

8. The curriculum and learning activities

Chapter outline

This chapter presents findings relating to teaching practices and the curriculum in reading, mathematics and science in Year 6 (Y6, ages 9-10) reported by teachers, principals and National Research Coordinators (or their designated national contact). Within each sub-section, findings for reading are presented first, followed by findings for mathematics and science. Where relevant, outcomes for Northern Ireland are compared with international averages and comparator countries.

Key findings

- In Northern Ireland, teaching time for reading and mathematics was higher than the international average. However, for science, teaching time was lower than the international average.
- A small proportion of Y6 pupils in Northern Ireland were taught science by teachers who reported emphasising science investigation in at least half their science lessons; this proportion is considerably below the international average. In a number of the highest performing countries, teachers tended to report emphasising science investigation to a greater extent than in Northern Ireland.
- Computers were available to the majority of Y6 pupils in their reading, mathematics and science lessons. No obvious patterns emerged regarding computer availability and average achievement in PIRLS and TIMSS.
- There was variation internationally in the age at which schools emphasised the teaching of a range of reading skills and strategies; in Northern Ireland just over half of pupils were at schools that emphasised the teaching of these reading skills at or before the academic year in which they turned eight (Year 4). Generally, English-speaking countries had the highest proportions of pupils who were taught a range of reading skills at or before the academic year in which they turned eight.
- Internationally, the average achievement of pupils in schools where the teaching of a range of reading skills was emphasised earlier was higher than that of pupils in schools where these skills were emphasised later. However, in Northern Ireland, average achievement was similar regardless of the age at which these reading skills were first emphasised.
- Northern Ireland's intended national curriculum includes all of the topics assessed in the TIMSS mathematics and science assessments. According to teachers' reports of topics taught in lessons, a higher proportion of Y6 pupils are taught the TIMSS mathematics topics than the TIMSS science topics. This is also 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.

Y6 pupils were sampled by class. The Y6 teacher questionnaire would, in most cases therefore, 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 reading, mathematics and/or science separately.

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

8.1 Teaching time

Total teaching time¹ for all subjects, as reported by principals and teachers, was calculated using the following formula. These calculations enabled direct comparison of teaching time to be made between different countries.

Figure 1 Formula for calculation of teaching time

Total Instructional Hours per Year	=	Principal Reports of School Days per Year	x	Principal Reports of Instructional Hours per Day
Hours per Year for Instruction in Language/Mathematics/Science	=	$\frac{\text{Teacher Reports of Weekly Language/Mathematics/Science Instructional Hours}}{\text{Principal Reports of School Days per Week}}$	x	Principal Reports of School Days per Year

Source: adapted from Exhibit 8.4 international PIRLS report, Exhibit 8.6 international TIMSS mathematics report, Exhibit 8.6 international TIMSS science report

Data was collected on total teaching time for all three subjects. As part of PIRLS 2011, data was also collected from teachers on the total amount of *Time Spent On Reading as Part of Language Instruction* and *Reading Across the Curriculum, Including Time Spent on Reading Instruction* in a typical week. In the questionnaires in Northern Ireland, the phrase *Language Instruction* was adapted to *English teaching*.

Overall teaching time was higher than the international average in Northern Ireland. Among the comparator countries, teaching time was higher than the international average in Australia, England, Hong Kong, New Zealand and Singapore, and below the average in Finland and the Republic of Ireland.

1 Teaching time is referred to as 'Instructional time' in the international data and report.

8.1.1 Teaching time for language and reading

Table 8.1 shows the amount of time spent teaching English to Y6 pupils in Northern Ireland was 274 out of 970 teaching hours per year, higher than the international average. Comparator countries differed considerably in the amount of time devoted to the teaching of reading and reading activities. Compared with the international average, most English-speaking countries reported spending more time both on language instruction in total and on the two teaching approaches specified. Conversely, in most of the top performing countries, teachers reported spending less time than the international average teaching *Reading Across the Curriculum, Including Time Spent on Reading Instruction*.

8.1.2 Teaching time for mathematics

Table 8.1 shows in Northern Ireland the amount of time for teaching mathematics to Y6 pupils was 232 hours per year, out of a possible 970 (total hours of teaching per year), higher than the international average (162 hours). Among comparator countries, Northern Ireland was similar to Australia. Like the majority of countries, in Northern Ireland, teaching time was higher for mathematics than science in Y6.

8.1.3 Teaching time for science

Table 8.1 shows that in Northern Ireland, the amount of time for teaching science to Y6 pupils was 72 hours out of 970 (total hours of teaching per year), lower than the international average (85 hours). Among comparator countries, teaching time for science was higher in Finland and Singapore (98 and 96 hours respectively), as well as in most other high performing countries. It was lower in Australia and New Zealand (65 and 52 hours respectively).

Table 8.1 Teaching time in Y6

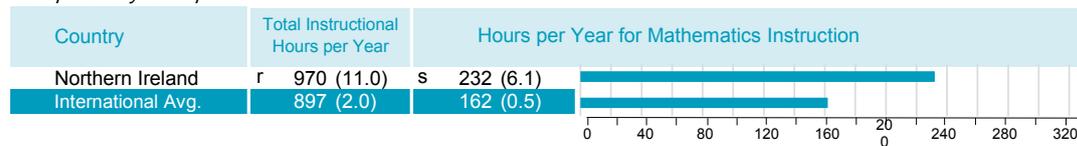
Language and reading

Reported by Principals and Teachers

Country	Instructional Hours per Year			
	Total	Language Instruction	Time Spent on Reading as Part of Language Instruction	Reading Across the Curriculum, Including Time Spent on Reading Instruction
Northern Ireland	r 970 (11.0)	s 274 (7.7)	s 80 (3.7)	s 155 (9.9)
International Avg.	905 (2.1)	232 (1.2)	70 (0.5)	146 (1.4)

Mathematics

Reported by Principals and Teachers



Science

Reported by Principals and Teachers



() 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. An "s" indicates data are available for at least 50% but less than 70% of the pupils.

Source: Exhibit 8.4 international PIRLS report, Exhibit 8.6 international mathematics report, Exhibit 8.6 international science report

8.2 Teachers' emphasis on science investigation in Y6

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.

Teachers' emphasis on science investigation is measured by their responses to six statements about teaching science (these statements can be seen below Table 8.2). The international analysis used responses to these statements to create the *Emphasize Science Investigation* scale.² Pupils were categorised into two bands: those whose teachers emphasise science investigation in *About Half the Lessons or More* and those whose teachers emphasise science investigation in *Less than Half the Lessons* (details of how pupils were assigned to each band is provided above Table 8.2).

Table 8.2 shows that 13 per cent of Y6 pupils in Northern Ireland were taught by teachers who emphasised science investigation in *About Half the Lessons or More*. This was considerably below the international average (40 per cent), and lower than in England (41 per cent) and the Republic of Ireland (43 per cent), but similar to Finland (the third highest performing country in science, 13 per cent) and Hong Kong (12 per cent). Emphasis on science investigation was much more prevalent in Korea, the highest performing country in science, and in Singapore, where 58 and 50 per cent of pupils respectively were taught by teachers who emphasised science investigation in *About Half the Lessons or More*.

There are no clear associations between teachers' emphasis on science investigation and pupils' average achievement within Northern Ireland and most comparator countries. Among pupils in Northern Ireland whose teachers emphasised science investigation in *About Half the Lessons or More*, average achievement appears to have been lower than among those for whom it was emphasised in *Less Than Half the Lessons*. However, this difference is unlikely to be statistically significant.³ Differences in average achievement between the equivalent categories of pupils in the majority of comparator countries were also unlikely to be significant.⁴ However, this was not the case in Australia, or on average internationally, where the average achievement of pupils whose teachers emphasised science investigation in *About Half the Lessons or More* was 24 points higher and 4 points higher respectively than that of pupils whose teachers emphasised science investigation to a lesser extent, differences that were likely to be statistically significant.

2 The scale is labelled as such in the international report; hence American spelling may be used in such scale labels in this report.

3 Differences in achievement between groups have not been tested formally for statistical significance in this international analysis, but the sizes of the standard errors in the national data suggest that this apparent difference between groups would not be statistically significant.

4 Throughout this report, findings listed as 'significant' are statistically significant.

Table 8.2 Teachers' emphasis on science investigation in Y6

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of six instructional activities on the *Emphasize Science Investigation* scale. Students with teachers who emphasized science investigation in **About Half the Lessons or More** had a score on the scale of at least 10.7, which corresponds to their teachers using all six activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**.

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score
	Per cent of Students	Average Achievement	Per cent of Students	Average Achievement	
Northern Ireland	13 (3.1)	510 (12.2)	87 (3.1)	518 (4.0)	8.0 (0.16)
International Avg.	40 (0.5)	488 (0.9)	60 (0.5)	484 (0.9)	

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 students.

S3

In teaching science to the pupils in this class, how often do you usually ask them to do the following?

Tick one circle for each row.

Every or almost every lesson
About half the lessons
Some lessons
Never

a) Observe natural phenomena such as the weather or a plant growing and describe what they see ----- ○ — ○ — ○ — ○

b) Watch me demonstrate an experiment or investigation --- ○ — ○ — ○ — ○

c) Design or plan experiments or investigations ----- ○ — ○ — ○ — ○

d) Conduct experiments or investigations ----- ○ — ○ — ○ — ○

g) Give explanations about something they are studying ----- ○ — ○ — ○ — ○

h) Relate what they are learning in science to their daily lives ----- ○ — ○ — ○ — ○

← About Half the Lessons or More 10.7 Less than Half the Lessons →

Source: Exhibit 8.27 international science report and adapted from the international version of the PIRLS and TIMSS Teacher Questionnaire.⁵

5 <http://timssandpirls.bc.edu>

8.3 Use of computers

Teachers were asked whether computers were available during English, mathematics and science lessons, including the frequency of their use for different subject-specific computer-based activities. Table 8.3 summarises this information, giving the results for Northern Ireland and the international average.

8.3.1 Use of computers in Y6 reading lessons

Table 8.3 shows that in Northern Ireland, 65 per cent of pupils were taught by teachers who reported that computers were available for use in reading lessons, 20 percentage points above the international average (45 per cent).

In most of the highest performing countries in PIRLS 2011 the proportion of pupils who had access to a computer for reading lessons was equal to or higher than the international average. The Russian Federation was the exception where 29 per cent of pupils were in schools with access to computers in reading lessons.

In the comparator countries, availability was above the international average in Australia, Finland, New Zealand, Republic of Ireland and Singapore, and was close to the average in England and Hong Kong.

The international average achievement did not vary whether pupils had access to a computer for reading lessons or not. The average achievement scores of pupils in Northern Ireland were very similar in the two categories, as in several comparator countries including New Zealand and Finland.

Teachers reported on pupils' use of computers for a variety of activities. In most of the high performing countries, the percentage of pupils who used computers for each of the four activities identified in Table 8.3 at least monthly was above the international average; this pattern was also seen in Northern Ireland. In Northern Ireland, pupils most commonly used computers *to write stories or other texts*, whereas on average internationally they were most commonly used *to look up information*.

8.3.2 Use of computers in Y6 mathematics lessons

Table 8.3 shows that, in Northern Ireland, 76 per cent of pupils were taught by teachers who reported that computers were available for use in mathematics lessons, almost double the international average (42 per cent). Computer availability varied across comparator countries and across the highest performing countries. Among comparator countries, only Australia and New Zealand had a higher percentage of pupils with access to computers during mathematics lessons, compared with Northern Ireland (79 and 87 per cent respectively). In Korea, the second highest performing country in mathematics, computer availability was below the international average at 31 per cent.

Internationally there was no clear pattern of achievement according to whether computers were available in mathematics lessons. In Northern Ireland, average achievement appears to be lower among those pupils who did have access to computers. However, this difference is unlikely to be statistically significant. It is also worth bearing in mind that the relationship between computer availability and average attainment is complex, and that achievement data in this area should be interpreted with caution. For example, in some cases, computers might be made available to able pupils in order to challenge them and stretch their skills. In other cases, they might be made available to lower-achieving pupils for drill and practice. Thus, any association,

or lack of association, with achievement might be affected by such varying reasons for making computers available.

In Northern Ireland, where pupils did have access to computers for their mathematics lessons, they were mainly used *to practice skills and procedures*. This was also the case in Australia, New Zealand, Finland and England, but not in Singapore, Hong Kong and the Republic of Ireland, where they were used *to practice skills and procedures* and *to explore mathematical principles and concepts* to a similar extent.

8.3.3 Use of computers in Y6 science lessons

Table 8.3 shows that, in Northern Ireland, 78 per cent of Y6 pupils were taught by teachers who reported that computers were available for use in science lessons, 31 percentage points above the international mean. This percentage was similar in Australia and England, but was higher in New Zealand (85 per cent). As was the case for mathematics, computer availability for science lessons was generally lower in the highest performing countries and the remaining comparator countries than in Northern Ireland. In many countries, computer availability was higher for science than for mathematics. Again, computer availability was particularly low in Korea, the highest performing country in science, with only 35 per cent of pupils taught by teachers who reported that computers were available for science lessons (below the international average).

In Northern Ireland and internationally, there was no clear pattern of science achievement according to whether computers were available in science lessons. Where pupils did have access to computers for science lessons, they were mainly used *to look up ideas and information*. This was the case across the majority of participants.

Table 8.3 Use of computers in Y6 lessons

Reading

Reported by Teachers

Country	Computers Available for Reading Lessons			Per cent of Students Whose Teachers Have Them Use Computers At Least Monthly			
	Per cent of Students	Average Achievement		To Look Up Information	To Read Stories or Other Texts	To Write Stories or Other Texts	To Develop Reading Skills and Strategies with Instructional Software
	Yes	Yes	No				
Northern Ireland	r 65 (4.2)	559 (3.1)	562 (5.6)	r 61 (4.3)	r 51 (4.4)	r 63 (4.2)	r 40 (4.8)
International Avg.	45 (0.5)	513 (0.9)	513 (0.6)	38 (0.5)	32 (0.5)	32 (0.5)	29 (0.5)

Mathematics

Reported by Teachers

Country	Computers Available for Mathematics Lessons			Per cent of Students Whose Teachers Have Them Use Computers At Least Monthly		
	Per cent of Students	Average Achievement		To Explore Mathematics Principles and Concepts	To Look Up Ideas and Information	To Practice Skills and Procedures
	Yes	Yes	No			
Northern Ireland	r 76 (3.9)	561 (4.3)	570 (6.4)	r 66 (4.4)	r 62 (4.4)	r 74 (4.0)
International Avg.	42 (0.5)	491 (1.1)	490 (0.7)	27 (0.4)	26 (0.5)	34 (0.5)

Science

Reported by Teachers

Country	Computers Available for Science Lessons			Per cent of Students Whose Teachers Have Them Use Computers At Least Monthly			
	Per cent of Students	Average Achievement		To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Practice Skills and Procedures
	Yes	Yes	No				
Northern Ireland	r 78 (3.5)	519 (3.6)	511 (6.3)	r 73 (3.9)	r 47 (4.0)	r 42 (4.3)	r 53 (4.4)
International Avg.	47 (0.5)	488 (1.0)	486 (0.8)	41 (0.5)	24 (0.4)	25 (0.4)	31 (0.5)

() 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 students.

Source: Exhibit 8.14, international PIRLS Report, Exhibit 8.29 international mathematics report, Exhibit 8.29, international science report

8.4 Emphasis in early years on reading skills and strategies

In order to investigate the teaching of early reading skills and strategies, principals reported the age at which the teaching of a range of specific skills, including *reading isolated sentences, comparing different texts, describing the style or structure of a text and determining the author's perspective or intention*, were emphasised. A full list of these 11 skills can be seen below Table 8.4. This table shows Northern Ireland and comparator countries listed in descending order of the percentage of pupils in schools where these skills and strategies had a major emphasis *At or before the academic year in which they turn eight*. This is Year 4 in Northern Ireland.

Table 8.4 shows that there was large variation in the percentage of pupils in schools where the teaching of all 11 of these skills was emphasised *At or before the academic year in which they turn eight*; the international averages range from 84 per cent of pupils (in England) to 1 per cent (in Morocco). Northern Ireland had 55 per cent of pupils in this category. The comparator country with the lowest proportion in this category was Finland (10 per cent).

Mostly, English-speaking countries had high proportions of pupils in schools where the teaching of these skills was emphasised *At or before the academic year in which they turn eight*. Only eight participating countries, six of which were English-speaking, had 50 per cent of pupils or more attending schools where these skills received a major emphasis *At or before the academic year in which they turn eight*.

Hong Kong, the highest performing country in PIRLS 2011, had only 16 per cent of pupils receiving emphasis on these skills *At or before the academic year in which they turn eight* and Finland, the third highest, had 10 per cent. Completing the top four achieving countries, the Russian Federation and Singapore had around half of their pupils in this category. In all four of the top performing countries, the statutory age for starting school is later than that of the four English-speaking countries (England, United States,⁶ Australia and New Zealand) which have the highest proportions of pupils in schools where these skills are emphasised at or before the equivalent of Northern Ireland's Year 4.

Although pupils in several countries showed similar achievement regardless of their age when the range of skills and strategies is emphasised (for example, United States, Singapore and Finland), internationally the overall average achievement scores suggest that earlier teaching of a range of reading skills and strategies is associated with higher reading achievement. The average achievement scores were similar within Northern Ireland,⁷ regardless of the age at which the range of reading skills were emphasised.

Table 8.4 Emphasis in early years on reading skills and strategies

Reported by Principals

Students were scored according to their principals' responses about the earliest academic year at which each of eleven reading skills and strategies were emphasised. Students in schools where their principals reported reading skills and strategies were emphasised **in or before the academic year in which students are eight** had a score on the scale of at least 11.1, which corresponds to all eleven skills and strategies being emphasised in Year 4, on average. Students in schools where their principals reported reading skills and strategies were emphasised **in the academic year in which students are ten or later** had a score no higher than 6.5, which corresponds to all eleven skills and strategies being emphasised in Year 6, on average. All other students attended schools where reading skills and strategies were emphasised in **Year 5**.

Country	In or before the academic year in which students are eight (Year 4)		In the academic year in which students are nine (Year 5)		In the academic year in which students are ten or later (Year 6)		Average Scale Score
	Per cent of Students	Average Achievement	Per cent of Students	Average Achievement	Per cent of Students	Average Achievement	
England	84 (3.3)	553 (3.2)	15 (3.2)	538 (7.3)	1 (0.9)	~ ~	12.6 (0.20)
Australia	73 (4.0)	528 (2.9)	27 (4.0)	531 (5.9)	0 (0.0)	~ ~	12.6 (0.19)
New Zealand	73 (3.6)	538 (2.8)	27 (3.6)	523 (7.2)	0 (0.0)	~ ~	12.2 (0.16)
Northern Ireland	^r 55 (4.6)	561 (3.0)	45 (4.6)	557 (4.6)	0 (0.0)	~ ~	11.6 (0.17)
Singapore	46 (0.0)	567 (4.0)	54 (0.0)	566 (5.4)	0 (0.0)	~ ~	10.9 (0.00)
Ireland, Rep. of	40 (4.0)	558 (3.9)	60 (4.0)	547 (3.4)	0 (0.0)	~ ~	10.6 (0.13)
Hong Kong SAR	16 (3.5)	579 (6.7)	81 (3.8)	569 (2.9)	3 (1.6)	548 (15.3)	9.5 (0.14)
Finland	10 (2.6)	569 (5.6)	87 (2.8)	568 (2.0)	3 (1.5)	555 (8.2)	9.2 (0.12)
International Avg.	28 (0.5)	522 (1.1)	68 (0.5)	511 (0.6)	4 (0.2)	450 (3.3)	

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 students.

6 Including the customary, though not statutory, kindergarten year.

7 The small difference was not likely to be statistically significant.

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In which year group do the following reading skills and strategies first receive a major emphasis in teaching in your school?

Tick **one** circle for each row.

	Year 3 or earlier	Year 4	Year 5	Year 6	Not in these year groups
a) Knowing letters of the alphabet -----	<input type="radio"/>				
b) Knowing letter-sound relationships -----	<input type="radio"/>				
c) Reading words -----	<input type="radio"/>				
d) Reading isolated sentences ---	<input type="radio"/>				
e) Reading connected text -----	<input type="radio"/>				
f) Locating information within the text -----	<input type="radio"/>				
g) Identifying the main idea of a text -----	<input type="radio"/>				
h) Explaining or supporting understanding of a text -----	<input type="radio"/>				
i) Comparing a text with personal experience -----	<input type="radio"/>				
j) Comparing different texts -----	<input type="radio"/>				
k) Making predictions about what will happen next in a text -----	<input type="radio"/>				
l) Making generalisations and drawing inferences based on a text -----	<input type="radio"/>				
m) Describing the style or structure of a text -----	<input type="radio"/>				
n) Determining the author's perspective or intention -----	<input type="radio"/>				



Items a, b and c did not contribute to the scale.

Source: Exhibit 6.4 international PIRLS report and adapted from the international version of the PIRLS and TIMSS School Questionnaire.⁸

8 <http://timssandpirls.bc.edu>

8.5 Teachers' focus on specific comprehension skills and strategies

In order to assess how teachers develop pupils' reading comprehension skills, teachers were asked to specify the frequency with which pupils in their class were asked to practise a range of nine reading skills and strategies. These skills range from the ability to retrieve information from the text to those requiring some analysis of the whole text. Table 8.5 shows how teachers responded to these questions, listing Northern Ireland and comparator countries alphabetically.

For three of the nine activities the proportion of pupils in Northern Ireland whose teachers asked them to do the activity at least weekly was more than 10 percentage points lower than the international mean. In most of the comparator countries the percentages of pupils practising each skill at least weekly were above the international average in most or all activities. However the percentage of pupils in Finland was below the international average in all of the activities, sometimes considerably so. Generally, lower percentages were also seen in Norway, Denmark and Sweden, the other Scandinavian countries.

In the majority of countries, most pupils were taught by teachers who frequently asked them to *Locate information within the text*, *Identify the main ideas of what they have read* and *Explain or support their understanding of what they have read*. Although the percentages generally remained high, there was more variation across countries in the proportions of pupils asked to practise the remaining six activities on a weekly basis.

Table 8.5 Teachers develop students' reading comprehension skills and strategies

Reported by teachers

Country	Per cent of Students whose teachers ask them to do the following at least weekly								
	Locate information within the text	Identify the main ideas of what they have read	Explain or support their understanding of what they have read	Compare what they have read with experiences they have had	Compare what they have read with other things they have read	Make predictions about what will happen next in the text	Make generalizations and draw inferences	Describe the style or structure of the text	Determine the author's perspective or intention
Australia	r 96 (1.6)	r 95 (2.2)	r 96 (1.7)	r 87 (2.4)	r 72 (3.7)	r 92 (1.4)	r 92 (1.9)	r 84 (2.8)	r 73 (3.4)
England	97 (1.4)	97 (1.4)	95 (1.8)	78 (3.3)	74 (3.5)	96 (1.4)	93 (1.9)	82 (3.2)	72 (3.6)
Finland	86 (2.2)	88 (2.8)	80 (2.8)	67 (3.5)	39 (3.5)	44 (3.4)	66 (3.2)	24 (2.6)	15 (2.1)
Hong Kong SAR	100 (0.0)	96 (1.9)	96 (1.9)	81 (3.6)	70 (3.9)	78 (4.0)	84 (3.3)	77 (4.2)	82 (3.7)
Ireland, Rep. of	98 (0.9)	97 (1.1)	96 (1.3)	87 (2.5)	68 (3.6)	91 (2.1)	83 (3.0)	58 (3.7)	52 (4.2)
New Zealand	99 (0.5)	98 (0.7)	97 (0.9)	89 (2.3)	74 (3.0)	94 (1.6)	94 (1.4)	72 (2.4)	72 (2.5)
Northern Ireland	r 99 (1.1)	r 94 (2.5)	r 98 (1.3)	r 67 (3.8)	r 59 (3.7)	r 84 (3.4)	r 82 (3.4)	r 64 (4.4)	r 50 (4.6)
Singapore	95 (1.2)	95 (1.2)	95 (1.2)	89 (1.8)	81 (2.1)	90 (1.7)	90 (1.7)	78 (2.4)	72 (2.3)
International Avg.	96 (0.2)	95 (0.3)	95 (0.2)	81 (0.4)	70 (0.5)	74 (0.4)	80 (0.4)	66 (0.5)	63 (0.5)

() 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. An "s" indicates data are available for at least 50% but less than 70% of the pupils.

Source: Exhibit 8.8, international PIRLS report

8.6 The Y6 mathematics and science curriculum

The TIMSS mathematics and science Assessment Frameworks are not designed to match exactly the curriculum of any one participating country. In order to assess the degree of correspondence between national curricula and the topics covered in TIMSS 2011, National Research Coordinators (NRCs), or their designated person, were asked to indicate whether each of the TIMSS 2011 mathematics and science topics (listed in Figures 2 and 3) within the content domains, was included in their country's intended curriculum for pupils aged 9-10 (Y6), and, if so, whether the topics were intended to be taught to *all or almost all students* or *only the more able students*. The outcomes are summarised in Table 8.6.

Teachers were also asked to indicate whether each of the topics was *mostly taught before this year*, *mostly taught this year* or *not yet taught or just introduced*. Table 8.7 shows the percentage of pupils whose teachers reported that they had been taught the topics either prior to or during the year of the assessment, averaged across topics, presented both as an overall percentage and according to content domain.

8.6.1 The Y6 mathematics curriculum

Figure 2 TIMSS 2011 mathematics topics

TIMSS 2011 Mathematics Topics
A. Number
1) Concepts of whole numbers, including place value and ordering
2) Adding, subtracting, multiplying, and/or dividing with whole numbers
3) Concepts of fractions
4) Adding and subtracting with fractions
5) Concepts of decimals, including place value and ordering
6) Adding and subtracting with decimals
7) Number sentences
8) Number patterns
B. Geometric Shapes and Measures
1) Lines: measuring, estimating length of; parallel and perpendicular lines
2) Comparing and drawing angles
3) Using informal coordinate systems to locate points in a plane
4) Elementary properties of common geometric shapes
5) Reflections and rotations
6) Relationships between two-dimensional and three-dimensional shapes
7) Finding and estimating areas, perimeters, and volumes
C. Data Display
1) Reading data from tables, pictographs, bar graphs, or pie charts
2) Drawing conclusions from data displays
3) Displaying data using tables, pictographs and bar graphs

Source: Exhibit 7.9, *international mathematics report*

Table 8.6 shows that, in Northern Ireland, all 18 TIMSS mathematics topics were intended to be taught to all Y6 pupils. This was higher than the international average (13 topics). Fewer topics were intended to be taught in Hong Kong and Finland, where some topics from Number and Geometric Shapes and Measures were not included in the curriculum. In England, New Zealand and Australia, some topics in Number (and one in Geometric Shapes and Measures for New Zealand) were intended to be taught only to more able pupils. However, on average internationally, very few topics were taught only to more able pupils.

Table 8.7 shows that 93 per cent of pupils in Northern Ireland were taught the TIMSS mathematics topics either before or during the year of the TIMSS assessment. This percentage was the highest across all countries and 21 percentage points above the international average. There was a mixed picture internationally in terms of the content domains that were most commonly taught to pupils. The most commonly taught domains in Northern Ireland were Number and Data Display. On average internationally, topics from these two content domains were most commonly taught, while Geometric Shapes and Measures topics were less commonly taught. However, in England, New Zealand, Hong Kong and Australia, Data Display was more commonly taught than Number. Northern Ireland was similar to Singapore in its teaching of the TIMSS Number topics; 97 per cent and 100 per cent of pupils respectively were taught these topics, in comparison to 76 per cent on average internationally. However, Northern Ireland was also similar to Australia and England in that a higher proportion of pupils in these countries were taught Geometric Shapes and Measures topics than in Finland, Hong Kong, New Zealand, the Republic of Ireland and Singapore.

8.6.2 The Y6 science curriculum

Figure 3 TIMSS 2011 science topics

TIMSS 2011 Science Topics	
A. Life Science	
1)	Major body structures and their functions in humans and other organisms (plants and animals)
2)	Life cycles and reproduction in plants and animals
3)	Physical features, behavior, and survival of organisms living in different environments
4)	Relationships in a given community (e.g., simple food chains, predator-prey relationships)
5)	Changes in environments (effects of human activity, pollution and its prevention)
6)	Human health (e.g., transmission/ prevention of communicable diseases, signs of health/ illness, diet exercise)
B. Physical Science	
1)	States of matter (solids, liquids, gases) and differences in their physical properties (shape, volume), including changes in state of matter by heating and cooling
2)	Classification of objects/ materials based on physical properties (e.g., weight/ mass, volume, magnetic attraction)
3)	Forming and separating mixtures
4)	Familiar changes in materials (e.g., decaying, burning, rusting, cooking)
5)	Common energy sources/ forms and their practical uses (e.g., Sun, electricity, water, wind)
6)	Light (e.g., sources, behavior)
7)	Electrical circuits and properties of magnets
8)	Forces that cause objects to move (e.g., gravity, push/ pull forces)
C. Earth Science	
1)	Water on Earth (location, types, and movement) and air (composition, proof of its existence, uses)
2)	Common features of Earth's landscape (e.g., mountains, plains, rivers, deserts) and relationship to human use (e.g., farming, irrigation, land development)
3)	Weather conditions from day to day or over the seasons
4)	Fossils of animals and plants (age, location, formation)
5)	Earth's solar system (planets, Sun, moon)
6)	Day, night, and shadows due to Earth's rotation and its relationship to the Sun

Source: Exhibit 7.9, international science report

Table 8.6 shows that in Northern Ireland, all 20 TIMSS science topics were intended to be taught to all Y6 pupils. In all of the highest performing countries at this level, fewer topics were intended to be taught: in the highest achieving country, Korea, only eight topics were

included. The picture was mixed internationally in that the topics identified as not included in the curriculum were drawn from across the content domains. In particular, on average internationally, and in the majority of comparator countries, some of the Earth Science and Physical Science topics tended not to be included. Singapore, for example, did not include any of the Earth Science topics. This may have been because these topics were located elsewhere in the curriculum in these countries (notably in geography). Very few countries intended to teach particular science topics only to more able pupils.

Table 8.7 shows that 61 per cent of pupils in Northern Ireland were taught the TIMSS science topics either before or during the year of the TIMSS assessment. This was similar to the international average. Fewer pupils were taught the TIMSS science topics than were taught the TIMSS mathematics topics both in Northern Ireland and on average internationally.

The percentage of pupils taught the TIMSS science topics was lower in most of the comparator countries and this was especially noticeable for Singapore. However, the percentage was higher in England and the Republic of Ireland. The most commonly taught content domain in Northern Ireland was Life Science, the same as in all the comparator countries except for England and Singapore, where the most commonly taught domain was Physical Science.

Table 8.6 Number of TIMSS topics intended to be taught by the year of assessment

Mathematics

Reported by National Research Coordinators

Country	All Mathematics (18 Topics)			Number (8 Topics)			Geometric Shapes and Measures (7 Topics)			Data Display (3 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4
Australia	16	2	0	6	2	0	7	0	0	3	0	0
England	17	1	0	7	1	0	7	0	0	3	0	0
Finland	13	0	5	5	0	3	5	0	2	3	0	0
Hong Kong SAR	14	0	4	7	0	1	4	0	3	3	0	0
Ireland, Rep. of	17	0	1	7	0	1	7	0	0	3	0	0
New Zealand	15	2	1	7	1	0	6	1	0	2	0	1
Northern Ireland	18	0	0	8	0	0	7	0	0	3	0	0
Singapore	16	0	2	8	0	0	5	0	2	3	0	0
International Avg.	13	1	4	6	0	2	5	0	2	2	0	1

Science

Reported by National Research Coordinators

Country	All Science (20 Topics)			Life Science (6 Topics)			Physical Science (8 Topics)			Earth Science (6 Topics)		
	Topics Taught to All or Almost All Pupils	Topics Taught to Only the More Able Pupils (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Pupils	Topics Taught to Only the More Able Pupils (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Pupils	Topics Taught to Only the More Able Pupils (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Pupils	Topics Taught to Only the More Able Pupils (Top Track)	Not Included in the Curriculum Through Grade 4
Australia	15	1	4	5	0	1	5	1	2	5	0	1
England	16	0	4	6	0	0	7	0	1	3	0	3
Finland	11	0	9	3	0	3	4	0	4	4	0	2
Hong Kong SAR	17	0	3	6	0	0	7	0	1	4	0	2
Ireland, Rep. of	18	0	2	6	0	0	8	0	0	4	0	2
New Zealand	12	8	0	3	3	0	5	3	0	4	2	0
Northern Ireland	20	0	0	6	0	0	8	0	0	6	0	0
Singapore	6	0	14	3	0	3	3	0	5	0	0	6
International Avg.	14	1	5	5	0	1	5	0	2	4	0	2

Source: Exhibit 8.10 international mathematics report, Exhibit 8.10 international science report

Table 8.7 Percentage of students taught the TIMSS mathematics and science topics**Mathematics***Reported by Teachers*

Country	All Mathematics (18 Topics)	Number (8 Topics)	Geometric Shapes and Measures (7 Topics)	Data Display (3 Topics)
Australia	r 87 (1.0)	r 85 (1.2)	r 86 (1.4)	r 94 (1.3)
England	91 (0.9)	91 (0.8)	89 (1.5)	96 (1.2)
Finland	73 (1.1)	88 (1.1)	53 (2.2)	83 (2.2)
Hong Kong SAR	78 (0.8)	83 (1.1)	66 (1.4)	95 (1.6)
Ireland, Rep. of	78 (1.0)	87 (0.9)	63 (1.5)	87 (2.3)
New Zealand	74 (1.0)	74 (1.1)	66 (1.6)	90 (1.8)
Northern Ireland	r 93 (0.6)	r 97 (0.6)	r 88 (1.3)	r 96 (1.5)
Singapore	85 (0.5)	100 (0.2)	65 (1.1)	94 (1.0)
International Avg.	72 (0.2)	76 (0.2)	65 (0.2)	76 (0.4)

Science*Reported by Teachers*

Country	All Science (20 Topics)	Life Science (6 Topics)	Physical Science (8 Topics)	Earth Science (6 Topics)
Australia	r 58 (1.8)	r 69 (2.0)	s 47 (2.6)	s 62 (2.3)
England	r 71 (1.7)	r 72 (2.4)	r 78 (1.8)	r 62 (2.9)
Finland	55 (1.2)	73 (1.6)	43 (1.8)	53 (1.6)
Hong Kong SAR	56 (1.9)	72 (2.4)	48 (2.3)	51 (2.1)
Ireland, Rep. of	71 (1.4)	73 (1.8)	68 (2.0)	72 (1.8)
New Zealand	54 (1.7)	66 (2.0)	44 (2.2)	56 (1.9)
Northern Ireland	r 61 (2.1)	r 74 (2.3)	r 57 (2.8)	r 53 (3.0)
Singapore	41 (0.8)	47 (1.3)	59 (0.9)	12 (1.1)
International Avg.	64 (0.2)	75 (0.2)	57 (0.3)	63 (0.3)

() 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 students. An "s" indicates data are available for at least 50% but less than 70% of the students.

Source: Exhibit 8.8, international mathematics report, Exhibit 8.8 international science report

8.7 Conclusion

Teachers, principals and National Research Coordinators were asked a range of questions relating to learning activities and the curriculum in Y6 English, mathematics and science lessons. This included total teaching time and use of computers for all three subjects. For reading, information was obtained on schools' emphasis in the early years on reading skills and strategies, and the frequency of teachers' focus on specific comprehension skills and strategies. For science, teachers were asked about the extent to which they emphasised science investigation. For both mathematics and science, to assess the degree of correspondence between participants' curricula and the TIMSS assessment frameworks, National Research Coordinators reported on their country's intended curriculum, and teachers reported on whether the TIMSS topics were covered in lessons, according to content domain.

In Northern Ireland, teaching time for English and mathematics was higher than the international average. However, for science, teaching time was lower than the international average.

There was a high level of computer availability for reading, mathematics and science lessons in Y6. However, a higher proportion of pupils had access to computers in mathematics and science lessons compared with reading lessons. No clear patterns emerged relating computer availability to average achievement in any of the three subjects. This was the case both on average internationally and within Northern Ireland.

In Northern Ireland, a small proportion of Y6 pupils were taught science by teachers who emphasise science investigation in at least half of their science lessons; this proportion was considerably below the international average. In some (but not all) of the highest performing countries, science investigation was emphasised to a greater extent. However patterns relating emphasis on science investigation to average achievement within countries were not generally apparent.

There was variation internationally in the age at which schools emphasised a range of reading skills and strategies; in Northern Ireland just over half of pupils were taught in schools that emphasised these reading skills in Year 4. Generally, English-speaking countries had the highest proportions of pupils who were taught a range of reading skills *At or before the academic year in which they turn eight*. On average internationally, there appeared to be a positive association between the early introduction of a range of reading skills and strategies and average PIRLS achievement. However, in Northern Ireland, no such pattern was apparent.

In three of nine activities used to develop comprehension skills and strategies, noticeably fewer pupils in Northern Ireland were asked to practise these activities weekly than pupils on average internationally.

Northern Ireland's curriculum included all of the TIMSS assessment topics for mathematics and science. However, according to teachers' reports of topics taught in lessons, a higher proportion of Y6 pupils were taught the TIMSS mathematics topics than the TIMSS science topics, as was also the case on average internationally.

