1 Attainment in TIMSS 2015 in Northern Ireland

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Chapter outline

This chapter summarises pupils' attainment in mathematics and science in Year 6 (Y6) at ages 9-10 in 2015. In each section, the relevant tables of data are presented, accompanied by discussion of the outcomes. Findings for mathematics are discussed followed by findings for science. Outcomes for Northern Ireland are compared with those of other relevant nations.

Key findings

- Pupils in Northern Ireland significantly[2] outperformed 42 of the 50 participating countries in mathematics and were significantly outperformed by five countries.

- The average score for science (520) is lower than for mathematics (570), although still above the TIMSS science international average[3]. Northern Ireland is outperformed by 22 countries in science and is in a group of seven countries scoring similarly.

- Compared with TIMSS 2011, five additional countries significantly outperformed Northern Ireland in the TIMSS 2015 science assessment. This included the comparator country the Republic of Ireland.

- Mathematics and science attainment for 9- and 10-year-olds in Northern Ireland has remained stable. Northern Ireland's mathematics and science scores in 2015 are not significantly different from scores in 2011.

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1.1 Summary of attainment

Tables 1.1 and 1.2 below summarise Northern Ireland's attainment in each subject, taking account of the significance of any apparent differences in attainment. The tables for mathematics and science are presented consecutively and then discussed in turn.

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[2] Throughout this report, the term 'significant' refers to statistical significance.
[3] Throughout this chapter 'international average' refers to the TIMSS scale centre point.

Interpreting the data: performance groups

The TIMSS achievement scales have a centre point of 500 and a standard deviation of 100. The scales are 'standardised' in this way to facilitate comparisons between countries and over time. The summaries below compare the average performance in Northern Ireland in the TIMSS scale for each subject with that of the other participating countries (57 countries[4] in total took part in TIMSS 2015). The summaries indicate whether average scores, which may appear similar, are statistically significantly different from each other.

Countries participating in TIMSS follow guidelines and strict sampling targets to provide samples that are nationally representative. In addition to the participating countries shown in these tables, TIMSS includes 'benchmarking participants'. These are regional entities which follow the same guidelines and targets to provide samples that are representative at regional level. Their results are not reported here but are included in the TIMSS international reports.

Table 1.1   TIMSS 2015 performance groups: mathematics at ages 9-10

HIGHER performance compared with Northern Ireland			
Participants performing at a significantly higher level than Northern Ireland			
Country	Scale score	Country	Scale score
Singapore	618	Chinese Taipei	597
Hong Kong	615	Japan	593
Korea	608		

SIMILAR performance compared with Northern Ireland			
Participants performing at a similar level to Northern Ireland (not significantly different statistically)			
Country	Scale score	Country	Scale score
Northern Ireland	**570**	Russian Federation	564

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[4] Fifty countries and seven benchmarking participants administered the fourth grade assessments (ages 9-10). Each of these participating countries or entities administered the mathematics and science assessment, except Jordan and South Africa who participated in mathematics only. Armenia participated in the Grade 4 assessment but no data is available.

LOWER performance compared with Northern Ireland

Participants performing at a significantly lower level than Northern Ireland

Country	Scale score	Country	Scale score
Norway (5)*	549	Canada	511
Rep. of Ireland	547	Italy	507
England	546	Spain	505
Belgium (Flemish)	546	Croatia	502
Kazakhstan	544	Slovak Republic	498
Portugal	541	New Zealand	491
United States	539	France	488
Denmark	529	Turkey	483
Lithuania	535	Georgia	463
Finland	535	Chile	459
Poland	535	United Arab Emirates	452
Netherlands	530	Bahrain	451
Hungary	529	Qatar	439
Czech Republic	528	Iran	431
Bulgaria	524	Oman	425
Cyprus	523	Indonesia	397
Germany	522	Jordan	388
Slovenia	520	Saudi Arabia	383
Sweden	519	Morocco	377
Serbia	518	South Africa (5)*	376
Australia	517	Kuwait	353

*Norway and South Africa assessed fifth grade pupils.

Table 1.2   TIMSS 2015 performance groups: science at ages 9-10

HIGHER performance compared with Northern Ireland
Participants performing at a significantly higher level than Northern Ireland

Country	Scale score	Country	Scale score
Singapore	590	Hungary	542
Korea	589	Sweden	540
Japan	569	Norway (5)*	538
Russian Federation	567	England	536
Hong Kong	557	Bulgaria	536
Chinese Taipei	555	Czech Republic	534
Finland	554	Croatia	533
Kazakhstan	550	Rep. of Ireland	529
Poland	547	Germany	528
United States	546	Lithuania	528
Slovenia	543	Denmark	527

*Norway assessed fifth grade pupils.

SIMILAR performance compared with Northern Ireland
Participants performing at a similar level to Northern Ireland (not significantly different statistically)

Country	Scale score	Country	Scale score
Canada	525	**Northern Ireland**	**520**
Serbia	525	Spain	518
Australia	524	Netherlands	517
Slovak Republic	520	Italy	516

LOWER performance compared with Northern Ireland
Participants performing at a significantly lower level than Northern Ireland

Country	Scale score	Country	Scale score
Belgium (Flemish)	512	United Arab Emirates	451
Portugal	508	Qatar	436
New Zealand	506	Oman	431
France	487	Iran	421
Turkey	483	Indonesia	397
Cyprus	481	Saudi Arabia	390
Chile	478	Morocco	352
Bahrain	459	Kuwait	337
Georgia	451		

1.1.1 Mathematics attainment: TIMSS 2015

The TIMSS 2015 mathematics score for Y6 pupils in Northern Ireland was 570, above the centre point of the international scale (500) and ranking sixth[5] among participating nations.

Table 1.1 summarises Northern Ireland's performance internationally, taking account of the significance of any apparent differences in attainment. As was the case for TIMSS 2011, Northern Ireland was significantly outperformed by only five of the 50[6] participating countries (all Asian Pacific Rim countries). Only one country, the Russian Federation, performed similarly to Northern Ireland and both significantly outperformed the remaining 42 participating countries.

Overall, Northern Ireland's mathematics performance in TIMSS 2015 was similar to that in 2011.

1.1.2 Science attainment: TIMSS 2011

The TIMSS 2015 science score for Y6 pupils in Northern Ireland was 520, above the centre point of the international scale (500) and ranking 27th among participating nations.[7]

Table 1.2 summarises Northern Ireland's performance internationally, taking account of the significance of any apparent differences in attainment. Although Northern Ireland's average scale score for science was significantly above the international average, as was the case in 2011, pupils did less well comparatively in science than in mathematics at ages 9-10. Whereas five countries outperformed Northern Ireland in TIMSS mathematics, 22 did so in science, including all but one of the selected comparator countries (Australia performed similarly to Northern Ireland). There was some movement amongst the group of countries outperforming Northern Ireland in science, notably the movement of the Republic of Ireland into this group. In 2011 the performance of the Republic of Ireland was not significantly different in science to that of Northern Ireland.

Although the primary level curriculum in Northern Ireland[8] does not include science as a discrete subject - it is covered as part of 'The World Around Us'[9], comparison of the Key Stage 2 curriculum in Northern Ireland and the TIMSS Assessment Framework for science shows that all but one of the TIMSS science topics are included in the Northern Ireland Curriculum at this stage. This comparison also shows that almost two-thirds of Northern

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[5] Rankings should be treated with caution as some apparent differences in attainment may not be statistically significant. See 'Interpreting the data: international rankings' in section 1.2 for more information. In absolute terms, Northern Ireland is ranked sixth, but the Russian Federation ranked seventh has an achievement score that is not significantly different from that of Northern Ireland (see Table 1.1).

[6] Armenia administered the Grade 4 assessment but no data is available, therefore data from 49 countries is available for comparison.

[7] As noted above, rankings should be treated with caution. In absolute terms, Northern Ireland is ranked 27th, but the countries ranked 23rd to 30th have achievement scores that, statistically, are not significantly different from that of Northern Ireland (see Table 1.2).

[8] See CCEA (2007) *The Northern Ireland Curriculum: KS1 and 2*.

[9] See the TIMSS 2015 Encyclopaedia (Mullis *et al.*, 2016b).

Ireland's pupils had been taught these topics before, or were engaged in study of the topics over the TIMSS assessment period (slightly lower than the average internationally).[10]

1.2 Attainment rankings: TIMSS 2015

Tables 1.3 to 1.4 below show the full rankings for each subject, indicating Northern Ireland's ranking in terms of international attainment in the subject concerned. The tables are presented consecutively and then discussed in turn.

Interpreting the data: international rankings

The mean scores on the TIMSS achievement scales (with 95 per cent confidence intervals) are shown graphically as the darkened areas on the achievement distributions, and listed (together with their standard errors) in the 'Average Scale Score' column of the tables. Arrows beside the scores indicate whether the average achievement in that country is significantly higher (upward arrow) or lower (downward arrow) than the TIMSS centre point of 500. The standard error refers to uncertainty in estimates resulting from random fluctuations in samples. The smaller the standard error, the better the score is as an estimate of the population's score. The distribution of attainment is discussed further in Chapter 3.

It is important to bear in mind that small differences may or may not be statistically significant, depending on the size of the standard error for each country. Tables 1.1 and 1.2 identified whether any given difference between Northern Ireland's scores and those of other countries is, or is not, statistically significant. More information is available in Chapter 1 of the international reports (Mullis *et al.*, 2016a; Martin *et al.*, 2016a).

Interpreting the data: participation notes

Northern Ireland almost met the sampling guidelines for participation rates only after replacement schools were included. As the sampling requirements were not quite achieved, further analysis of the sample was undertaken to ensure it was not biased. This further analysis demonstrated that the sample of participating schools for TIMSS 2015 was suitably representative of the Northern Ireland population as a whole and did not differ significantly on any of the stratification variables. Further details of the bias analysis are included in Appendix A.5.

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[10] See Chapter 9 of this report for more information.

Table 1.3 **Mean scores and distribution of mathematics achievement at ages 9-10, TIMSS 2015**

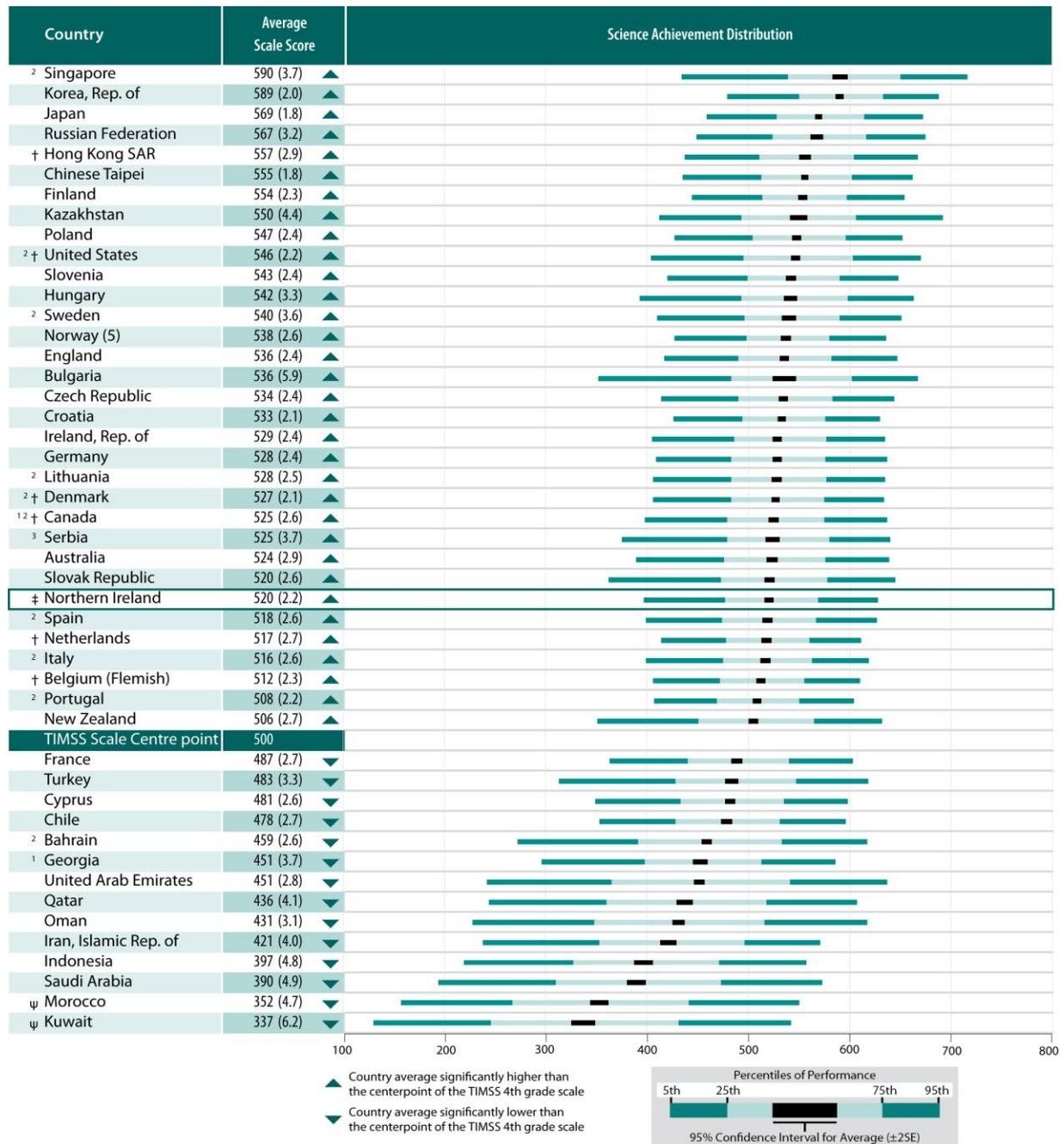| Country	Average Scale Score	Mathematics Achievement Distribution
[2] Singapore	618 (3.8) ▲	
† Hong Kong SAR	615 (2.9) ▲	
Korea, Rep. of	608 (2.2) ▲	
Chinese Taipei	597 (1.9) ▲	
Japan	593 (2.0) ▲	
‡ Northern Ireland	570 (2.9) ▲	
Russian Federation	564 (3.4) ▲	
Norway (5)	549 (2.5) ▲	
Ireland, Rep. of	547 (2.1) ▲	
England	546 (2.8) ▲	
† Belgium (Flemish)	546 (2.1) ▲	
Kazakhstan	544 (4.5) ▲	
[2] Portugal	541 (2.2) ▲	
[2] † United States	539 (2.3) ▲	
[2] † Denmark	539 (2.7) ▲	
[2] Lithuania	535 (2.5) ▲	
Finland	535 (2.0) ▲	
Poland	535 (2.1) ▲	
† Netherlands	530 (1.7) ▲	
Hungary	529 (3.2) ▲	
Czech Republic	528 (2.2) ▲	
Bulgaria	524 (5.3) ▲	
Cyprus	523 (2.7) ▲	
Germany	522 (2.0) ▲	
Slovenia	520 (1.9) ▲	
[2] Sweden	519 (2.8) ▲	
[3] Serbia	518 (3.5) ▲	
Australia	517 (3.1) ▲	
[1][2] † Canada	511 (2.3) ▲	
[2] Italy	507 (2.6) ▲	
[2] Spain	505 (2.5) ▲	
Croatia	502 (1.8)	
TIMSS Scale Centre point	500	
Slovak Republic	498 (2.5)	
New Zealand	491 (2.3) ▼	
France	488 (2.9) ▼	
Turkey	483 (3.1) ▼	
[1] Georgia	463 (3.6) ▼	
Chile	459 (2.4) ▼	
United Arab Emirates	452 (2.4) ▼	
[2] Bahrain	451 (1.6) ▼	
Qatar	439 (3.4) ▼	
Iran, Islamic Rep. of	431 (3.2) ▼	
Oman	425 (2.5) ▼	
Indonesia	397 (3.7) ▼	
Jordan	388 (3.1) ▼	
Ψ Saudi Arabia	383 (4.1) ▼	
Morocco	377 (3.4) ▼	
South Africa (5)	376 (3.5) ▼	
Ψ Kuwait	353 (4.6) ▼	

100   200   300   400   500   600   700   800

▲ Country average significantly higher than the centerpoint of the TIMSS 4th grade scale

▼ Country average significantly lower than the centerpoint of the TIMSS 4th grade scale

Percentiles of Performance
5th   25th   75th   95th

95% Confidence Interval for Average (±2SE)

Ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix C.1 for target population coverage notes 1, 2, and 3. See Appendix C.7 for sampling guidelines and sampling participation notes †, ‡, and ‡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Source: Exhibit 1.1, International mathematics report (Mullis *et al.*, 2016a).

Table 1.4   Mean scores and distribution of science achievement at ages 9-10, TIMSS 2015

Country	Average Scale Score	Science Achievement Distribution
2 Singapore	590 (3.7) ▲	
Korea, Rep. of	589 (2.0) ▲	
Japan	569 (1.8) ▲	
Russian Federation	567 (3.2) ▲	
† Hong Kong SAR	557 (2.9) ▲	
Chinese Taipei	555 (1.8) ▲	
Finland	554 (2.3) ▲	
Kazakhstan	550 (4.4) ▲	
Poland	547 (2.4) ▲	
2 † United States	546 (2.2) ▲	
Slovenia	543 (2.4) ▲	
Hungary	542 (3.3) ▲	
2 Sweden	540 (3.6) ▲	
Norway (5)	538 (2.6) ▲	
England	536 (2.4) ▲	
Bulgaria	536 (5.9) ▲	
Czech Republic	534 (2.4) ▲	
Croatia	533 (2.1) ▲	
Ireland, Rep. of	529 (2.4) ▲	
Germany	528 (2.4) ▲	
2 Lithuania	528 (2.5) ▲	
2 † Denmark	527 (2.1) ▲	
1 2 † Canada	525 (2.6) ▲	
3 Serbia	525 (3.7) ▲	
Australia	524 (2.9) ▲	
Slovak Republic	520 (2.6) ▲	
‡ Northern Ireland	520 (2.2) ▲	
2 Spain	518 (2.6) ▲	
† Netherlands	517 (2.7) ▲	
2 Italy	516 (2.6) ▲	
† Belgium (Flemish)	512 (2.3) ▲	
2 Portugal	508 (2.2) ▲	
New Zealand	506 (2.7) ▲	
TIMSS Scale Centre point	**500**	
France	487 (2.7) ▼	
Turkey	483 (3.3) ▼	
Cyprus	481 (2.6) ▼	
Chile	478 (2.7) ▼	
2 Bahrain	459 (2.6) ▼	
1 Georgia	451 (3.7) ▼	
United Arab Emirates	451 (2.8) ▼	
Qatar	436 (4.1) ▼	
Oman	431 (3.1) ▼	
Iran, Islamic Rep. of	421 (4.0) ▼	
Indonesia	397 (4.8) ▼	
Saudi Arabia	390 (4.9) ▼	
ψ Morocco	352 (4.7) ▼	
ψ Kuwait	337 (6.2) ▼	

▲ Country average significantly higher than the centerpoint of the TIMSS 4th grade scale

▼ Country average significantly lower than the centerpoint of the TIMSS 4th grade scale

Percentiles of Performance
5th   25th   75th   95th
95% Confidence Interval for Average (±2SE)

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

See Appendix C.1 for target population coverage notes 1, 2, and 3. See Appendix C.7 for sampling guidelines and sampling participation notes †, ‡, and ‡.

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

Source: Exhibit 1.1, International science report (Martin *et al.*, 2016a).

Although the scores for both subjects in Northern Ireland are significantly above the international average, the ranking for mathematics is notably higher than for science. Sections 1.2.1 and 1.2.2 below outline this difference in more detail.

1.2.1 Mathematics attainment, TIMSS 2015

Table 1.3 emphasises how well Northern Ireland performed in TIMSS 2015 mathematics. The mean scale score of 570 is 48 scale points behind that of the highest performing country, Singapore, and 217 scale points ahead of the lowest performing country, Kuwait.

As was the case in 2011, only two of the comparator countries outperformed Northern Ireland (Singapore and Hong Kong at 618 and 615 respectively). The remaining comparator countries performed significantly less well than Northern Ireland in mathematics. Of these, the nearest scoring comparator countries were the Republic of Ireland (547) and England (546). This is a slightly different picture to that seen in 2011 where Finland was the nearest scoring comparator country. The lowest scoring comparator country in 2015 was Australia, with a scale score of 517, 53 points below Northern Ireland, but still 17 scale points above the international average.

Rankings can be volatile, varying according to the mix of countries participating in any given cycle. However, measurement of trends can indicate progress in a more stable fashion, since the outcomes from successive cycles of TIMSS are analysed on comparable scales. Figure 1.1 shows that mathematics attainment of 9- and 10-year-olds in Northern Ireland has remained stable since the last TIMSS cycle in 2011. Northern Ireland's score then was 562, and although this is 8 points lower, it is not significantly different statistically from the 2015 score of 570.

Figure 1.1   Trends in Y6 mathematics achievement in Northern Ireland
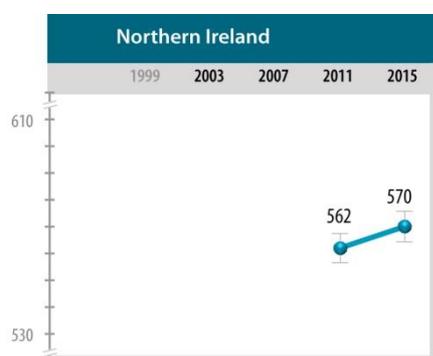
Source: Exhibit 1.5, International mathematics report (Mullis *et al.*, 2016a).

As shown in Figure 1.2, the majority of the comparator countries had higher scale scores in mathematics in 2015 compared with 2011. In Singapore, Hong Kong, the Republic of Ireland and Poland the overall mathematics achievement in 2015 was significantly higher than in 2011. In contrast, in Finland, mathematics achievement in 2015 was significantly lower than in 2011.

Figure 1.2   TIMSS mathematics achievement in 2015 compared with TIMSS 2011
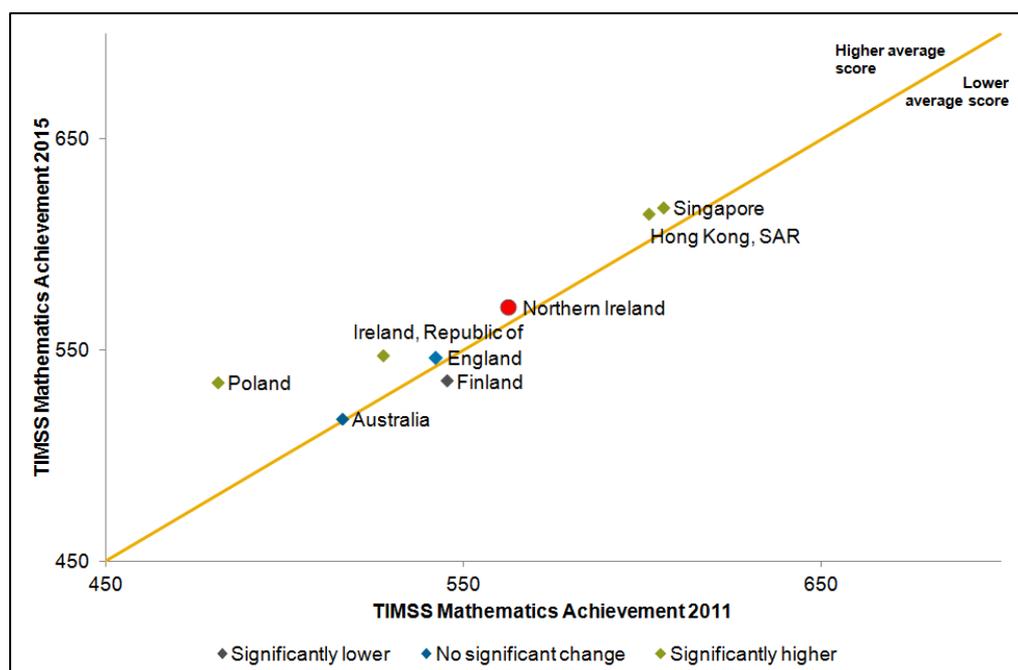

1.2.2 Science attainment, TIMSS 2011

Table 1.4 shows that, as in 2011, Northern Ireland's average scale score for science is significantly above the international average (517 in 2011 and 520 in 2015); performance in science, however, compares somewhat less favourably than mathematics in international terms. In science, Northern Ireland is 70 scale points behind the highest performing country (Singapore), although still 183 scale points ahead of the lowest performing country (Kuwait).

In science, Northern Ireland was outperformed by six of the seven comparator countries (Singapore, Hong Kong, Finland, Poland, England and the Republic of Ireland, with scores between 590 and 529 respectively). Australia's performance, with a scale score of 524, was not significantly different. When examining Northern Ireland's performance against that of the comparator countries, the main change since 2011 is that the Republic of Ireland now outperforms Northern Ireland in science, having performed similarly in 2011.

As noted, rankings can be volatile, varying according to which countries have participated in the survey. A trend analysis can indicate progress in a more stable fashion since the outcomes from successive cycles of TIMSS are analysed on comparable scales. As shown in Figure 1.3, the science attainment of 9- and 10-year-olds in Northern Ireland has remained stable since the last round of TIMSS in 2011. Northern Ireland's score then was 517, not significantly different from its 2015 score of 520.

As is the case for mathematics, the majority of the comparator countries had higher scale scores in science in 2015 compared with 2011. Hong Kong, Poland the Republic of Ireland and Australia had significantly higher science achievement in 2015. In Finland, reflecting what was seen in mathematics, science achievement in 2015 was significantly lower than in 2011 (Figure 1.4).

Figure 1.3   Trends in Y6 science achievement in Northern Ireland
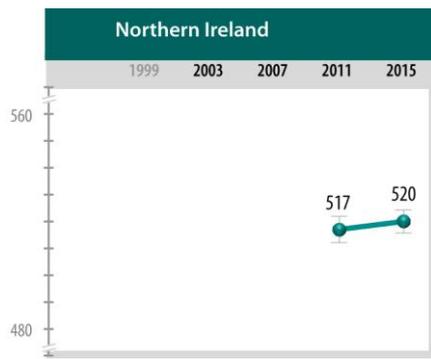
Source: Exhibit 1.5, International science report (Martin *et al.*, 2016a).

Figure 1.4   TIMSS science achievement in 2015 compared with TIMSS 2011
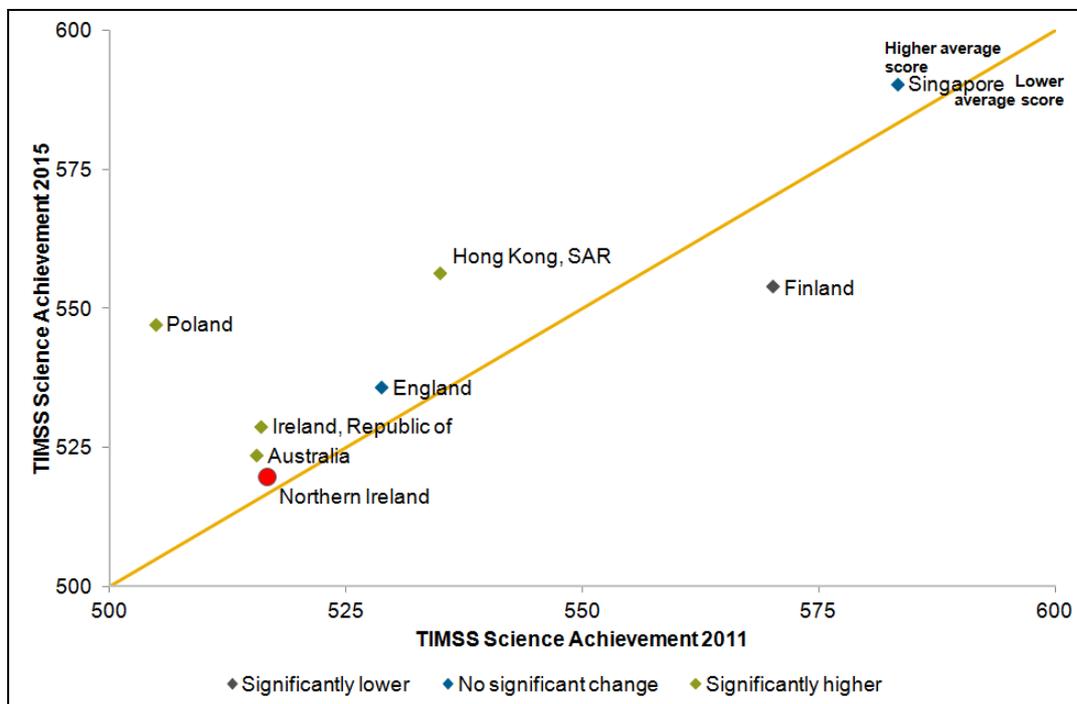
1.3 Conclusion

Pupils in Northern Ireland performed very well in TIMSS 2015 mathematics and were outperformed by only five of the 50 participating countries. Performance in science is notably weaker although still significantly above the international average.

Overall, mathematics and science achievement in Northern Ireland is similar to that in TIMSS 2011; Northern Ireland's scores in 2015 are not significantly different statistically from those in 2011. This shows that the performance of pupils in Northern Ireland in mathematics and science, as measured by the TIMSS assessments, has been stable between 2011 and 2015. This is in contrast to a number of the comparator countries, notably Hong Kong, Poland and the Republic of Ireland, where performance in both mathematics and science has improved significantly since 2011.