In the cognitive domains, performance in the areas of *reasoning* and *knowing* was relatively strong, while *applying* was the weakest area. This pattern of strengths and weaknesses was apparent for all states. There were no significant gender differences in performance in each of the three content domains.

At Year 8, Singapore and Chinese Taipei outscored all other participating countries. Australia's mean score of 515 was similar to three countries, significantly lower than that of 10 countries and significantly higher than that of 35 countries and the TIMSS scale average. However, Australia's mean score has decreased significantly since 2003.

While the proportion of Australian Year 8 students at each of the international benchmarks was higher than the international median, the eight per cent reaching the advanced benchmark was much less than that of the highest scoring countries. The proportion reaching the low benchmark was, however, similar to the proportions of students performing at this level in the highest scoring countries.

Performance across the states was fairly uniform at Year 8, with no significant differences in mean scores. There was very little variation in attainment at each of the benchmarks across the states except for the substantially larger proportion of students achieving the advanced benchmark in the Australian Capital Territory and New South Wales than in the other states.

At Year 8, there was a substantial and significant gender difference in favour of males in Australia, while internationally it was female students, on average, who outperformed males. In Australia, the higher performance of males is apparent mainly at the higher benchmarks – there is little difference in the proportion of females and males achieving at the low benchmark. At the state level, the only significant gender difference (in favour of males) was found in Queensland.

Indigenous students performed at a significantly lower level in Year 8 than both non-Indigenous students and the TIMSS scale average. The proportion of Australian Indigenous students performing at each of the international benchmarks was also smaller than the international median.

The geographic location of schools had little impact on science achievement at Year 8. Students in metropolitan and provincial schools performed at the same level, and remote students, while less likely to achieve at the higher benchmarks, were not significantly different from their metropolitan and provincial peers at other levels.

Speaking a language other than English at home was related, on average, to lower achievement in science. However, the spread of scores for these students was quite large, with the proportion of students reaching the advanced benchmark similar to that of English-speaking students, but far more not reaching the low benchmark.

Parental education was also significantly related to science achievement, with mean science achievement increasing as parental education increased. The proportion of students achieving the advanced benchmark was strikingly higher for students with at least one parent completing a university degree compared to all other parental education groups.

In terms of the content domains, Australian Year 8 students were strongest in *Earth science* and *biology* rather than in *physics* and *chemistry*. In the cognitive domains, *reasoning* was a strength, while *knowing* was an area of relative weakness. This pattern of strengths and weaknesses was apparent for all of the states. The gender difference in overall science achievement in favour of males was also found to be significant in most of the content and cognitive domains, except for *biology* and *reasoning*. The gender difference was largest (around 30 score points) for *Earth science* and *physics*.

The next chapter will explore trends over time in the mathematics and science achievement of Australian students.