

7 School resources

Chapter outline

This chapter summarises principal and teacher reports concerning the working conditions and resources available in their school for teaching mathematics and science in Year 6 (Y6, ages 9-10).

Outcomes for Northern Ireland are compared with the international averages and, in some cases, comparator countries.

Key findings

- In terms of teaching space and conditions, and teaching materials and supplies, teachers in Northern Ireland rated their working conditions relatively highly compared with international averages.
- The majority of pupils participating in TIMSS 2015 were taught mathematics and science by teachers who were classified as having 'Hardly Any Problems' with their working conditions; teachers of 30 per cent of pupils in both subjects reported 'Moderate Problems'.
- According to principals, there were no pupils in Northern Ireland attending schools in which teaching was 'Affected a Lot' by resource shortages. This was the same for both mathematics and science.
- For mathematics, 67 per cent of pupils were in schools in which teaching was reported to be 'Affected' by shortages in resources. This is similar to the international average. For science, the equivalent figure was 80 per cent which is higher than the international average.
- Schools in Northern Ireland had a lower average number of computers available than was the case in most of the subset of main comparator countries and the international average. However, the number of computers available in Northern Ireland's schools has increased on average since 2011.
- Fewer than 10 per cent of pupils were in schools where capacity to teach was affected 'A Lot' by a shortage or inadequacy of five technological resources. This included: 'Technically Competent Staff', 'Audio-visual Resources', 'Computer Technology for Teaching and Learning' and 'Computer Software / Applications for Science / Mathematics Teaching'. This is lower than the international average.
- In Northern Ireland, fewer pupils were affected by a lack of 'Computer Technology for Teaching and Learning' and by 'Audio-visual Resources of Delivery for Teaching' than was the case in any of the comparator countries.
- Northern Ireland had a higher percentage of pupils attending schools without a school library than the international average and most comparator countries. In Northern Ireland, school libraries seem to be less well equipped than is the case on average internationally.

Interpreting the data: percentages in tables

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

Year 6 (Y6) pupils 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.

7.1 School conditions and resources

Teachers were asked to rate the working conditions in their current school in terms of seven potential problem areas. Pupils were scored according to their teachers' responses concerning these areas on the 'Problems with School Conditions and Resources' scale, covering buildings, workspace, materials, classroom conditions and technology. Teachers were asked to rate the severity of each problem (see Figure 7.1) and their responses were analysed as a separate scale for each of mathematics and science. The data for each subject is shown in Table 7.1.

Figure 7.1 School conditions and resources

In your current school, how severe is each problem?

*Tick **one** circle for each row.*

Not a problem

Minor problem

Moderate problem

Serious problem

a) The school building needs significant repair ----- — — —

b) Teachers do not have adequate workspace (e.g. for preparation, collaboration, or meeting with students) ---- — — —

c) Teachers do not have adequate teaching materials and supplies ----- — — —

d) The school classrooms are not cleaned often enough ---- — — —

e) The school classrooms need maintenance work ----- — — —

f) Teachers do not have adequate technological resources ----- — — —

g) Teachers do not have adequate support for using technology ----- — — —

Mathematics

Hardly Any Problems	Minor Problems	Moderate to Severe Problems
	10.6	8.2

Science

Hardly Any Problems	Minor Problems	Moderate to Severe Problems
	10.6	8.2

Statements a), b), d) and e) were also used in 2011.

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

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.

Table 7.1 School conditions and resources

Mathematics

Reported by teachers

Students were scored according to their teachers' responses concerning seven conditions and resources on the *Problems with School Conditions and Resources* scale. Students whose teachers reported **Hardly Any Problems** with their school conditions and resources had a score on the scale of at least 10.6, which corresponds to their teachers reporting "not a problem" for four of seven conditions and resources and "minor problem" for the other three, on average. Students whose teachers reported **Moderate to Severe Problems** had a score no higher than 8.2, which corresponds to their teachers reporting "moderate problem" for four of seven conditions and resources and "minor problem" for the other three, on average. All other students had teachers that reported **Minor Problems** with their school conditions and resources.

Country	Hardly Any Problems		Minor Problems		Moderate to Severe Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Northern Ireland	60 (4.2)	572 (3.5)	30 (3.3)	570 (7.5)	10 (3.2)	579 (9.1)	10.8 (0.19)
International Avg.	37 (0.5)	512 (0.8)	43 (0.5)	505 (0.7)	20 (0.4)	499 (1.1)	

Centre point of scale set at 10.

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

An "r" indicates data are available for at least 70% but less than 85% of the pupils.

Source: Exhibit 5.8, international mathematics report (Mullis *et al.*, 2016a).

Science

Reported by teachers

Students were scored according to their teachers' responses concerning seven conditions and resources on the *Problems with School Conditions and Resources* scale. Students whose teachers reported **Hardly Any Problems** with their school conditions and resources had a score on the scale of at least 10.6, which corresponds to their teachers reporting "not a problem" for four of seven conditions and resources and "minor problem" for the other three, on average. Students whose teachers reported **Moderate to Severe Problems** had a score no higher than 8.2, which corresponds to their teachers reporting "moderate problem" for four of seven conditions and resources and "minor problem" for the other three, on average. All other students had teachers that reported **Minor Problems** with their school conditions and resources.

Country	Hardly Any Problems		Minor Problems		Moderate to Severe Problems		Average Scale Score
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Centre point of scale set at 10.

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

An "r" indicates data are available for at least 70% but less than 85% of the pupils.

Source: Exhibit 5.8, international science report (Martin *et al.*, 2016a).

Teachers in Northern Ireland rated the conditions of their school and availability of resources highly. The percentages in each category are the same for each subject, with teachers of almost two-thirds of pupils reporting 'Hardly Any Problems'. This is higher than the international average.

Northern Ireland had the second highest percentage of pupils with teachers reporting 'Hardly Any Problems' in mathematics and the third highest in science across all countries. The percentage of pupils in Northern Ireland with teachers reporting 'Moderate to Severe Problems' or 'Minor Problems' was lower than the international average in both mathematics and science.

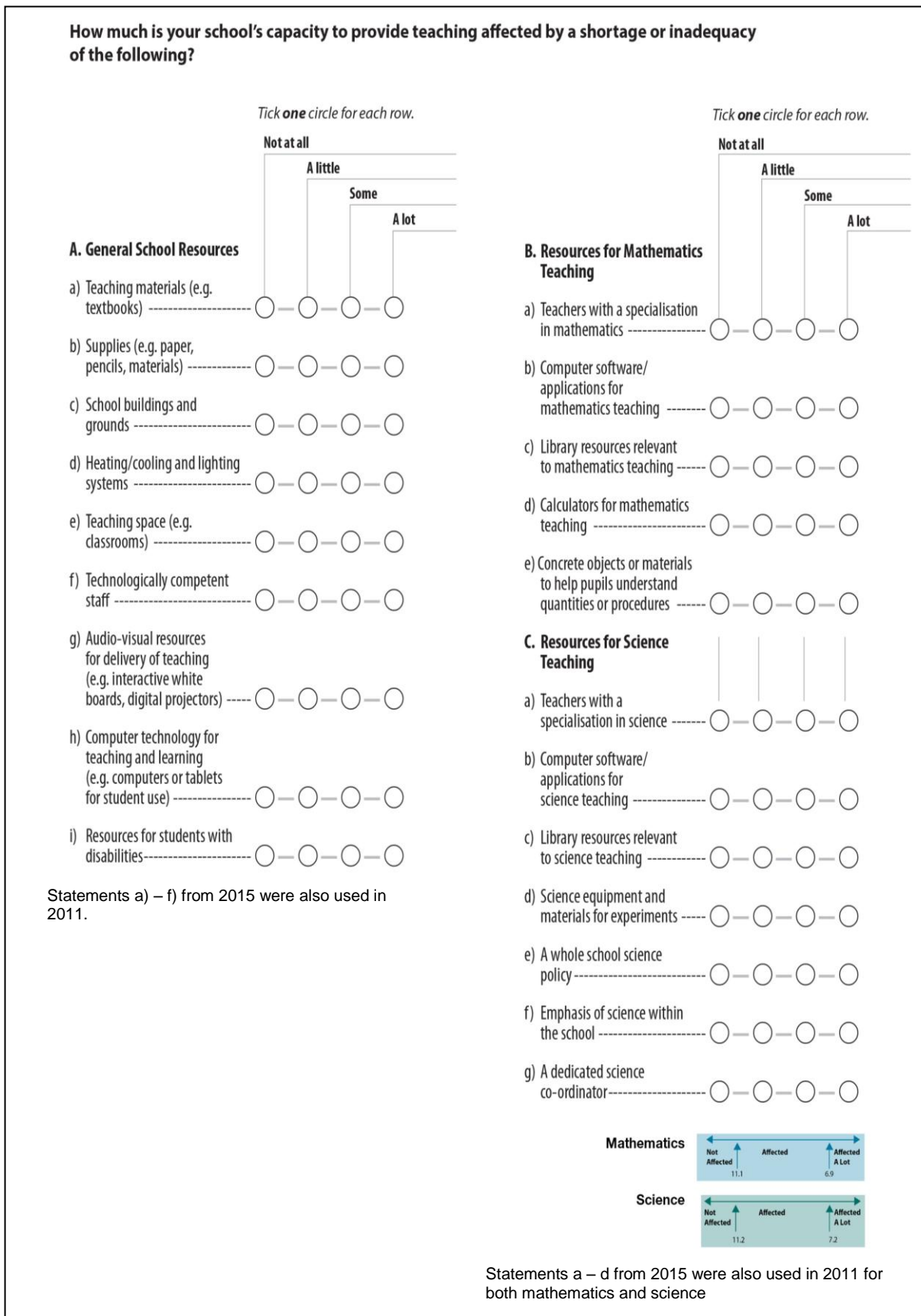
Internationally, there are apparent associations between the severity of problems in a school and achievement. That is, as the severity of problems increases achievement decreases. For both mathematics and science, pupils in schools where teachers report 'Moderate to Severe Problems' appear, on average, to have lower scores than those whose teachers report 'Minor Problems' or 'Hardly Any Problems'. This is not the case in Northern Ireland, where there is no association between teacher reports of the severity of challenges with school conditions and resources and pupil achievement. This was true for mathematics and science.

7.2 Views about limitations on teaching caused by resources

7.2.1 Shortage or inadequacy of resources

Principals were asked to rate the extent to which their teachers' capacity to teach was limited by a shortage of resources. Pupils were scored according to their principals' responses concerning the resources shown below (Figure 7.2). In each case, the scale contained the general resources and the relevant subject-specific resources. The question was analysed as two separate scales, one for each subject (mathematics and science). The data for each subject is shown in Table 7.2.

Figure 7.2 Teaching affected by resource shortages



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

Table 7.2 Limitations on teaching caused by resourcing

Mathematics

Reported by principals

Students were scored according to their principals' responses concerning thirteen school and classroom resources on the *Mathematics Resource Shortages* scale. Students in schools where instruction was **Not Affected** by resource shortages had a score on the scale of at least 11.1, which corresponds to their principals reporting that shortages affected instruction "not at all" for seven of the thirteen resources and "a little" for the other six, on average. Students in schools where instruction was **Affected A Lot** had a score no higher than 6.9, which corresponds to their principals reporting that shortages affected instruction "a lot" for seven of the thirteen resources and "some" for the other six, on average. All other students attended schools where instruction was **Affected** by resource shortages.

Country	Not Affected		Affected		Affected A Lot		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	r 33 (4.8)	571 (7.3)	67 (4.8)	570 (4.4)	0 (0.0)	~ ~	10.7 (0.16)	r 0.1 (0.24)
International Avg.	27 (0.5)	519 (1.5)	69 (0.5)	502 (0.5)	4 (0.2)	466 (3.1)		

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 "r" indicates data are available for at least 70% but less than 85% of the pupils.

Significantly higher than 2011 ▲
Significantly lower than 2011 ▼

Source: Exhibit 5.6, international mathematics report (Mullis *et al.*, 2016a).

Science

Reported by principals

Students were scored according to their principals' responses concerning twelve school and classroom resources on the *Science Resource Shortages* scale. Students in schools where instruction was **Not Affected** by resource shortages had a score on the scale of at least 11.2, which corresponds to their principals reporting that shortages affected instruction "not at all" for six of the twelve resources and "a little" for the other six, on average. Students in schools where instruction was **Affected A Lot** had a score no higher than 7.2, which corresponds to their principals reporting that shortages affected instruction "a lot" for six of the twelve resources and "some" for the other six, on average. All other students attended schools where instruction was **Affected** by resource shortages.

Country	Not Affected		Affected		Affected A Lot		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	r 20 (4.4)	526 (7.7)	80 (4.4)	517 (3.4)	0 (0.0)	~ ~	10.3 (0.14)	r -0.1 (0.23)
International Avg.	25 (0.5)	517 (1.7)	69 (0.5)	504 (0.6)	5 (0.2)	483 (3.1)		

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 "r" indicates data are available for at least 70% but less than 85% of the pupils.

Significantly higher than 2011 ▲
Significantly lower than 2011 ▼

Source: Exhibit 5.6, international science report (Martin *et al.*, 2016a).

According to their principals, the majority of pupils in Northern Ireland participating in TIMSS 2015 were 'Affected' by resource shortages in both mathematics and science. This is similar to findings in 2011. However, the percentage of pupils, according to their principals, in Northern Ireland that were 'Affected' by shortages of science resources was much higher than for mathematics (80 per cent and 67 per cent respectively). In 2011 there was a similar difference between the subjects.

For mathematics, the percentage of pupils in Northern Ireland in the 'Not Affected' and 'Affected' categories was relatively close to the international averages. For science, on the other hand, whilst the percentage of pupils 'Not Affected' by resource shortages was also relatively close to the international average (although lower), the percentage of pupils in the

‘Affected’ category was higher. Northern Ireland had no pupils in the ‘Affected A Lot’ category for either subject, as did 11 of the other countries participating in TIMSS 2015.

Internationally, the pattern is for pupils in less well resourced schools to show lower attainment in each subject. This appears to be the pattern in Northern Ireland also, although the achievement scores in mathematics are almost identical for pupils in Northern Ireland in the ‘Affected’ and ‘Not Affected’ categories. Due to the sizes of the standard errors, however, this apparent trend is unlikely to be statistically significant at national level in Northern Ireland. This mirrors what was seen in 2011.

7.2.2 Availability of computers

Principals were asked about the availability of computers, including tablets, in their schools. Table 7.3 shows the average number of computers available for Y6 pupils. (Data is provided for Northern Ireland and the comparator countries for 2015 and 2011.)

The average number of computers available per school for use by Y6 pupils in Northern Ireland was slightly lower than the international average (30 and 35 respectively). Although there has been an increase in the average number of computers available in Northern Ireland since 2011, this is not as big an increase as that seen on average internationally. Of the comparator countries, Singapore had the highest number of computers for Y6 pupils (180). Poland and the Republic of Ireland had a lower average number of computers available to pupils compared with Northern Ireland: 25 and 18 respectively.

Table 7.3 Availability of computers

Country	Average number of computers available for Y6	
	2015	2011
Australia	45	33
England	47	43
Finland	31	17
Hong Kong SAR	74	64
Northern Ireland	30	24
Poland	25	11
Republic of Ireland	18	12
Singapore	180	123
International Avg.	35	25

Sources: 2015 School Context Data Almanac by Mathematics Achievement and 2015 School Context Data Almanac by Science Achievement question ACBG11, and 2011 School Background Data Almanac by Mathematics Achievement and School Background Data Almanac by Science Achievement question ACBG07.

7.2.3 Limitations on teaching caused by technological resources

As discussed in section 7.2.1, principals reported the extent to which their school’s capacity to provide teaching was affected by shortages in or inadequacies of resources. Table 7.4

highlights the statements that focused on various technological resources. It shows the percentages of pupils in schools where principals reported that teaching was affected ‘A Lot’ by shortages of these technological resources. Among comparator countries and internationally, findings varied significantly. This may reflect the way in which different education systems benchmark the availability of resources and competence of staff.

Table 7.4 Limitations on teaching caused by technological resources

Country	Percentage of pupils whose principals reported teaching being affected ‘A Lot’ by shortages or inadequacies				
	Technologically competent staff	Audio-visual resources of delivery for teaching	Computer technology for teaching and learning	Computer software / applications for mathematics	Computer software / applications for science
	(%)	(%)	(%)	(%)	(%)
Australia	5	3	6	4	10
England	1	3	6	2	3
Finland	1	3	12	4	4
Hong Kong SAR	8	11	13	7	9
Northern Ireland	7	0	2	1	9
Poland	5	8	10	8	6
Republic of Ireland	4	4	20	10	21
Singapore	10	13	11	8	8
International Avg.	11	12	14	10	12

Sources: 2015 School Context Data Almanac by Mathematics / Science, questions ACBG14AF, ACBG14AG, ACBG14AH, ACBG14BB, ACBG14CB.

In Northern Ireland, 7 per cent of pupils were taught in schools which principals reported were affected ‘A Lot’ by shortages or inadequacies of ‘Technologically Competent Staff’, while none were affected by ‘Audio-visual Resources of Delivery for Teaching’, 2 per cent were affected by shortages or inadequacies of ‘Computer Technology for Teaching and Learning’ and 1 per cent were affected by shortages or inadequacies of ‘Computer Software / Applications for Mathematics’. A shortage or inadequacy of ‘Computer Software / Applications for Science Teaching’ had the highest percentage, affecting 9 per cent of pupils participating in TIMSS 2015, although this has decreased since 2011 when it was 15 per cent. Despite the percentage of pupils being affected ‘A Lot’ by a shortage or inadequacy of ‘Technologically Competent Staff’ and ‘Computer Software Applications for Science’ being slightly higher than for the other shortages or inadequacies, the percentages of pupils affected in all categories in Northern Ireland are lower than the international averages.

Across the comparator countries, Singapore and Hong Kong had higher percentages of pupils affected ‘A Lot’ by a shortage or inadequacy of ‘Technologically Competent Staff’ than Northern Ireland (10 per cent and 8 per cent respectively). For ‘Audio-visual Resources of Delivery for Teaching’ and ‘Computer Technology for Teaching and Learning’, Northern Ireland had the lowest percentage of pupils affected ‘A Lot’ by shortages or inadequacies than any comparator country.

Among the comparator countries, Singapore also had the highest percentage of principals reporting that shortages of ‘Audio-visual Resources of Delivery for Teaching’ (13 per cent) impacted on capacity to teach. In the Republic of Ireland, 20 per cent of pupils participating in TIMSS 2015 were taught in schools affected ‘A Lot’ by shortages or inadequacies of ‘Computer Technology for Teaching and Learning’, and 10 per cent were affected by shortages or inadequacies of ‘Computer Software / Applications for Mathematics’. These are the highest percentages in these shortage areas across the comparator countries.

The Republic of Ireland and Australia had higher percentages of pupils affected ‘A Lot’ by shortages or inadequacies of ‘Computer Software / Applications for Science’, than Northern Ireland (21 per cent and 10 per cent respectively), and Hong Kong had the same percentage as Northern Ireland (9 per cent).

7.3 Access to school library

In Northern Ireland, 73 per cent of pupils participating in TIMSS 2015 attended schools with a library. This is similar to 2011 but is lower than the international average of 87 per cent (in both 2015 and 2011).

Table 7.5 Percentage of pupils attending a school with a library

Country	Percentage of pupils (%)
Australia	99
England	92
Finland	67
Hong Kong SAR	100
Northern Ireland	73
Poland	97
Republic of Ireland	53
Singapore	100
International Avg.	87

Sources: 2015 School Context Data Almanac Mathematics / Science, question ACBG13

Among comparator countries, Northern Ireland had the second lowest percentage of pupils with access to a school library. All pupils in Hong Kong and Singapore, 99 per cent of pupils in Australia, 97 per cent of pupils in Poland, 92 per cent of pupils in England and 76 per cent

of pupils in Finland attended a school with a library. Only the Republic of Ireland was lower, with 53 per cent of pupils participating in TIMSS 2015 attending a school with a library.

Where principals reported that there was a library in their school they were then asked to indicate:

- the number of books with different titles (print and digital) available in the library
- the number of magazines and other periodicals (print and digital) available in the library (Table 7.6).

Table 7.6 Availability of books, magazines and other periodicals in school libraries

Country	Percentage of pupils			
	Books with different titles		Magazines and other periodicals	
	More than 5000 printed (%)	More than 250 digital (%)	More than 10 print (%)	More than 10 digital (%)
Australia	61	25	35	11
England	17	14	8	0
Finland	4	1	3	0
Hong Kong SAR	80	25	41	1
Northern Ireland	1	0	6	0
Poland	60	3	18	3
Republic of Ireland	9	1	3	0
Singapore	73	37	45	8
International Avg.	36	14	24	5

Sources: 2015 School Context Data Almanac by Mathematics / Science, questions ACBG13AA, ACBG13AB, ACBG13BA, ACBG13BB.

Principals in Northern Ireland reported that 1 per cent of pupils attended a school with a large school library (more than 5000 printed books). This was considerably lower than the international average (36 per cent) but similar to the 2011 findings. As was the case in 2011, Hong Kong and Singapore reported the highest percentages of pupils with access to school libraries with more than 5000 printed books (80 per cent and 73 per cent respectively).

In terms of digital books, Northern Ireland had no pupils in schools with more than 250 digital books in their library. Across the comparator countries the picture was varied, with Finland, the Republic of Ireland and Poland reporting very low numbers of pupils attending schools with libraries containing more than 250 digital books, while Singapore, Hong Kong and Australia, by contrast, reported the highest levels of access to school libraries equipped with more than 250 digital books (37 per cent, 25 per cent and 25 per cent of pupils respectively).

Northern Ireland had only 6 per cent of pupils at schools with more than 10 print magazines and other periodicals in the school library, and no pupils in schools with libraries equipped with more than 10 magazines and periodicals in digital form. This is lower than the international averages (24 and 5 per cent respectively). However, among the comparator countries, Northern Ireland is not alone in having no pupils attending schools with access to 10 or more digital magazines / periodicals. Of the comparator countries, the situation is the same in England, Finland and the Republic of Ireland. In fact, when compared with Northern Ireland, the Republic of Ireland and Finland had a lower percentage of pupils attending schools with 10 or more printed periodicals / magazines.

Once again it was Singapore, Hong Kong and Australia that had the best equipped school libraries. In Australia, 11 per cent of pupils participating in TIMSS 2015 attended schools with a library equipped with more than 10 digital magazines and other periodicals. This is higher than any of the other comparator countries and significantly higher than the international average.

7.4 Conclusion

Teachers were asked about a number of potential challenges relating to school conditions and resources that might impact on their teaching. These included the condition of their school buildings, workspace and classrooms. They were also asked about support around technology and technological resources. Responses indicated that, overall, the majority of pupils in Northern Ireland participating in TIMSS 2015 were taught by teachers who reported having 'Hardly Any Problems' with their working conditions, although a sizeable minority reported 'Minor Problems'. Although international results show that, as the severity of challenges increases, achievement decreases, this is not true in Northern Ireland, where there is no association between the reported severity of problems and achievement.

In Northern Ireland, the majority of pupils attended schools where the principal reported that teaching was 'Affected' by a shortage of resources. This was true for both mathematics and science, although results for science in Northern Ireland were higher than the international average. No principals reported pupils being 'Affected A Lot' by resource shortages. Findings were similar in 2011. The pattern in the international results is for pupils in less well resourced schools to show lower attainment in each subject; this pattern was also seen in Northern Ireland but is unlikely to be statistically significant..

On average, principals in Northern Ireland reported that their schools had 30 computers available for Y6 pupils. Although this is an increase from 2011, it remains lower than the international average and most of the comparator countries. In terms of the impact of shortages of or inadequacies in technological resources and support, more pupils were reported to be affected by a shortage or inadequacy of 'Technologically Competent Staff' and 'Computer Software / Applications for Science' in Northern Ireland than any other shortage or inadequacy. However, in all areas of shortage, Northern Ireland had a lower percentage of pupils affected than the international average.

In Northern Ireland a higher percentage of pupils attended schools without a school library than the international average and most comparator countries. In addition pupils participating in TIMSS 2015 in Northern Ireland were less likely to attend schools with a well-

resourced library, as in 2011. Pupils in Northern Ireland were not alone in attending schools with less well equipped libraries; this was also the case in the Republic of Ireland and Finland.