10 Characteristics of pupils and home

Chapter outline

This chapter summarises teacher and parent reports to consider the relationship between children's home circumstances in Northern Ireland and their performance in mathematics and science in TIMSS 2015. Outcomes for Northern Ireland are compared with international averages and with comparator countries of interest where relevant.

Key findings

- In Northern Ireland, the majority of children reported having 'Many Resources' or 'Some Resources' for learning at home. Children with access to more home resources for learning had higher average achievement in both mathematics and science.
- A higher proportion of children in Northern Ireland reported having 'Many Resources' compared with the average internationally.
- Parents in Northern Ireland had relatively positive attitudes towards mathematics and science. A higher proportion of children had parents with a 'Very Positive' or 'Positive Attitude' to mathematics and science compared with the international average. Children with parents who had a 'Very Positive Attitude' had higher average achievement in both mathematics and science.
- A high proportion of teachers reported that their teaching was limited to 'Some' extent by pupils' lack of prerequisite knowledge or skills, in both subjects. The proportion was similar to those on average internationally.
- Teachers of pupils in Northern Ireland were more likely to report pupils' lack of sleep as limiting their teaching compared with pupils' lack of nutrition.
- The proportion of pupils whose teachers reported lack of sleep as a limiting factor was greater in Northern Ireland than the international average for both mathematics and science.
- Pupils in Northern Ireland whose teachers reported that pupils' lack of basic nutrition and lack of sufficient sleep limited teaching had lower average achievement in both mathematics and science than those whose teachers reported not having these limitations. This mirrors the international data.

10.1 Home resources for learning

Interpreting the data: indices and scales

In order to summarise data from a questionnaire, responses to several related items are sometimes combined to form an index or scale. The respondents to the questionnaire items are grouped according to their responses, and the way in which responses have been categorised is shown for each index or scale. The data in an index or scale is often considered to be more reliable and valid than the responses to individual items.

Possessions in the home, as well as indicators of socio-economic status such as parents' education level and occupation, are associated with educational achievement (OECD, 2013). The TIMSS 2015 study acquired information about these background factors from pupils and parents. In the international data and report these are referred to as 'Home Resources for Learning'.

The 'Early Learning Survey' asked the parents of children involved in TIMSS 2015 to report on the availability of three key home variables highly related to achievement in school:

- parents' education
- parents' occupation
- number of children's books in the home.

In addition, in the Pupil Questionnaire children were asked about:

- the number of books in the home and
- the availability of key study supports at home: their own computer, an internet connection and their own room.

Table 10.1 presents the results for the 'Home Resources for Learning scale' for Northern Ireland. The scale was created using parents' and children's reports about the variables listed above. Pupils were categorised into three groups ('Many Resources', 'Some Resources' and 'Few Resources') according to the availability of these 'Home Resources for Learning'. (Details of how responses were categorised during analysis are given in Figure 10.1, below Table 10.1).

In Northern Ireland, 35 per cent of children were in the 'Many Resources' category, 64 per cent were in the 'Some Resources' category, and 1 per cent were in the 'Few Resources' category. Compared with the 2011 study, there was a 5 per cent increase in the percentage of children in Northern Ireland in the highest category. A higher proportion of children were also reported to have 'Many Resources' in Northern Ireland than on average internationally, mirroring the findings from 2011. In Table 10.1, the percentages of children in each category are the same for both mathematics and science since they refer to the same children, but the data on average achievement is different for each.

In Northern Ireland, there were patterns of achievement across the categories. Children who were in the 'Many Resources' category scored higher in mathematics and science than those who were in the 'Some Resources' category[47]. This mirrors 2011 and is also the case on average internationally. No comparisons could be made between achievement of children in the 'Many Resources' and 'Few Resources' categories (for both subjects) because only 1 per cent of children in Northern Ireland were categorised as having 'Few Resources'.

Table 10.1 Home resources for learning

Mathematics

Reported by parents, except 'Number of Books' and 'Home Study Supports', which were reported by pupils.

Students were scored according to their own and their parents' responses concerning the availability of five resources on the *Home Resources for Learning* scale. Students with **Many Resources** had a score of at least 11.9, which is the point on the scale corresponding to students reporting they had more than 100 books in the home and both of the home study supports, and parents reporting that they had more than 25 children's books in the home, that at least one parent had finished university, and that at least one parent had a professional occupation, on average. Students with **Few Resources** had a score no higher than 7.4, which is the scale point corresponding to students reporting that they had 25 or fewer books in the home and neither of the home study supports, and parents reporting that they had 10 or fewer children's books in the home, that neither parent had gone beyond upper-secondary education, and that neither parent was a small business owner or had a clerical or professional occupation, on average. All other students were assigned to the **Some Resources** category.

Country	Many Resources		Some Resources		Few Resources		Average Scale Score	Difference in Average Scale Score from 2011
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement		
Northern Ireland s	35 (1.4)	632 (3.2)	64 (1.4)	564 (3.9)	1 (0.3)	~ ~	11.1 (0.06)	s 0.2 (0.09)
International Avg.	17 (0.2)	569 (0.9)	74 (0.2)	501 (0.4)	9 (0.1)	427 (1.5)		

Significantly higher than 2011 ▲
Significantly lower than 2011 ▼

Centre point of scale set at 10.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A tilde (~) indicates insufficient data to report achievement.
An "s" indicates data are available for at least 50% but less than 75% of the pupils.

Source: Exhibit 4.1, international mathematics report (Mullis *et al.*, 2016a).

Science

Reported by parents, except 'Number of Books' and 'Home Study Supports', which were reported by pupils.

Students were scored according to their own and their parents' responses concerning the availability of five resources on the *Home Resources for Learning* scale. Students with **Many Resources** had a score of at least 11.9, which is the point on the scale corresponding to students reporting they had more than 100 books in the home and both of the home study supports, and parents reporting that they had more than 25 children's books in the home, that at least one parent had finished university, and that at least one parent had a professional occupation, on average. Students with **Few Resources** had a score no higher than 7.4, which is the scale point corresponding to students reporting that they had 25 or fewer books in the home and neither of the home study supports, and parents reporting that they had 10 or fewer children's books in the home, that neither parent had gone beyond upper-secondary education, and that neither parent was a small business owner or had a clerical or professional occupation, on average. All other students were assigned to the **Some Resources** category.

Country	Many Resources		Some Resources		Few Resources		Average Scale Score	Difference in Average Scale Score from 2011
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement		
Northern Ireland s	35 (1.4)	570 (3.1)	64 (1.4)	511 (3.1)	1 (0.3)	~ ~	11.1 (0.06)	s 0.2 (0.09)
International Avg.	18 (0.2)	567 (0.9)	74 (0.2)	503 (0.5)	8 (0.1)	426 (1.9)		

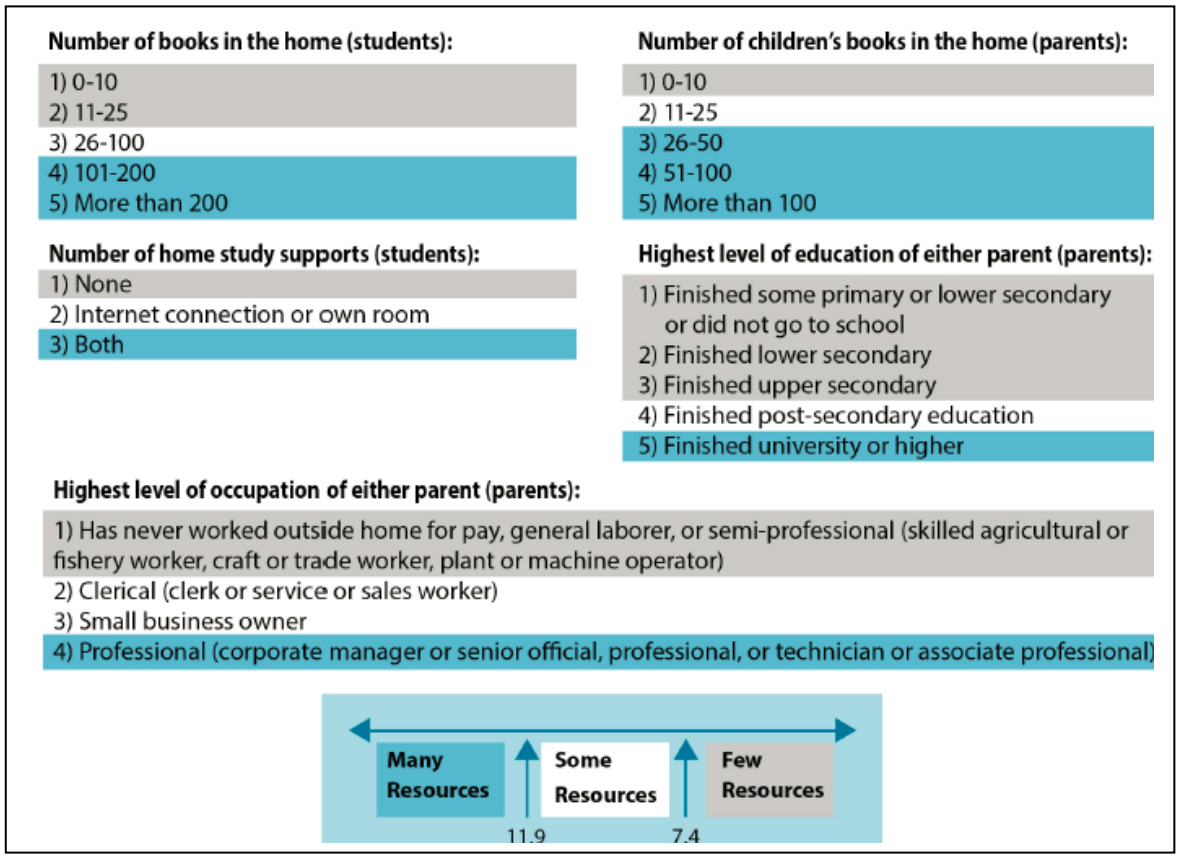
Significantly higher than 2011 ▲
Significantly lower than 2011 ▼

Centre point of scale set at 10.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A tilde (~) indicates insufficient data to report achievement.
An "s" indicates data are available for at least 50% but less than 75% of the pupils.

Source: Exhibit 4.1, international science report (Martin *et al.*, 2016a).

[47] The differences in achievement have not been tested for statistical significance in the international analysis but, based on the size of the standard errors, are likely to be significant.

Figure 10.1 The 'Home Resources for Learning' scale



Source: Exhibit 4.1, international mathematics report (Mullis *et al.*, 2016a) and international science report (Martin *et al.*, 2016a).

10.2 Parental attitudes towards mathematics and science

Research evidence suggests that the importance parents place on education and how they convey this to their children when discussing future goals can be associated with educational achievement (Mullis and Martin, 2013). In TIMSS 2015, parent's attitudes were measured by their responses to eight statements about their feelings towards mathematics and science. (These statements are provided in Figure 10.2). The international analysis uses responses to these statements to create the 'Parental Attitude Toward Mathematics and Science' scale. It categorises children into having parents in one of three bands: 'Very Positive Attitude', 'Positive Attitude' and 'Less than Positive Attitude'. (Details of how pupils were assigned to each band are also provided in Figure 10.2.) As this data was not collected in 2011, no trend comparisons can be made.

In Northern Ireland, 77 per cent of children participating in TIMSS 2015 were categorised as having parents with a 'Very Positive Attitude' towards mathematics and science. A further 22 per cent of children were categorised as having parents with a 'Positive Attitude' and a very small proportion (1 per cent) as having parents with a 'Less than Positive Attitude' towards mathematics and science. Northern Ireland had a higher percentage of children with parents who had a 'Very Positive Attitude' than the international average (66 per cent for both mathematics and science). In Table 10.2, the percentages of children in each category are

the same for both subjects since they refer to the same children, but the data on average achievement is different for each subject.

In Northern Ireland, there were also patterns of achievement across the categories. Children who were in the parents with a 'Very Positive Attitude' category scored higher in mathematics and science than those who were in the 'Positive Attitude' category. [48] This was also the case on average internationally. No comparisons could be made between achievements of children in the 'Very Positive Attitude' and 'Less than Positive Attitude' categories (for both subjects), because only 1 per cent of children in Northern Ireland had parents with a 'Less than Positive Attitude'.

Table 10.2 Parental attitude towards mathematics and science

Mathematics

Reported by parents

Students were scored on the *Parental Attitude Toward Mathematics and Science* scale according to their parents' responses to eight statements about their feelings toward the subjects. Students whose parents have a **Very Positive Attitude** had a score on the scale of at least 9.3, which corresponds to their parents "agreeing a lot" with four of the eight statements and "agreeing a little" with the other four, on average. Students whose parents have a **Less than Positive Attitude** had a score no higher than 5.9, which corresponds to their parents "disagreeing a little" with four of the eight statements and "agreeing a little" with the other four, on average. All other students had parents who have a **Positive Attitude** toward mathematics and science.

Country	Very Positive Attitude		Positive Attitude		Less than Positive Attitude		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Northern Ireland s	77 (1.1)	588 (3.7)	22 (1.1)	577 (5.3)	1 (0.3)	~ ~	10.4 (0.05)
International Avg.	66 (0.1)	510 (0.5)	32 (0.1)	495 (0.6)	2 (0.0)	509 (2.9)	

Centre point of scale set at 10.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A tilde (~) indicates insufficient data to report achievement.
An "s" indicates data are available for at least 50% but less than 70% of the pupils.

Source: Exhibit 4.5, international mathematics report (Mullis *et al.*, 2016a).

Science

Reported by parents

Students were scored on the *Parental Attitude Toward Mathematics and Science* scale according to their parents' responses to eight statements about their feelings toward the subjects. Students whose parents have a **Very Positive Attitude** had a score on the scale of at least 9.3, which corresponds to their parents "agreeing a lot" with four of the eight statements and "agreeing a little" with the other four, on average. Students whose parents have a **Less than Positive Attitude** had a score no higher than 5.9 which corresponds to their parents "disagreeing a little" with four of the eight statements and "agreeing a little" with the other four, on average. All other students had parents who have a **Positive Attitude** toward mathematics and science.

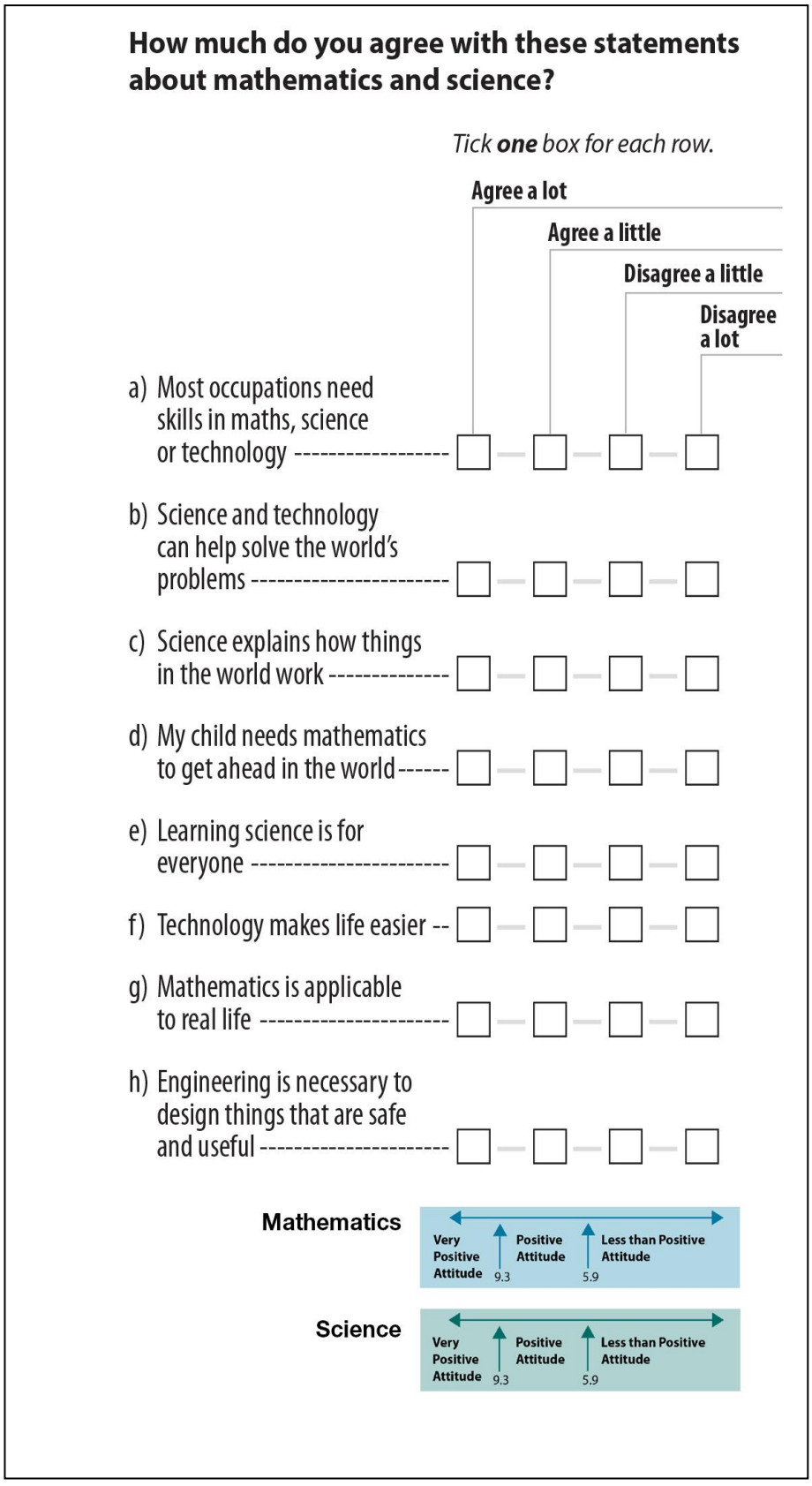
Country	Very Positive Attitude		Positive Attitude		Less than Positive Attitude		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Northern Ireland s	77 (1.1)	533 (2.9)	22 (1.1)	522 (3.9)	1 (0.3)	~ ~	10.4 (0.05)
International Avg.	66 (0.1)	512 (0.5)	32 (0.1)	496 (0.8)	2 (0.0)	504 (3.0)	

Centre point of scale set at 10.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A tilde (~) indicates insufficient data to report achievement.
An "s" indicates data are available for at least 50% but less than 70% of the pupils.

Source: Exhibit 4.5, international science report (Martin *et al.*, 2016a).

[48] The differences in achievement have not been tested for statistical significance in the international analysis but, based on the size of the standard errors, are unlikely to be significant.

Figure 10.2 Parental attitude towards mathematics and science



Source: Exhibit 4.5, international mathematics report (Mullis *et al.*, 2016a) and international science report (Martin *et al.*, 2016a), and adapted from the international version of the TIMSS 2015 Home Questionnaire.

10.3 Pupil level factors that limit teaching

Interpreting the data: percentages in tables

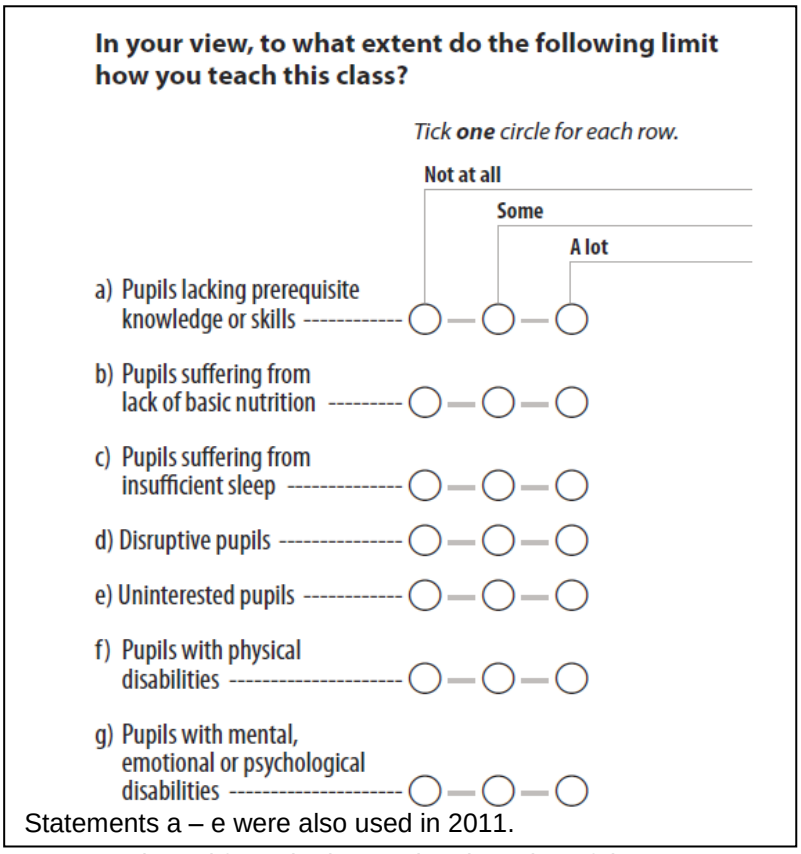
Some of the data in this chapter is derived from teacher reports. Reported percentages refer to pupils and can usually be interpreted as the percentage of pupils whose teachers reported a particular practice or circumstance.

Year 6 (Y6) pupils (ages 9-10) were sampled by class. As a result, the Y6 Teacher Questionnaire would, in most cases, have been completed by the class teacher of the sampled class. However, in some cases, it might have been completed by different teachers who teach these pupils mathematics and / or science separately.

This means that the teacher-derived data for mathematics and science may differ slightly, as the sample of teachers in each group is not necessarily the same, or because the distribution of pupils within the sample of teachers may differ by subject.

Teachers were asked to report the extent to which a number of pupil level factors limited their teaching. The question to which teachers responded is shown in Figure 10.3. This section focuses on the first three elements of this question: teachers' perceptions of pupils' lack of prerequisite skills and knowledge, pupils' lack of basic nutrition and pupils suffering from not enough sleep.

Figure 10.3 The limitations on teaching question



Statements a – e were also used in 2011.

Source: Adapted from the international version of the TIMSS 2015 Teacher Questionnaire.

10.3.1 Pupils lacking prerequisite knowledge or skills

Table 10.3 shows that, in Northern Ireland, over two thirds of pupils were taught by teachers who reported that their teaching was limited to 'Some' extent by pupils lacking prerequisite knowledge or skills. At the same time just under a quarter (21 per cent) reported that their teaching was 'Not at all' limited by pupils' lack of prerequisite skills. This was similar to 2011.

In all seven comparator countries, for both mathematics and science, the percentage of pupils whose teachers reported that their teaching was limited to 'Some' extent by pupils' lack of prerequisite knowledge or skills was similar to or lower than that for Northern Ireland. This mirrors the results from 2011. The majority of comparator countries also had similar percentages of pupils whose teachers reported that their teaching was limited 'A lot' by pupils' lack of prerequisite knowledge or skills as Northern Ireland. This is in contrast to 2011, where the comparator countries generally had higher percentages of pupils in this category.

In Northern Ireland, and internationally, there appears to be an association between attainment and teachers' reports of limitations based on pupils' lack of prerequisite knowledge or skills.[49] That is, pupils whose teachers reported that their teaching was limited 'A lot' had a lower average achievement than those who teaching was limited to 'Some' extent or 'Not at all'.

Table 10.3 Y6 teaching limited by pupils lacking prerequisite knowledge or skills

Mathematics

Country	Percentage of pupils in classrooms where teachers reported teaching is limited by pupils lacking prerequisite knowledge or skills					
	Not at all		Some		A lot	
	%	Mean score	%	Mean score	%	Mean score
Northern Ireland	21	597	67	570	12	545
International Avg.	**16**	**524**	**65**	**511**	**19**	**489**

Source: 2015 Mathematics Teacher Context Data Almanac by Mathematics Achievement question ATBG15A.

[49] The differences in achievement have not been tested for statistical significance in this international analysis.

Country	Percentage of pupils in classrooms where teachers reported teaching is limited by pupils lacking prerequisite knowledge or skills					
	Not at all		Some		A lot	
	%	Mean score	%	Mean score	%	Mean score
Northern Ireland	21	539	67	519	12	504
International Avg.	**18**	**521**	**64**	**507**	**17**	**485**

Source: 2015 Science Teacher Context Data Almanac by Science Achievement question ATBG15A.

10.3.2 Pupils suffering from a lack of basic nutrition / lack of sleep

In Northern Ireland, 75 per cent of pupils participating in TIMSS 2015 were taught by teachers who reported that their teaching was 'Not at all' affected by pupils lacking in basic nutrition (Table 10.4). This is a slightly lower percentage than in 2011. As was the case in 2011, the percentage of pupils in this category was higher than the international average. Across the comparator countries, Poland and Finland had the highest percentages of pupils taught by teachers reporting that their teaching was 'Not at all' affected by pupils' lack of basic nutrition, for both mathematics and science (over 90 per cent of pupils).

Teachers of pupils in Northern Ireland were more likely to report pupils' lack of sleep as limiting their teaching than their lack of nutrition, as in 2011[50]. In Northern Ireland, 60 per cent of pupils in mathematics and 61 per cent of pupils in science were taught by teachers who reported that their teaching was limited to 'Some' extent by their pupils' lack of sleep. This is higher than the international averages (50 per cent and 48 per cent respectively).

Across the comparator countries, the results for mathematics and science mirror those in Northern Ireland, where a lack of sleep was more likely to be reported by teachers as limiting their teaching than pupils' lack of nutrition.

Pupils in Northern Ireland, and internationally, whose teachers reported that pupils' lack of basic nutrition and lack of sufficient sleep limited their teaching 'A lot' appeared to have lower average achievement in mathematics and science than those whose teachers reported not having these limitations[51]. In addition, in Northern Ireland, there was a difference between the average achievement of pupils who were taught by teachers limited to 'Some' extent and 'A lot' by pupils suffering from lack of basic nutrition and not enough sleep. This was not the case internationally, however, where the average achievement of pupils in these categories was similar.

[50] In 2011, the response categories 'Some' and 'A lot' were combined, both for pupils suffering from a lack of basic nutrition and for pupils suffering from not enough sleep. Caution is therefore required when making direct comparisons.
[51] The differences in achievement have not been tested for statistical significance in this international analysis.

Table 10.4 Y6 teaching limited by pupils' lack of basic nutrition / sleep

Mathematics

Country	Percentage of pupils in classrooms where teachers reported teaching is limited by pupils lacking basic nutrition					
	Not at all		Some		A lot	
	%	Mean score	%	Mean score	%	Mean score
Northern Ireland	75%	579	24%	555	2%	524
International Avg.	**67%**	**518**	**28%**	**498**	**5%**	**482**

Country	Percentage of pupils in classrooms where teachers reported teaching is limited by pupils not getting enough sleep					
	Not at all		Some		A lot	
	%	Mean score	%	Mean score	%	Mean score
Northern Ireland	32%	592	60%	564	8%	557
International Avg.	**42%**	**519**	**50%**	**506**	**9%**	**492**

Source: 2015 Mathematics Teacher Context Data Almanac by Mathematics Achievement, question ATBG15B and ATBG15C.

Country	Percentage of pupils in classrooms where teachers reported teaching is limited by pupils lacking basic nutrition					
	Not at all		Some		A lot	
	%	Mean score	%	Mean score	%	Mean score
Northern Ireland	75%	526	24%	507	2%	486
International Avg.	**68%**	**514**	**28%**	**495**	**5%**	**474**

Country	Percentage of pupils in classrooms where teachers reported teaching is limited by pupils not getting enough sleep					
	Not at all		Some		A lot	
	%	Mean score	%	Mean score	%	Mean score
Northern Ireland	31%	536	61%	515	8%	507
International Avg.	**44%**	**514**	**48%**	**502**	**8%**	**491**

Source: 2015 Science Teacher Context Data Almanac by Science Achievement, question ATBG15B and ATBG15C.

10.4 Conclusion

Possessions in the home, as well as indicators of socio-economic status such as parents' education level and occupation, are associated with educational achievement (OECD, 2013). It is therefore reassuring that, overall, the majority of children in Northern Ireland were categorised as having access to 'Some' or 'Many' resources, slightly higher than in 2011 and higher than the international average. The findings for Northern Ireland in TIMSS 2015 support the findings from the OECD research. That is, there were differences in achievement between children categorised as having access to 'Many resources', compared with those having access to 'Some'. This mirrors the findings from 2011.

Research suggests that the value parents place on mathematics and science, and how this is conveyed to their children, can have an impact on achievement in these subjects (Mullis and Martin, 2013). It is therefore encouraging that the majority of children in Northern Ireland participating in TIMSS 2015 had parents with a positive attitude towards mathematics and science. This positive parental attitude was also reflected internationally and appeared to be significantly associated with achievement[52]. However, in Northern Ireland, the difference in achievement between children categorised as having parents with a 'Very Positive Attitude' and those with parents with a 'Positive Attitude' is unlikely to be significant.

[52] Although significance tests have not been conducted in the international analysis, based on the size of the standard errors, the differences in international average achievement scores are likely to be statistically significant.

In Northern Ireland, a high proportion of teachers reported that their teaching was limited to 'Some' extent by pupils' lack of prerequisite knowledge or skills, in both mathematics and science, as was the case in 2011. This was consistent with the international averages. There appears to be an association between attainment and teaching being limited by a lack of prerequisite knowledge or skills.

Three-quarters of pupils in Northern Ireland were taught by teachers who reported that their teaching was 'Not at all' limited by pupils' lack of nutrition. However, teachers of more pupils reported that pupils' lack of sleep limited teaching. There was a similar pattern in the international averages and across the comparator countries, and this reflects the findings from the TIMSS 2011 study. In addition, the average achievement of pupils whose teachers reported that pupils' lack of basic nutrition and / or sleep limited their teaching was lower than that of pupils whose teachers reported that these factors did not limit their teaching at all.